3 1761 0 [illegible]4 6

Presented to the
LIBRARY *of the*
UNIVERSITY OF TORONTO

FROM THE ESTATE
OF
MISS MARY SINCLAIR

Helen Adair

CHAMBERS'S

ENCYCLOPÆDIA

A DICTIONARY

OF UNIVERSAL KNOWLEDGE FOR THE PEOPLE

WITH MAPS AND NUMEROUS WOOD ENGRAVINGS

REVISED EDITION

UNALTERED AND UNABRIDGED

VOLUME VII.

NEW YORK
COLLIER, Publisher
1888.

MAPS FOR VOL. VII.

PAGE

SPAIN AND PORTUGAL 334

SWEDEN AND NORWAY 498

SWITZERLAND 502

TASMANIA 546

TURKEY IN EUROPE, GREECE, ROUMANIA, SERVIA, MOTENEGRO, BULGARIA 748

TURKEY IN ASIA 750

8-vol. ed. p. 2.

AE
5
C443
1888
v.7

RU'VO IN APU'LIA, a city of southern Italy, province of Bari, and 22 miles west of the city of that name. Pop. (1872) 15,055. It is built upon a rising ground, contains many churches, and two museums of Italo-Grecian vases, and is famous for its potteries. The staple produce is grain, pulse, and dried fruits. R. is the Rubi of Horace.

RUYSDAEL, or RUÏSDAEL, JAKOB, was born at Haarlem. The date of his birth is uncertain; some make it 1625, others 1630 or 1635. It is said that there is a picture by him signed and dated 1645, which makes the last date improbable. He died in 1681. It has been stated, that for some years he directed his attention to the study and practice of surgery, but was advised by his friend Nicholas Berghem to devote his time to painting. In his pictures the trees are excellent in form, the foliage touched with sharpness and precision, and the skies are light and floating. His style of composition is entirely original, and characterized by a certain compactness in the arrangement; the Italian painters have generally groups of trees at the sides, and running out of the picture; in R.'s compositions, they are almost always massed within the picture. R. and Hobbima hold about an equal position—namely, that of the best landscape-painters of the Dutch school; but R. was also equally eminent for his sea-pieces. His etchings, seven in number, are much prized by collectors. Jan van Kessel and Jan Renier de Vries were imitators of Ruysdael. His elder brother, *Salomo* (born *circa* 1613, died 1676), was also a painter of some note.

RUYTER, MICHAEL ADRIAANSZOON VAN, Dutch admiral, was born at Vlissingen in 1607, of poor parents, who sent him to sea as a cabin boy when only eleven years old. He became a warrant officer, and in 1635 rose to be a captain in the Dutch navy. After serving several years in the Indian seas, he was, in 1645, made rear-admiral. He engaged and sunk a piratic Algerine squadron off Sallee in 1647. In 1652, when war broke out between the States and England, then under the Protectorate, he was placed in command of a squadron, and ordered to convoy a large number of merchant-ships. He was met by the English fleet under Sir G. Ayscough off Plymouth, and an engagement took place. Neither of the fleets gained any decisive advantage; but R. succeeded in saving his convoy. In 1653, when a fight of three days took place between the English and Dutch fleets off Portland, R. commanded a division under Van Tromp. The English, under Blake, finally obtained a great victory, taking and destroying 11 Dutch men-of-war and 30 merchantmen. The states-general, in 1659, sent him to assist Denmark against Sweden. He defeated the Swedish fleet, and obtained a title of nobility and a pension from the king of Denmark. In 1664, he fell upon the English factories at Cape Verde, and attempted to seize the island of Barbadoes. As other depredations of the Dutch upon English merchants, as well in the East Indies as on the high seas, were complained of, war was declared against the Dutch. In June 1666, R. and Van Tromp, with 90 sail, engaged the English fleet under Prince Rupert and the Duke of Albemarle. Both sides fought with such obstinacy that the battle lasted four days, and ended without any decisive result. In July, the conflict was renewed, when the English gained a complete victory, destroying above 20 of R.'s men-of-war. In 1667, he destroyed the shipping at Sheerness, sailed up the Medway as far as Chatham, burned several English men-of-war, and effected more towards the conclusion of peace at Breda (1667) than any diplomatist. In 1671, he commanded the Dutch fleet, and fought several battles with the combined English and French fleets, but without decisive results. In 1675, he was sent to the Mediterranean. He fought, off the coast of Sicily, a desperate battle with the French fleet, under the celebrated Admiral Duquesne. Victory declared itself on the side of the French; but R. made good his retreat into the harbor of Syracuse. He had his legs shattered in the engagement, and died of his wounds, April 1676. Europe did justice to his bravery; and Louis XIV. said he could not help regretting the loss of a great man, although an enemy. His death was deeply mourned by his countrymen, and a splendid monument was erected to his memory at Amsterdam.

RY'AN, LOCH. See WIGTOWNSHIRE.

RYBI'NSK, a district town of Great Russia, in the government of Jaroslav, stands on the right bank of the Volga, 418 miles east-south-east of St. Petersburg. It is the great center of the corn trade on the Volga, and, after Nijni Novgorod, is the chief commercial center on that river. The trade of R. consists principally in transhipping and forwarding to the capital the goods brought hither by large vessels up the Volga. For this purpose, upwards of 6000 barges are built here every year. The landing-place extends along the river for several miles, and is divided into nine sections, each of which is appropriated to special varieties of goods. The chief articles of trade are corn, flour, tallow, spirits, metals and timber, and these are forwarded to St. Petersburg by three systems of communications, of which the Mariinsky Canal, conveys goods to the value of £5,000,000; the Tichvin Canal, goods to the value of £4,000,000; and the Vyshnivolotsk Canal, goods to the value of £2,000,000. There is, besides, the railway. Pop. (1880) 15,050.

RYDE, a flourishing and fashionable watering-place and market-town, on the north coast of the Isle of Wight, Hampshire, occupies the east and north slopes of a hill six miles south-south-west of Portsmouth from which it is separated by the roadstead of Spit Head. It consists of Upper and Lower R.; the former anciently called *Rye*, or *La Riche*, and the latter of quite modern construction. The shores are wooded to the verge of the water, and the appearance of the town, with its streets and houses interspersed with trees, is pleasing and picturesque. The pier, nearly a mile in length, forms an excellent promenade. Yacht and boat-building are carried on to some extent. Steamers cross every hour to Portsmouth in summer, and several times a day in winter. R., the largest town in the island, had, in 1881, 11,422 inhabitants. R. is connected with Ventnor by a railway.

RYE, a seaport, market-town, and parliamentary and municipal borough in the south-east of the county of Sussex, ten miles north-east of Hastings. It is charmingly situated on an eminence bounded east by the Rother, and south and west by the Tillingham, which streams unite here, and, entering the sea two miles below the town, form the old harbor. The appearance of the town is remarkably quaint and old-fashioned. Overlooking the junction of the streams is a small castle built by William de Ypres, in the reign of Stephen, and now used as a jail. The church is a beautiful and interesting structure—the central tower, transepts, a number of circular arches, &c., all being early Norman. In former times the sea flowed close up to R., washing the rock on which the Ypres tower stands, but it has retired to a distance of two miles. The harbor admits vessels of 200 tons, and has been recently improved. This ancient town receives historical mention as early as 893. It was walled on two sides by Edward III., and contributed nine ships to the fleet with which that monarch invaded France. Brewing, ship-building, and trade in corn, hops, &c., are carried on. R. is one of the Cinque Ports, and sends a member to parliament. Pop. (1881) of municipal b., 4220; of parl. b., 8409.

RYE (*Secale*), a genus of grasses, allied to Wheat and Barley, and having spikes which generally consist of two-flowered, rarely of three-flowered, spikelets; the florets furnished with terminal awns, only the upper floret stalked. One species (*S. cereale*) is a well-known grain. It has, when in fruit, a roundish-quadrangular spike, with a tough rachis. Its native country, as in the case of the other most important cereals, is somewhat doubtful; but it is said to be found wild in the desert regions near the Caspian Sea, and on the highest mountains of the Crimea. It has long been cultivated as a cereal plant; although the supposed mention of it in Exodus ix. 32 is doubtful, spelt being perhaps intended. It is much cultivated in the north of Europe and in some parts of Asia. Its cultivation does not extend so far north as that of barley; but it grows in regions too cold for wheat, and on soils too poor and sandy for any other grain. Its ripening can also be more confidently reckoned upon in cold regions than that of any other grain. But R. succeeds best, and is most productive, in a climate where wheat still ripens. It delights in sandy soils.

The varieties of R. are numerous, although much less so than those of other important cereals. Some are best fitted for sowing in autumn, others for sowing in spring. The former kinds (*Winter R.*) are most extensively cultivated, being generally the most productive. In some places on the continent of Europe, R. is sown at midsummer, mowed for green fodder in autumn, and left to shoot in spring, which it does at the same time with autumn-sown R., producing a good crop of small but very mealy grain. In Britain, R. is not a common grain crop, and is cultivated to a smaller extent than it formerly was; the sandy soils, to which it is best adapted, being improved and fitted for other kinds of corn. It is, however, sometimes sown to be used as a green crop, for feeding sheep and oxen in winter, and is found particularly good for milch cows. It is sometimes also mown for horses and other animals.—Bread made of R. is much used in the north of Europe. It is of a dark color, more laxative than that made of wheat-flour, and perhaps, rather less nutritious. R. is much used for fermentation and distillation, particularly for the making of *Hollands*. R. affected with Ergot (q. v.) is a very dangerous article of food. The straw of R. is tougher than that of any other corn-plant, and is much valued for straw-plait.—PERENNIAL R. (*S. perenne*) differs from Common R. in having a very hard, red-like culm; ears, 3—5 inches long, flatly compressed, with a brittle rachis, and 50—60 closely imbricated spikelets. It endures for many years, but is not much cultivated, as its grain is slender, and does not yield an easily separable flour.

RYE-GRASS (*Lolium*), a genus of grasses, having a two-rowed, flatly-compressed spike, the spikelets appressed edgewise to the rachis. COMMON R., or PERENNIAL R. (*L. Perenne*), the *Ray-grass* of the older English authors, is frequent on waysides, and

in meadows and pastures, in Britain and on the continent of Europe. The spikelets are much longer than their solitary external glume, 6—8 flowered; the florets awnless or nearly so; the culm flattened, from one foot to three feet high; the root producing leafy barren shoots, which add much to the agricultural value of the grass. This grass is highly valued for forage and hay, and is more extensively sown for these uses than any other grass, not only in Britain, but on the continent of Europe and in North America. It grows well even on very poor soils. The *Common Perennial R.* is the kind most generally cultivated. A kind called

1, Common Rye-grass; 2, Italian Rye-grass.

Annual R.—not really an annual plant, although useful only for one year—is sometimes cultivated; but is, in almost every respect, inferior.—ITALIAN R. (*L. Italicum*, or *L. multiflorum*, or *L. Bouchianum*), a native of the south of Europe is much esteemed as a forage and hay grass. In many soils and situations in Britain it succeeds extremely well, and is remarkable for its verdure and luxuriance in early spring. It is preferred by cattle to the Common Rye-grass. The young leaves are folded up, whilst those of the Common R. are rolled together.—There are many varieties of Rye-grass. It is nowhere so much valued or cultivated as in Britain. It was cultivated in England before the end of the 17th century. Italian R. was introduced into Britain in 1831 by Mr. Thomson of Banchory and Messrs. Lawson and Son of Edinburgh. R. is generally sown along with some kind of corn, and vegetating for the first year amongst the corn, appears in the second year as the proper crop of the field.

RYE'HOUSE PLOT. In 1683, at the same time that a scheme was formed in England among the leading Whigs to raise the nation in arms against Charles II., a subordinate scheme was planned by a few fiercer spirits of the party, including Colonel Rumsey and Lieutenant-colonel Walcot, two military adventurers; Goodenough, under-sheriff of London; Ferguson, an independent minister; and several attorneys, merchants, and tradesmen of London—the object of which was to waylay and assassinate the king on his return from Newmarket. The deed was to be perpetrated at a farm belonging to Rumboldt, one of the conspirators, called the Ryehouse Farm, whence the plot got its name. The R. P. is supposed to have been kept concealed from Monmouth, Russell, Shaftesbury, and the rest of those who took the lead in the greater conspiracy. It owed its defeat to the circumstance, that the house which the king occupied at Newmarket took fire accidentally, and Charles was thus obliged to leave that place eight days sooner than was expected. Both the greater and lesser conspiracy were discovered before long, and from the connection subsisting between the two, it was difficult altogether to dissever them. The indignation excited by the R. P. was extended to the whole Whig party; Lord Russell, Algernon Sidney, and Lieutenant-colonel Walcot were brought to the block for treason; John Hampden, grandson of his more noted namesake, was fined £40,000; and scarcely one escaped who had been concerned in either plot.

RY'OT (from the Arabic *raaya*, to pasture, to protect, to govern; hence, literally, the governed, a subject) is the vernacular term for a Hindu cultivator or peasant.

RYOTWAR (literally, according to or with ryots) is the term applied to the revenue settlement which is made by the government officers in India with each actual cultivator of the soil for a given term—usually a twelvemonth—at a stipulated money-rent, without the intervention of a third party. This mode of assessment prevails chiefly, though not exclusively, in the Madras presidency. See H. H. Wilson, *Glossary of Judicial and Revenue Terms* (Lond. 1855), under RAIYATWAR.

RYSBRACH, MICHAEL, a sculptor of considerable talent, born at Antwerp in 1693. He settled in London in 1720, and executed numerous works there, in particular the monuments to Sir Isaac Newton, in Westminster Abbey, and to the Duke of Marlborough at Blenheim, a bronze equestrian statue of William III. for the city of Bristol, a colossal statue of George II. for the parade at Greenwich Hospital; a Hercules, and busts of many of the eminent poets, wits, and politicians of his time. Scheemakers, also a native of Antwerp, and Roubilliac, a Frenchman, were contemporaries and rivals of his, and shared with him most of the commissions for works of sculpture in England at the period. With Scheemakers was placed as a pupil Nollekens, who became so distinguished for his busts, and as one of the founders of the English school of sculpture. R. died 8th January 1770.

RY'SWICK, PEACE OF, a treaty concluded in 1697 at Ryswick, a Dutch village between Delft and the Hague, which was signed by France, England, and Spain on September 20, and by Germany on October 30. It put an end to the sanguinary contest in which England had been engaged with France. It has been often said that the only equivalent then received by England for all the treasure she had transmitted to the continent, and all the blood which had been shed there, was an acknowledgment of William's title by the king of France; but it must not be forgot how much the allies were benefited by the check given to the gigantic power and overweening ambition of France.

S.

The nineteenth letter in the English and other western alphabets (the eighteenth in the Latin), belongs to the dental series, and marks the fundamental sound of the hissing or sibilant group, *s*, *z*, *sh*, *zh*. The Sanscrit has characters for three hissing or *s*-sounds; the Shemitic languages had four (see ALPHABET). The Hebrew or Phœnician character, from which the modern *s* is derived, was called *shin*—i. e., tooth, and in its original form probably represented two or three teeth. The same character, with the presence or absence of a diacritic point, marked either *s* or *sh*. In Eng., *s* is used both for the sharp and flat sounds, as *this, those* = *thoze*. The nearness of the *s*-sound to *th* is seen in the Eng. *loves* = *loveth*, and in the phenomenon of lisping *yeth* = *yes*. This seems to furnish the transition to the so frequent interchange of the High-Ger. *s* for the Low-Ger. *t*, as in Ger. *wasser* = *water*; Ger. *fuss* = *foot*. Comp. Gr. *thalassa* = *thalatta*. The substitution of *r* for *s* is noticed under R. In such cases as *melt*, compared with *smelt; pike*, with *spike; lick*, with *sleek;* Ger. *niesen*, with Eng. *sneeze;* Eng. *snow*, Goth. *snaivs*, with Lat. *nix* (gen. *niv*-is); Gr. *mikros*, with *smikros; short*, A.-S. *sceort*, with *curt*—it is difficult to say whether the form with, or that without the *s* is the older. Grimm considers *s* as the remnant of an old prefixed particle (*as, is, us*), having perhaps, the force of *ex* in Lat. *exopto*, I wish greatly; or *ur* in Ger. *urklein*, very small. An initial *s* before a vowel in Lat. corresponds to Gr. *h;* comp. Lat. *sub, sex, sal* (salt), with Gr. *hypo, hex, hals*. In Greek and Latin, *s* was pronounced feebly at the end of words, and still more so between two vowels. It thus frequently disappeared in these positions, and this was one of the chief sources of the irregularities in the declensions and conjugations, which had originally been formed on a uniform system (see INFLECTIONS). The dropping of *s* is one of the ways in which the forms of modern French words have become so degraded; compare Lat. *magister*, old Fr. *maistre*, mod-

ern Fr. *maître; presbyter, prestre, prêtre.* Even where still written, final *s* in French is mostly silent—e. g., *vos, les.*

SAAD-ED-DIN, a Turkish historian, was born in 1536, and died at Constantinople in 1599. His history, entitled the *Taj-al-Tuarikh* (the Crown of Histories), a work held in high estimation by scholars, gives a general account of the Ottoman empire from its commencement in 1299 till 1520; it has never been printed, but MS. copies of it are found in most of the great libraries of Europe, and an inaccurate translation into Italian was published in 1646—1652. S. also wrote the *Selim-Nameh*, or History of Selim I., which is chiefly a collection of anecdotes regarding that prince.

SAA'LÉ, a river of Germany, distinguished from other and smaller rivers of the same name as the Saxon or Thuringian S., rises on the western slope of the Fichtelgebirge (Bavaria), and flowing northwards through several minor states, and finally across the Prussian province of Saxony, falls into the Elbe, about 25 miles above Magdeburg, after a course of 200 miles. It is navigable only within the Prussian dominions.

SAA'RBRÜCKEN, a town of Rhenish Prussia, on the Saar, 40 miles south-south-east of Treves. It is the seat of an active industry, including coal-mining, spinning, the manufacture of cotton fabrics, of iron goods, pottery, and tobacco. Pop. (1880) 9514; but with St. Johann, on the other side of the Saar, 21,860. It was at S. that the French and German armies first met in the war of 1870—1871.

SAA'RDAM. See ZAANDAM.

SAARLOU'IS, a town of Rhenish Prussia, 31 miles south-south-east from Treves, and between four and five miles from the frontier of France. It stands on the left bank of the Saar, a branch of the Moselle, and is a place of some strength, being walled, and containing several forts. It is of considerable importance as a border fortress. There are manufactures of fire-arms in the town, and lead and iron mines in the neighborhood. There are also wire-works. S. was long in the possession of France, and was fortified by Vauban in the reign of Louis XIV. The Congress of Vienna gave it to Prussia in 1815. Pop. (1880) 6789.

SAAZ (Bohemian *Zatec*), a town of Bohemia, on the Eger, 45 miles west-north-west of Prague. Hops and grain are largely cultivated in the vicinity. Pop. (1880) 10,425.

SABADE'LL, a rising manufacturing town of Spain, in Catalonia, 14 miles by railway north-west of Barcelona. It has risen into importance only within recent years, and it is now the Manchester of Catalonia. Woollen and cotton fabrics are the staple manufactures, and of the 100 factories in the town, by far the greater number are engaged in these manufactures. Pop. about 16,000.

SABADI'LLA, CEBADILLA, or CEVADILLA (*Asagræa officinalis*, formerly *Helonias officinalis*), a Mexican plant of the natural order *Melanthaceæ*, the seeds of which are employed in medicine, because of properties analogous to those of White Hellebore (*Veratrum album*). The plant has a bulbous root, and grows in tufts; the leaves are linear and grassy, about four feet long, and not above a quarter of an inch broad; among them rises a round *scape* (leafless flower-stem), about six feet high, bearing a very dense raceme, a foot and a half long, of small white flowers. The seed-vessels are papery *follicles*, three together; the seeds one, two, or three in each follicle, two or three lines long, winged, and wrinkled. The powdered seeds have been known in medicine since the end of the 16th century. On submitting them to chemical analysis, they are found to consist of fatty matter, two special organic acids, to which the names *Cevadic* and *Veratric* acids have been given; of varieties of resin, yellow coloring matter, gum, and a highly poisonous alkaloid named *Veratria* in combination with gallic acid; and to these constituents, a French chemist, Couerbe, has added a crystalline body named *Sabadilline*.

Notwithstanding its highly poisonous properties, S. is prescribed on many parts of the continent as a vermifuge in cases of tape-worm and ascarides, and it may be administered to an adult in 8 or 10 grain doses, mixed with a little sugar, and a few drops of oil of fennel. In the form of powder, it is sometimes applied to the head to destroy lice, but if the skin be broken, some other remedy should be selected, as absorption to a dangerous extent might ensue. From its stimulating properties, it is usefully employed in the form of tincture (which, however, is not an officinal preparation) as an external application in chronic rheumatism and paralysis, and in cases of nervous palpitation.

The active principle of S., the *Veratria*, in doses of $\frac{1}{12}$th of a grain, gradually increased, and taken thrice a day, has been found very efficacious in acute rheumatism; and applied in the form of ointment, it has been highly recommended in scrofulous diseases of the joints. When prescribed internally, its use should be at once suspended if the patient complain of pain in the throat or stomach, vomiting or diarrhœa. Similar qualities are said to exist in the seeds of *Veratrum Sabadilla*, a native of Mexico and the West Indies, and in some of the species of *Helonias*, natives of the southern parts of North America.

SABÆ'ANS, the supposed descendants of one, two, or three Shebas mentioned in the Bible. Historically, the S. appear chiefly as the inhabitants of Arabia Felix or Yemen (to the north of the present Yemen), the principal city of which was called Saba, and the queen of which is said to have visited Solomon, attracted by the fame of his wisdom. Josephus, however (*Ant.* viii. 6, 5), makes her the queen of Ethiopia (Merŏe), and the modern Abyssinians claim her as their own. Her name, according to their tradition, was Makeda; and her visit to Jerusalem made her not only a proselyte to the religion of Solomon, but she became one of his wives, and had by him a son, Menilek, who afterwards ruled Ethiopia (q. v.). The Arabs, on the other hand, call her Balkis, the earliest name that occurs of a Himyaritic queen; but there is no more historical value to be attached to this tradition than to the innumerable legends that have clustered round her name in connection with the great king.

Numerous passages in Greek and Roman writers, as well as in the Bible, testify to the vast importance of these dwellers in Yemen as a wealthy, widely-extended, and enterprising people, of fine stature and noble bearing. Their chief greatness lay in their traffic, the principal articles of which consisted of gold and perfumes, spice, incense and precious stones, a very small portion of which, however, was of home production, Yemen being only productive in corn, wine, and the like matters of ordinary consumption. But the fact was, that the S. held the key to India, and were the intermediate factors between Egypt and Syria, which again spread the imported wares over Europe; and even when Ptolemy Philadelphus (274 B.C.) had established an Indian emporium in Egypt, the S. still remained the sole monopolists of the Indian trade, being the only navigators who braved the perilous voyage. As in many other respects, they also resembled the Phœnicians in this, that, instead of informing other people of their sources and the tracks of their ships, they told them the most preposterous tales about the countries they visited, and the fearful dangers they encountered; and in regard to most things, endeavored to impress upon the minds of their customers that what they sold them was, if artificial, their own manufacture—if natural products, home growth. Being the principal merchants of those things which the over-refined luxury of late classical times considered as absolute necessities of life, they could not fail to gather enormous riches; e. g., in the 3d c. of the Roman empire, every pound of silk—a material enormous quantities of which were used—that came from Arabia was paid by a pound of silver, at times even of gold.

As a natural consequence, the S. became luxurious, effeminate, and idle. The pictures of them drawn by the classic writers are doubtless exaggerated. The country itself, according to the reports of Greek writers, grew spice-wood to such an extent that its odor caused apoplexy among the inhabitants, and bad smells had to be used to counteract these over-potent influences. The meanest utensils in the houses of these merchant princes were—if we were to credit those writers—wrought in the most cunning fashion, and were of gold and silver; their vases were incrusted with gems, their firewood was cinnamon. Their colonies must, in the nature of things, have extended over immense tracts of Asia—the Ethiopian S. probably being one of the first foreign settlements; yet nothing beyond the vaguest conjectures can be given about them. Regarding their government, Dio Cassius informs us that they had a king, who never was allowed to leave his palace, and that the first child born, after the accession of a new king, into one of a certain number of noble families, was considered the heir-presumptive for the time being. Commerce had also done for them what it did for the Phœnicians—it civilized them, and caused them to carry civilization further; and they stand out among the ancient semi-barbarous Arabs as a commonwealth of high culture. Respecting their religion, see ZABISM. Their language is supposed to have been a Semitic (Arabic) dialect, which, however, is almost entirely lost to us now. Some tablets with Himyaritic inscriptions have been found, but their readings are not quite satisfactorily fixed as yet. See SHEMITIC LANGUAGES, ARABIA.

SA'BBATH (Heb. *Shabbath, Sabbathon*, &c., from *shabath*, to rest; not from *shub*, to return, or *shebah*, seven) designates the seventh day of the week, set aside, in the Old Testament, as a period of cessation from work. Without entering into the question of its origin, i. e., whether it be an institution of pre-Mosaic times—either of 'paradise' or of 'heathenism'—or whether it be purely Mosaic, we shall merely state that, according to our only available source, the Pentateuch, the division of the Week (q. v.) into seven days appears at a very early period; but the celebration of the seventh day as a day consecrated to Jehovah, is first mentioned after the Exodus from Egypt, and seems to have preceded the Sinaitic legislation, which merely confirmed

and invested it with the highest authority. On the occasion of the manna (Ex. xvi. 23), the S. and its solemnity seemed presupposed, and the 'Remember the Sabbath-day' of the Decalogue, further seems to indicate its previous institution. There is no trace of its celebration in the patriarchal times, although the Semitic traditions of the creation, and of the divine completion of it on that day, had undoubtedly marked it early as a special day of sanctity among the Abrahamites. The significance that was superadded to it after the Exodus, i. e., that of being a remembrance of the freedom from bondage, makes it appear likely enough that its first legal promulgation dates, as a Talmudical tradition has it, from Marah, where Moses 'set them laws and rights' (Ex. xv. 25). While it thus on the one hand formed a sort of general human memento of the creation and the Creator of all things as it is characterized in the first redaction of the commandments in Exodus, it became also, on the other hand, a national day of record of the bondage and the liberation from it, a notion prominently brought forward in the second recension of the Decalogue (q. v.) (Deut. v. 15), and the 'rest' that was inculcated for everybody—kindred, strangers, slaves, even animals —received a double meaning. It is in the latter sense also denominated a sign between Jehovah and the generations of Israel (Ex. xxxi. 13): a kind of badge of nationality, a token of the covenant between Jehovah and Israel for ever (Ex. xxxi. 16, cf. Ezek. xx. 12, Neh. ix. 13, &c.).

It is constantly mentioned together with institutions of the same peculiar nature; such as reverencing the sanctuary (Lev. xix. 30), celebrating the feasts of a national character (Hos. ii. 11), keeping the ordinances (Ezek. xlv. 17), &c. And in like manner it was made one of the first obligations for proselytes, as one by which they were 'taking hold of the covenant' (Is. lvi. 6). A few special cases only are furnished by the Pentateuch in explanation of the word 'work' used in the prohibition—lighting a fire, gathering sticks, going out of the camp for the purpose of gathering manna. The violation of this law of rest was, as a crime of high treason against Jehovah, punishable with death; yet cessation from labor was only the negative part of the celebration of the day, which is called, like the other festivals, a 'holy convocation.' It is difficult to decide now what precise meaning is to be attached to these words, as referring to the early periods of Israelitish history, particularly before the institution of the prophets or sacred orators had been fully developed. It may be conjectured that the convocation was a kind of general religious assembly, in which readings and some kind of exposition of the law formed the principal features; and there is indeed a tradition to that effect recorded in the Talmud. Some, however, suppose that it was a festive meeting in honor of Jehovah, and refer to Neh. viii. 9—18 for proof that such a celebration was consistent with Jewish notions of keeping days holy to the Lord. As a further celebration of the day, a special burnt-offering, consisting of two lambs of the first year, with the corresponding meat and drink-offering, besides the ordinary daily sacrifice, was instituted, and the shew-bread was renewed in the sanctuary.

Thus far the Pentateuch on the Sabbath. Turning to the later biblical books of the times before the Exile, we find casual references to it as a day of rest and joy, exalted over the other days of the week, and on which agricultural labors and all things connected with them, such as carrying loads, selling and buying, &c., ceased. No deeper signification seems to have been attached to it yet. Although both Jeremiah and Ezekiel, single it out especially, in common with monotheism and the laws of morality, yet they both rest satisfied with the inculcation of its outward observance, which seems occasionally to have fallen into entire disuse. With the return from the Exile, however, a new phase was inaugurated. It is well known how energetically Nehemia carried out his reformation, or rather the restoration of the primitive laws, as in other respects so with regard to the S.; how he 'testified' against those who were treading wine-presses on the S., and bringing in sheaves, and lading asses, &c., and, further, against those 'men of Tyre' who brought 'all manner of ware, and sold on the Sabbath unto the children of Judah and in Jerusalem.' It is by profaning the S., he urges, that their fathers have caused all the evil and wrath that befell the nation and the city. He had the gates shut from Friday evening to Saturday night, and drove away those merchants who still kept lodging outside, by threats of 'laying hands on them.'

What Nehemiah had reinstituted, seems to have been most rigorously upheld, and in many cases made more binding even than he ever intended it, or, at all events, than the originally promulgated form of his words would seem to imply at first sight. With respect to the S. in particular, we find it not more than 100 years afterwards kept with such severity that the people would not even stir in defence of the city of Jerusalem, stormed by the soldiers of Ptolemy I. on that day. Later still, those who had fled into caves to escape the persecution of Antiochus Epiphanes, allowed themselves to be butchered wholesale, nay, burned alive, without any attempt at flight or resistance; 'because they made a conscience to help themselves for the honor of the most sacred day' (2. Macc. vi. 11).

It was only in consequence of these horrible catastrophes, and in consideration of the probability of the enemy's always choosing the hallowed day for his attacks, and thus gradually rooting out the nation, that fighting in self-defence was allowed; although it appears the enemy was not to be disturbed in his siege works. Yet this relaxation in favor of the defensive appears again to have been abrogated through the influence of the fanatical Chassidaic party. Both Pompey and Herod, it would seem, took advantage of the S. for the preparation of the storm on Jerusalem, relying—and successfully—on the strict observance of that day by their antagonists. The incessant tribulations, however, that followed almost without interruption till the final destruction of the Jewish empire, together with the influence of new schools and views, wrought an immense change. Shammai himself, the austere interpreter of the law, and the so-called antagonist of the milder Hillel, pronounced not only the defensive but the offensive legal and righteous (Sabb. xix. a): as, indeed, in his days, human life was placed, under all circumstances whatsoever, higher than any divine or human precept about the Sabbath. 'The Law,' it is said with regard to the S., was given, according to the Scriptures, like other laws, 'that man should *live by them*,' '*not that he should die through them*' (Tos. Shab. xvi. 5). That Joshua had never stopped in his sieges on the S., was not considered so weighty an argument as the dire and imminent necessity that forced itself upon the military and spiritual leaders of the people, of preserving at all hazards a remnant at least of the fast perishing nation.

It was probably after the Exile that the first attempts at legally fixing, or rather 'fencing about' the divine ordinance in a minute and rigorous manner, were made. As we have seen before, no special definition of the 'work' prohibited—save in a few instances—is to be found in the Old Testament. Whether it was the 'men of the great synagogue,' or the later schools, that promulgated the special precepts and prohibitions—part of which were traced to the legislation on Sinai itself (Oral Law)—is difficult to decide. The Mishna only enumerates thirty-nine principal ('*father-*') works, each of which, again, carries a certain number of minor ('*begotten*') works with it, which are strictly forbidden on the Sabbath. A certain portion of these inhibitions and prohibitions refers to work connected with agriculture and the chase; another to domestic labors generally performed by women (such as spinning, sewing, &c.); another again to trade (of builders, mechanics, laborers, &c.) and the like. One of the most harassing of precepts, and one which had at last to be amended by a number of new enactments, was the prohibition of moving things from one place into another (from public to private localities, and *vice versâ*). The minor prohibitions referred chiefly to things which might easily 'lead' to the violation of the S., such as riding on horseback, climbing trees, &c. The 'Sabbath-day's journey,' or prohibition, based on Ex. xvi. 29, of walking more than the supposed utmost space between the ark and the extreme end of the camp, seems to belong, in the Mishnaic form at least, to the Roman times; the *mil* to which it was limited, and which contains the requisite 2000 yards, being a Roman measure.

However it is to be reconciled with the well-known narrative of Christ's healing on the S.-day, contained in the New Testament, there is absolutely no doubt about the fact that, according to the so-called Pharisaical code—i. e., the Oral Law, the highest and absolute authority of Judaism—the safety of life and limb utterly over-rules not only the S., but even the day of Atonement itself. It is only certain smaller alleviations of momentary pain, such as could not by any chance place the patient in the slightest danger, about which we find some kind of casuistical discussions. Practically—that is, according to the final enactments (see Maimonides Yad Chasaka)—it is not only the regard to life, but to the health and well-being of the patient, that sets all Sabbatical prohibitions at nought. The law of 'rest,' according to the Talmud, applies no more to the case of the sick or those anyhow endangered, than it did with regard to the temple, and all the 'work' therein, which, indeed, was much heavier on S. and feast days than at other times. Another difficulty is found in the words in which Christ refers to the beast that is to be taken out of a pit on a S.; the Jewish law, ordaining, in reality, that it should be aided in its own efforts if it endeavored to get out by itself; if it did not succeed, it should be left there, food being let down to it until the end of the S. (Luke xiv.; Matt. xii. 11; Sabb. 128 b). Could it be that the common people (the Hediots or Idiots—i. e., the untutored in the law) were ignorant of the real scope and purport of the 'Pharisaical' code, and that the argument was directed against their crude notions, as directly opposed to the law as established?—But on this we must not enlarge here. It is also impossible to enter into any of the various ancient and modern ways of looking at the S. in an allegorical and symbolical light, e. g., its being connected by Philo and his school with the planets, the spheres, the number seven and the like mystical notions. Nor

can we follow here those speculations which make out a close parallel between the divine work and rest and human work and rest; and show how well-rounded and entire time itself appears when shaped into a week after the model of the six days of creation, and how man's life is, through it, conformed to that of his Creator.

There can be no doubt about its meaning in the Old Testament. It is intended as a principal testimony of faith in the Creator of the universe. Hence its supreme importance. Though the threatened punishments for S.-breakers never seem to have been carried out to the full during the times of the established commonwealth, in the scheme of Judaism it was placed on a par with the entire body of the Law. He who transgresses the S. is considered legally, according to Maimonides, as one who has set the whole law at defiance, and is to be looked upon in every respect as like a 'worshiper of stars'—i. e., a heathen.

Regarding the development of the positive side of the Sabbatical observance, we have to mention first, that in conformity with the precept making it a day of 'holy assembly,' the synagogue (irrespective of the temple service, its special sacrifices, prayers, and psalms for the day), assembled the faithful on that day within its precincts in every town and hamlet in and out of Palestine before and after the final Exile. A certain portion of the Pentateuch, to which afterwards was added a prophetical pericope, the Haftarah, was read, translated into the vernacular, and expounded homiletically. Special prayers and psalms, in addition to the ordinary slightly-modified service, with special reference to the sanctity of the S., were said and sung, and the rest of the day was devoted to pious meditation, study in the law, and to serenity and joyfulness. Respecting this last point, it must be borne in mind that the day is distinctly called a *day of joy and delight* (e. g., cf. Ps. xcii., Is. lviii. 13, Hos. ii. 11, 13, &c.—the words in Is. translated in the authorized version by 'doing thy pleasure,' in reality mean 'doing thy work;' the Hebrew word in this passage exactly corresponding to our 'affairs,' 'business').

A variety of minor regulations referring to bodily indulgences on that day, abundantly prove—if further proof were needed—its recognized character as a 'feast day' in the natural and general sense of the term, in Judaism. It was to be honored by the wearing of finer garments, by three special meals of the best cheer the house could afford (fish, meat, &c.); and it was considered a particularly meritorious thing on the part of the master of the house to busy himself personally as much as possible with the furnishing of the viands, nay, the fetching of the very wood for the cooking, so as to do as much honor to the 'bride Sabbath' as in him lay. Wine, if the means of the individual would anyhow allow it, was to crown the repast, special blessings being duly pronounced over it with reference to the holy day, both at its coming in and at its going out. From the circle of the family, this custom of welcoming, as it were, the S., and taking leave of it, with the cup of blessing, with lights, and with spice, found its way at an early period into the synagogue, on account of those strangers who, having to stop on their journey during the twenty-four hours, were often lodged and fed in or near the synagogue, and on whose behalf the blessing had to be pronounced generally. Fasting, mourning, mortification of all and every kind, even special supplicatory prayers, are strictly prohibited; but, on the contrary, the number of 'a hundred benedictions,' said at all varieties of enjoyments of the senses, are to be completed on the S., were it even by eating different kinds of fruit, smelling different spices, &c. Those who study hard during the week are to relax somewhat on that day, while those bent on business all week may indulge more freely in their readings; even school children are to be released from hard lessons on that day. Nay, the Friday itself participated in a manner in the solemnity of the Sabbath. Its very name was sunk in 'Eve of Sabbath.'

At an early hour in the afternoon, trumpets were blown from the steps of the temple in Jerusalem; and certain shops, the stopping of whose business required some time, began to close. Again and again the trumpets resounded at certain intervals, and other trades ceased, as, indeed, nothing might even be begun on Friday which could not be finished or stopped at the end of that day: walking also was restricted to a certain extent on Friday, and judgment over life and death was entirely suspended. At last, when the sun disappeared from the horizon—irrespective of the situation of the place, whence a difference arose between the beginning of the S. among the dwellers in valleys or on elevations—the hallowed period commenced, and lasted until three stars were visible in the following evening.

The original formulas, much enlarged in later times, as far as they are to be traced now, of the introductory benediction, as well as the valedictory prayer, both of which we subjoin, show the character and scope of the day in Judaism so fully, that they may stand instead of any further explanation of our own.

1. (Kiddush.) 'Blessed art Thou, O Lord, our God, King of the Universe, who hath sanctified us by His Laws, and hath made us participate in His Grace, and hath, in His Love and in His Mercy, given us the Sabbath, as a remembrance of the creation, as the first day of Holy Convocations, and in memory of the redemption from Egypt; for Thou hast chosen us and sanctified us from all peoples, and hast given unto us Thy holy Sabbath in Love and in Grace. Blessed art Thou, O Lord, who sanctifieth the Sabbath.'

2. (Habdalah.) 'Blessed art Thou, O Lord, our God, King of the Universe, who divided between Holy and Unholy, between Light and Darkness, between Israel and the peoples, between the Sabbath and the six days of creation. Blessed art Thou, O Lord, who divideth between Holy and Unholy.'

The same character of cheerfulness, of happy rest from the toil and turmoil of the world's business; of quiet and peaceful 'return into one's self;' of joyous communion with friends and kindred over good cheer—in short, of mental and bodily relaxation and recreation that strengthens, braces, pacifies, and maketh the heart glad, while the sublime ideas which it symbolizes are recalled to the memory at every step and turn—seems to have prevailed at all times, down to our own, among the Jews. Whatever difference there may be in the peculiar customs respecting the S. among some of the recent sects among them, e. g., the Karaites, the Chassidim, &c. (see JEWISH SECTS), they chiefly refer to the Liturgy (with the one vital exception, that the Karaites entirely abstain from the use of light and fire during the whole of the twenty-four hours), and to some minor points, upon which we cannot dwell here. It is also unnecessary here to go into the special 'superior' or 'mourning' Sabbaths during the year, i. e., those that precede or follow certain festivals or days of humiliation, or such as formerly inaugurated new academical semestres (Kallah), and the like. Suffice it to reiterate that in every class, every age, and every variety of Jews, from first to last, the S. has been absolutely a day of joy and happiness, nay, of dancing, of singing, of eating and drinking, and of luxury. The 'luxus Sabbatarius' of Sidonius Apollinarius has indeed been a reproach to them, as was their supposed over-indulgence in laziness. The thinking minds were, according to Philo and others, more than ever busy on that day with those sacred mysteries of God's revelation to man and his miraculous workings on behalf of the 'chosen' nation; others' hearts were lifted up by prayers, by readings, by earnest exhortations, and by pleasing and instructive homiletics. A dark, fanatical, self-torturing spirit is as foreign to the Jewish S. (which is prolonged as far as possible) as it is foreign to the Mosaic and post-Mosaic legislation, its written and oral laws in general.

The benefits of the institution itself for the individual are, after what we have said of its practice, too self-evident to require further comment. How it connected, on the one hand, the human being with the divine Creator, and, on the other, with his fellow-creatures, brother and stranger, children and slaves, nay, the very beast of burden, the ox and the ass—how, ever recurring, it inculcated with irresistible force pious reverence, fear, and love of God, the sole master of all things—man's time and property included—good-will to all things created; and the absolute equality of all men—need not be urged here. Proudhon has recently treated on it from the national-economy point of view, and he has come to the conclusion, that the proportion of the six days of work to the one of judicious rest, is one of manifest wisdom, and of great blessing to man.

It is necessary here to say a few words with reference to the notion that the S., i. e., the celebration of the seventh day as a day of rest, is an institution common to all or most of the civilized nations of antiquity (Assyrians, Arabs, Egyptians, Greeks, Romans), from whom Moses has also been charged with having borrowed it. There is no more truth in these statements than there is in the often repeated assertion of an ancient S. among the aboriginal savages. The dicta of Philo and Josephus, to the effect that there was no city, either Hellenic or barbarian, and not a single people, to which the custom of the S. had not penetrated, have absurdly enough been taken by some as a proof that the Jews borrowed the custom. If the number seven [six and one] is one to which a peculiar significance attached at a very early period, in connection with the calendar (compare the seven worlds, the seven continents, the seven seas, &c., of the Indian cosmogony), and if the weekly cycle of seven days which goes back to the ante-Mosaic period (see Gen. xxix. 27 *seq.*; vii. 4, 10; viii. 10, 12, &c.), is, probably, the common property of the Semitic races; yet there is a mighty difference between counting time by seven (the ancient Egyptians had, in fact, a ten days' previous to a seven days' cycle), and making the seventh day a 'day of rest and holy convocation,' with reference to the national life of Israel.

There is no special sanctity found attached to the day either with the Egyptians or with the pre-Mohammedan Arabs, who sacrificed on that day in black garments, in a hexagonal black temple, an old bull to Saturn: exactly as they sacrificed a boy on another day of the week, sacred to the planet Jupiter. As for the Greeks, the only authenticated passage we find with reference to the subject, is Hesiod's (*Op. et D.* 770, &c.) reference to the seventh day of the month, sacred to Apollo as other days were

sacred to other gods. Other verses quoted by Clemens Alexandrinus and Eusebius, as from Homer and Hesiod, are proved to be spurious Judæo-Hellenic fabrications. The Roman calendar knows absolutely nothing of a hallowed seventh day.

Thus much on the S. under the 'Old Dispensation.' We have still to consider it in relation to the Christian Church, and to trace the progress of opinion and practice in regard to the observance of the first day of the week, which in this country is frequently styled the Sabbath, or, more definitely, the Christian Sabbath.

It is hardly necessary to observe, that all the discourses of Jesus were addressed to Jewish hearers, subject, like himself, to the Mosaic law. That he is nowhere recorded to have enjoined the observance of the S. has by some been thought significant, but seems to have been natural enough in a case where those he addressed, so far from neglecting the duty, were superstitiously scrupulous in its performance. What his hearers needed and received was the lesson, that, the S. having been intended for human benefit, the duty of observing it ought to give way before the higher duty of effecting that purpose, when the two were in conflict; and that trivial acts demanding no exertion were not to be confounded with that real and exhausting labor which was the thing truly forbidden. (Matt. xii. 1—14; Mark ii. 23—28; iii. 1—6; Luke vi. 6—11 : cf. Hosea, vi. 6; Psal. l. 8—14; li. 16, 17; Is. i. 10—17; Jer. vi. 19, 20; vii. 21—23; 1 Sam. xxi. 6). Some have thought that by making clay on a S. to anoint the eyes of a blind man, and by ordering an invalid, when cured, to carry home his bed on another S., he designed to intimate, if not the present abolition of the S., at least its approaching end.

But others look upon the former of these acts as much too trivial to be confounded with 'servile work,' and the latter as an exceptional case within the scope of the principle above stated. On no occasion does he appear to have sanctioned the performance of real work on the seventh day, unless it was demanded by some higher duty than that of bodily rest.

For several years after the death of Jesus, the Church included none but Jews, and by these the S. and other Mosaic rites continued to be observed as before. It was not till Peter's visit to the centurion Cornelius (41 A.D.) that the Gospel began to be preached to the Gentiles; and when the apostles and elders met at Jerusalem to consider what was to be done with the Gentile brethren, it was decided that no Mosaic burden should be laid upon them beyond abstinence from certain practices, of which working on the S. is not one (Acts xv. 23—29). Nevertheless, the Judaizing party continued in various places to demand more or less conformity to the law on the part of the Gentile converts. This party was strenuously withstood by Paul (q. v.), in whose Epistles the dispute is a subject that frequently recurs. From his letters to the churches of Rome, Galatia, and Colosse, which contained both Jews and Gentiles, we learn that, while the Jews wished the Gentiles to observe the Sabbaths prescribed in the law, the Gentiles were prone to treat the observance of Jewish ceremonies with contempt.

Upon both parties the apostle enjoins mutual forbearance and respect; forbidding the Jew who esteemed one day above another to disturb the Gentile who esteemed every day alike, and ordering the Gentile to refrain from contemning the observances conscientiously performed by his weaker brother the Jew (Rom. xiv.; Col. ii. 11—17). That he never taught the Jewish Christians to abandon the observance of the law, but on the contrary, continued to the end to observe it himself—as appears from Acts xxv. 8; xxviii. 17; Philip. iii. 6—are facts of which different explanations have been given by theologians; some thinking that the law continued binding on the Jews, whether Christians or not, so long as the Temple stood; while most are of opinion that conformity to the rooted notions and habits of that people was tolerated for a time, in order that the diffusion of the Gospel might not be impeded amongst them. In the Eastern churches, where the proportion of Jews was greater than in the West, the S. continued to be observed till the 5th c., when we lose sight of the Ebionites (q. v.), a sect of Judaisers such as Paul withstood—and of the more moderate Ebionitic Nazarines, who, though they conceived it to be their *own* duty to circumcise, keep the S., &c., had no desire to impose the peculiarities of Judaism on the Gentile Christians. Down to the present time, however, S.-keeping and various other Jewish rites continue to be practised along with Christian observances by the Christians of Abyssinia, whose ancestors, it is probable, derived them either (as a tradition among them indicates) from missionaries of the Alexandrian Church, of which many members were Jews, or from expatriated Hebrews who settled in Abyssinia at some much earlier date. In other countries also, many of the Gentile Christians seem to have anciently observed the S., if not by resting the whole day from work, at least by attending on it the religious meetings of their sabbatising Jewish brethren.

Hitherto we have spoken of the observance of *Saturday*, the day of rest prescribed to the Jews, and to which exclusively the name of the S.-day was anciently applied, and still continues to be given by every nation but our own and its offshoots. At what date the Sunday, or first day of the week, began to be generally used by Christians as a stated time for religious meetings, we have no definite information either in the New Testament or in the writings of the Fathers of the Church (q. v.). By none of the Fathers before the 4th c. is it identified with the S., nor is the duty of observing it grounded by them either on the fourth commandment, or on the precept or example of Jesus or his apostles, or on an ante-Mosaic S.-law promulgated to mankind at the creation and continuing in force after the coming of Christ. To the reality of such a law—which many modern Christians have deduced from Gen. ii. 2, 3; iv. 3; vii. 4, 10; viii. 4, 10—12; xxix. 27; l. 10; Ex. xvi. 4—30, and which some (as Bishop Horsley, Serm. 22) regard as an indispensable basis for a Christian S.—it has been objected that the attention of the Gentile converts, who must be supposed to have been ignorant of the law in question, is nowhere found in Scripture to have been directed to it by Paul; that his declarations of their freedom from the observance of days are so general as to apply to every law on that subject, whensoever enacted; that consequently he must either have been unacquainted with a primeval law, or (if not) have regarded it as obsolete under the new dispensation; and lastly, that the Fathers, had they known such a law, would have mentioned it in their writings, instead of vindicating (as Justin, for instance, does in his *Dialogue with Trypho the Jew*) the neglect of S.-keeping by Gentile Christians, on the ground that the S. began with Moses and was not observed by the Patriarchs. By none of the Fathers is any S.-law whatever represented as being in force among the Gentiles.

On what grounds, then, did the Christians observe the first day of the week as a time for religious assemblies?—and how and when did the custom of so distinguishing it begin? To these questions very different answers have been given. According to some theologians, apostolic precept or example is the only conceivable origin of a custom apparently so general as well as early; and of such *example* at least, they find evidence in John xx. 19, 26; Acts ii. 1; xx. 6, 7; 1 Cor. xvi. 1, 2; and Rev. i. 10. But others, doubting or denying the conclusiveness of this scriptural proof, conceive that an adequate explanation may be found in the circumstances of the primitive Church. That the desire which naturally actuates the members of every new and unpopular religious sect to meet frequently for worship, instruction, and mutual encouragement, might very soon lead to the fixing of stated days for that purpose, may be assumed as self-evident; that a weekly day should be chosen, would be a natural result of the Jewish habits of the earliest Christians; and that the day on which their Lord had risen victorious from the grave should be thought fittest for this weekly festival, is precisely what was to be expected in their circumstances. But the resurrection of Jesus is by no means the only reason assigned by the Fathers for the honor which they paid to the Sunday. By Justin (see JUSTINUS), in whose *Apology for the Christians to Antoninus Pius*, ss. 87—89, written between 138 and 150 A. D., the earliest undoubted mention of Sunday meetings in the works of the Fathers occurs, several reasons for holding them *then* are assigned—the first being, that on this day of the week the world and light were created; and the second being the resurrection of Christ.

'We all of us,' says he, 'assemble together on Sunday, because it is the first day in which God changed darkness and matter, and made the world. On the same day, also, Jesus Christ our Saviour rose from the dead; for he was crucified on the day before that of Saturn, and on the day after that of Saturn, which is that of the Sun, he appeared to his apostles and disciples, and taught them what we now submit to your consideration.' To these reasons, Origen (*Seventh Hom. on Exod.*) adds the fact that manna was first given to the Israelites on a Sunday; while subsequent writers adduce various other events, either recorded, or by them imagined, to have occurred on that day. In arguing with Trypho, Justin opposes S.-keeping by Christians, on grounds which would have been retorted by the Jew as condemning equally the observance of a first-day S., had the Sunday at that time been regarded as the S.: from which fact, and the circumstance that in his *Apology* already spoken of, where he professes to give the Emperor Antoninus a full account of the observance of the day, no mention is made of rest from labor as a part of that observance, the inference has been drawn, that, except during the time of divine service, the Christians in this Father's age thought it lawful to follow, and actually did follow, their worldly pursuits on the Sunday. It is true that by Tertullian, who wrote in the latter half of the 2d c., the Christians are described as 'putting off even their business on the Lord's day, lest they might give place to the devil' (*De Orat.* c. 23); an indication, in Neander's opinion (*Church Hist.* i. 409, Bohn's ed.), that now the Jewish law of the S. had begun to be applied to the Lord's day.

But the soundness of this interpretation has been questioned—Dr. Hessey, for instance (*Bampton Lectures*, 1860, p. 63), stating that he can find in it 'nothing Sabbatarian—nothing, in fact, more

than I should have expected, considering that the Church had now become somewhat settled—that, rather than that the duties peculiar to the Lord's day should be neglected, worldly business was put off to another day.' But whatever may have been the opinion and practice of these early Christians in regard to cessation from labor on the Sunday, unquestionably the first law, either ecclesiastical or civil, by which the sabbatical observance of that day is known to have been ordained, is the edict of Constantine, 321 A.D., of which the following is a translation: 'Let all judges, inhabitants of the cities, and artificers, rest on the venerable Sunday. But in the country, husbandmen may freely and lawfully apply to the business of agriculture; since it often happens that the sowing of corn and planting of vines cannot be so advantageously performed on any other day; lest, by neglecting the opportunity, they should lose the benefits which the divine bounty bestows on us' (*Cod.* iii. 12, 3). Before this time, such of the Christian writers as had endeavored, by a mystical style of interpretation, to turn the Mosaic ceremonies to account as sources of moral and religious instruction, had, probably in imitation of Philo (q. v.) (*Works*, iii. 265, Bohn's ed), spiritualized the law of the S. to the effect of representing it as a mystical prohibition to the Christian of evil works during all the days of his life, and a prefiguration of the spiritual repose and enjoyment which is his portion both in this world and in the next.

But in addition to this significance, there now began to be discovered in the Old Testament, foreshadowings of the new Sunday-S.; and Eusebius (q. v.), bishop of Cæsarea, the friend and biographer of Constantine, was able to descry in Ps. xlvi. 5, and lix. 16, prophetic allusions to the *morning* assemblies of Christians on Sundays for worship, and in Psal. xxii. 29 a prefiguration of the weekly celebration of *the Lord's Supper* on that day. Applying Ps. xcii. to the first day of the week, the same writer says that 'the Word by the New Covenant, translated and transferred the feast of the Sabbath to the morning light, and gave us the symbol of true rest—viz., the saving Lord's Day, the first of the light,' &c. From other passages in Eusebius and subsequent writers, it is plain that they meant, not that this transference had been formally ordained by Christ (of which there is no trace in Scripture), but that by rising from the tomb on the first day of the week he had made that day more illustrious than the S., and more worthy to be celebrated by the holding of Christian assemblies for worship than the S. was to be similarly honored by the Jews. About the end of the 4th c., Chrysostom is found similarly expounding Gen. ii. 3, which, in his opinion, shows that already from the beginning God offered us instruction typically, teaching us to dedicate and separate the one day in the circle of the week wholly to employment in things spiritual—thus (as his translator observes) making the S. a *type* of the Lord's Day, and rest *from* bodily, of rest *in* spiritual work. (*Library of the Fathers*, ix. 209.)

It was a natural result of Constantine's law, backed by such interpretations of the Old Testament as these, that, in the words of Dr. Hessey, 'a new era in the history of the Lord's Day now commenced; tendencies towards Sabbatarianism, or confusion of the Christian with the Jewish institution, beginning to manifest themselves. These, however, were slight, until the end of the 5th century, and are traceable chiefly to and in the civil legislation of the period. Afterwards they developed themselves more decidedly; Sabbatarianism became at length systematized, in one of its phases, in the ante-Reformation Church both in England and on the Continent by the later Schoolmen, probably in their desire to lay down exact rules for consciences, and under a fancied necessity of urging the precedent of Jewish enactments in support of Christian holy-days' (p. 20). But it was not till the year 538 that abstinence from agricultural labor on Sunday was recommended, rather than enjoined, by an ecclesiastical authority (the third council of Orleans), and this expressly 'that the people might have more leisure to go to church, and say their prayers;' nor was it till about the end of the 9th c., that the Emperor Leo, 'the Philosopher,' repealed the exemption which it enjoyed under the edict of Constantine (Leo. *Const.* 54). And now, the Lord's Day being thoroughly established by law as a S., the fourth commandment would more than ever be employed by the clergy as a means of persuading to its observance. The entire Decalogue, indeed, had long been used by them as a convenient summary of human duty; and by the later Schoolmen it came to be represented as, to a certain extent,—i. e., so far as it coincided with the law of nature—actually *obligatory* on Christians.

This theory of its binding force, and the notion of the holiness of days, were vigorously opposed by Luther and the other Reformers, who denounced also the excessive multiplication of festivals, and proclaimed that the pardon of sin was not to be secured by their observance, or otherwise than by faith in Christ. (See Luther's *Larger Catechism;* the *Augsburg Confession*, 1530, c. vii.; Calvin's *Institutes*, b. ii. ch. viii. ss. 28—34; and his other writings on the subject, collected by R. Cox in *The Whole Doctrine of Calvin about the Sabbath and the Lord's Day*, Edin. 1860). But, while condemning everything which they viewed as abuses and corruptions, the Reformers never ceased to acknowledge the manifold utility and high importance of the Sunday as a day of rest, worship, and decorous enjoyment. Like the later Fathers and the Schoolmen, also, they recognized in the fourth commandment a useful means of instruction and exhortation; but, as we have said, they utterly rejected it as a law. 'The Ten Commandments,' says Luther, 'do not apply to us Gentiles and Christians, but only to the Jews.' (*On the Ten Commandments.*) 'A law,' says Grotius, 'obliges only those to whom it is given; and to whom the Mosaic law is given, itself declares: "Hear, O Israel."' (*De Jure Belli et Pacis*, lib. i. c. i. s. 16.) He quotes also Deut. iv. 7, and Ps. cxlvii. 19, 20. This is not Antinomianism (q. v.): the Reformers acknowledged their subjection not only to the more perfect law of Christ, but to that universal and perpetual law which Paul (Rom. ii. 14) speaks of as the light to the Gentiles of old, who, 'not having the law, were a law unto themselves, showing the work of the law written in their hearts.' See ETHICS.

The distinction, however, between Moses as a lawgiver and Moses as a teacher, was one very apt to be overlooked by the multitude, and disregarded in popular discourses by the clergy themselves. In England, where the writings of the Reformers were less studied than in Germany, the response after the fourth commandment in the Liturgy (where the Decalogue, adapted to general use by the omission of the words addressing it to the Jews, was inserted in 1552), 'Lord have mercy upon us, and incline our hearts to keep *this law*,' must have greatly tended to instil the belief that this commandment imposed on them the duty of keeping, not a mystical, but a literal Sabbath. Accordingly, in the reign of Elizabeth, it occurred to many conscientious and independent thinkers (as it had previously done to some Protestants in Bohemia), that the fourth commandment required of them the observance, not of the first, but of the specified *seventh* day of the week, and a strict bodily rest as a service then due to God; while others, though convinced that the day had been altered by divine authority, took up the same opinion as to the Scriptural obligation to refrain from work. The former class became numerous enough to make a considerable figure for more than a century in England under the title of 'Sabbatarians'—a word now exchanged for the less ambiguous appellation of 'Seventh-day Baptists.' The other and much larger class were the Puritans (q. v.), who, justly offended by the vices and frivolity of the times, but also soured by persecution, applying to themselves the threats of Jehovah against the profaners of the token of the covenant between him and his chosen people—led astray by the mistranslation of Is. lviii. 13 above noticed—overlooking the incidents in Luke xiv. 1—12—and giving a narrower scope than the Reformers had done to the teaching of Paul—added to Sunday-keeping an austerity by which neither it nor the S.-keeping of the Jews had ever before been marked. (See ASCETICISM.) This great party when predominant for a time in the reign of Charles I., availed themselves of the opportunity to maintain and spread their Sabbatarian opinions, not only in numerous treatises, but through what has proved to be the more lasting and influential means of the *Westminster Confession* and *Catechisms*. (See ASSEMBLY OF DIVINES; CATECHISMS; CREEDS AND CONFESSIONS.)

Chiefly through these formularies was effectually introduced into Scotland that scrupulous abstinence from recreation as well as business on Sunday, which still distinguishes the people. For it is a mistake to suppose that either Sabbatarianism or asceticism was recommended by Knox. Agreeing with the other Reformers, Knox, in setting forth in his *Confession of Faith* (1560) 'the works of the First Table,' says not a word about the Sabbath. This *Confession* and the *Geneva Catechism* were adhered to in Scotland till superseded in 1648 by the Westminster standards of faith. Nor is it only to the British Presbyterians that the opinions and habits of the Puritans have descended; as the colonists of New England they planted in that distant soil the rigid Sabbatarianism, which still survives in Massachusetts and Connecticut, and retains the Jewish peculiarity (which found its chief advocates in Prynne and Shepard, 1655) of being observed from sunset to sunset. In America, too, exists now the principal remnant of the Seventh-day Baptists. (See Rupp's *Relig. Denom. in the United States*, pp. 70—111; Mrs. Davis's *History of the Sabbatarian Churches*, Philad. 1851; and the publications of the American (Seventh-day) Sabbath Tract Society, New York, 1852, &c.) They have nearly disappeared in England, though in the 17th c. so numerous and active as to have called forth replies from Bishop White, Warren, Baxter, Bunyan, Wallis and others.

In Holland, though some English Puritan settlers gave birth to a controversy which, during the greater part of the 17th c., engaged the pens of many of the most eminent divines (among whom were Gomarus, Walæus, Rivetus, Cocceius, and F. Burmann), the principles of the Reformers, favored by Grotius among the laity, ultimately kept their ground, as they have done also in Protestant Germany. Yet in Holland were produced the two

bulkiest defences of Sabbatarianism that have ever been published —one, in Latin, by John Brown, an expatriated Scotchman, who had been minister of Wamphray, entitled *Causa Dei contra Anti-Sabbatarios* (2 vols., Rotter. 1674—1676); and the other, in Dutch, by his friend James Koelman, on *The Controversy, History, and Manner of Observance of the Sabbath and the Lord's Day* (Amst. 1685).

In England the earliest considerable treatise on the Puritan side was the *Sabbathum Veteris et Novi Testamenti* of Dr. Nicolas Bound, a minister in Suffolk (Lond. 1595; 2d ed. 1606). It is written in English, though the title is partly Latin. Many converts were made by it and the similar works of Greenham and Widley, his contemporaries; but till the heterodoxy of the Seventh-day Baptist Brabourne aroused, in 1632, the indignation of the bishops, little noise seems to have been made throughout the nation by the controversy; nor would it, perhaps, have ever attained much prominence, had not Charles I. committed, in 1633, the blunder, and, as the Puritans believed, the gross impiety, of reviving his father's *Declaration concerning Lawful Sports to be used [on Sundays]*. (See SPORTS, BOOK OF.) This the clergy were required by Laud (q. v.) to publish in their churches, and many who refused were punished severely. Hence arose the greatest English controversy about the S., between the High-Church party on the one hand, and the Puritans on the other. Bishop White (*Treatise of the Sabbath-day*, 1635) and Dr. Heylin (q. v.) (*History of the Sabbath*, 1636) took the lead for the former, and were ably supported by Sanderson (*A Sovereign Antidote against Sabbatarian Errors*, 1636), Ironside (*Seven Questions of the Sabbath briefly Disputed*, 1637), Taylor (*Holy Living*, ch. iv. s. 6, and *Ductor Dubitantium*, b. ii. ch. ii. rule 6, ss. 43—62), and Bramhall (*On the Controversies about the Sabbath and the Lord's Day*, in his *Works*, fol. p. 907). On the Puritan side were Henry Burton (*The Lord's Day the Sabbath-day*, 1636), John Ley (*Sunday a Sabbath*, 1641), Hamon L'Estrange (*God's Sabbath before the Law, under the Law, and under the Gospel*, 1641), Richard Bernard (*A Threefold Treatise of the Sabbath*, 1641), William Twisse, prolocutor of the Westminster Assembly (*Of the Morality of the Fourth Commandment as still in force to bind Christians*, 1641), and jointly Cawdrey and Palmer, two members of the same Assembly, in their *Sabbatum Redivivum, or the Christian Sabbath Vindicated* (2 vols. 1645—1652), which is the most elaborate defence of Sabbatarianism in our language.

A still more eminent writer on that side, and one of greater breadth of view, was Dr. John Owen, whose *Exercitations concerning a Day of Sacred Rest* (1671), since prefixed to his *Exposition of Hebrews*, gave, however, some offence to his friends by suggesting that the duration of the religious exercises of the day should be measured by the strength of the worshiper. Since then, the Sabbatarian cause has been maintained by numberless writers, among whom may be mentioned Bishop Hopkins, Willison, Jonathan Edwards, Dwight, Stopford, Macfarlan, and others to be afterwards named; while the opposite side is supported by Baxter, Milton, Barrow, Barclay, Morer, Michaelis, Paley, Evanson, Higgins, &c.

In the first half of the reign of George III., the comparative neglect into which the observance of the Lord's Day had fallen in England aroused the anxiety of its friends, and many efforts were made to bring the people to a better disposition towards it. Paley did excellent service, especially by his chapter on the use of Sabbatical Institutions (*Moral Philosophy*, b. v. ch. vi.); while Bishop Porteus successfully exerted himself to check open indulgence in vicious and unseemly amusements. About the same time, the new 'Evangelical' (q. v.) party began those efforts which it makes for the promotion of a strict observance of Sunday according to the Puritan model. But what, perhaps, had most effect in turning the current of public opinion in that direction was the substitution of the Decade (see DECA) for the Week, and the abolition of public worship, by the National Convention of France in 1793 (see CALENDAR); proceedings which brought to the aid of the pious advocates of the Lord's Day, the political conservatism and anti-Gallican feelings of the British people.

In the next generation, the revival of the study of ancient Christian literature led to fresh advocacy of the Lutheran views concerning the S. and the Lord's Day, by Bishop Kaye (*On Justin Martyr*, 1829). Dr. Whately (*Thoughts on the Sabbath*, 1830), Mr. Bannerman (*The Modern Sabbath Examined*, 1832), and the Oxford 'Tractarians;' while Sabbatarianism had influential advocates in Bishop Mant (*The Christian Sabbath, its Institution and Obligation*, 1830), Dr. Daniel Wilson, afterwards Bishop of Calcutta (*The Divine Authority and Perpetual Obligation of the Lord's Day Asserted*, 1830), and Dr. Ralph Wardlaw (*Discourses on the Sabbath*, 1832)—in support of whose principles was founded in 1831 the London 'Society for Promoting the Due Observance of the Lord's Day, which, aided by similar associations in Scotland and the United States still keeps a jealous watch on behalf of the institution. For 17 years preceding his death in 1849, its most noted member, Sir Andrew Agnew, M.P. for Wigtownshire, fought indefatigably both in and out of the House of Commons for a stricter legal enforcement of rest on Sunday; and though he failed to get his bill passed, the agitation which he headed was not wholly fruitless. The attempts, however, which he and his friends have made to suppress all post-office action on Sunday, all stated conveyance of passengers on railways, and such recreations as walking in public gardens, listening to music in the London parks, and viewing works of nature and art in the national collections, have seemed, even to many friends of the institution, to display more zeal than wisdom or knowledge, and have led to the formation (in 1855) of 'The National Sunday League,'—a society which, while deprecating the conversion of any part of the day into a season for ordinary labor, or for frivolous or vicious amusement, conceives that a more cheerful mode of spending some of its hours is expedient, and that the opening of public gardens, museums, and galleries of art, would promote alike the health and the moral and intellectual elevation of the people.

In France, where the Week was restored by Napoleon I. in 1806, the Sunday has not yet wholly recovered its former status as a day of rest; but efforts have lately been made by both clergymen and laymen to convince the people of the advantage of suspending all but necessary labor upon it. Among the advocates of this reform are Pérennès, Gaume, and Mullois, who, however, discountenance the austerity of the Puritans. In Switzerland, Mellet, the pastor of Yvorne, is the author of a clever treatise on *Sunday and the Sabbath*, of which there is an English translation (Lond. 1856). Bred a Sabbatarian, he was converted to the Dominical view by reading Dwight's Sabbatarian *Discourse on the Perpetuity of the Sabbath*, a doctrine still upheld by the 'evangelical' party in Switzerland.

Of late years the bearing of geological discovery on the interpretation of the Hebrew narrative of the creation, and consequently on the S. controversy, and, in particular, on questions arising out of the discrepance between the two copies of the fourth commandment, has been largely discussed. See GENESIS; DECALOGUE. Into the merits of this and other disputed points it is impossible to enter here; but, in concluding the present historical sketch, it may be allowable to express the satisfaction with which we observe, that notwithstanding the wide diversity of opinion as to the authority of the Lord's Day and the manner in which it may and ought to be spent, almost all agree in esteeming it highly as a civil institution at least, and in wishing to defend it from the intrusion of business as far as the public good will allow.

For additional information and discussion, see (on the Sabbatarian side) Holden's *Christian Sabbath* (Lond. 1825); *Report from the Select Committee of the House of Commons on the Obs. of the Sabbath-day* (Sir A. Agnew's committee), 6th August 1832; Jordan's *Scriptural Views of the Sabbath of God* (Lond. 1848); M'Crie's *Memoirs of Sir A. Agnew* (Edin. 1850); Pirret's *Ethics of the Sabbath* (Edin. 1855); Fairbairn's *Typology of Scripture* (3d ed., Edin. 1857); J. Gilfillan's *Sabbath viewed in the Light of Reason, Revelation, and History, with Sketches of its Literature* (Edin. 1861): and (on the Dominical side) Arnold's *Sermons*, vol. iii. (Lond. 1844), and his *Life* by Stanley, 5th ed. vol. i. p. 364, and vol. ii. p. 206; Neale's *Feasts and Fasts* (Lond. 1845); Sir W. Domville's *Examination of the Six Tests commonly adduced from the New Testament in proof of a Christian Sabbath* (Lond. 1849); Hengstenberg on *The Lord's Day*, translated by J. Martin (Lond. 1853); F. D. Maurice's *Sermons on the Sabbath-day* (Lond. 1853); R. Cox's *Sabbath Laws and Duties* (Edin. 1853); Domville's *Inquiry into the supposed Obligation of the Sabbaths of the Old Testament* (Lond. 1855); *Sunday the Rest from Labor*, by a Christian (Lond. 1856); Dr. W. F. Hook on *The Lord's Day* (Lond. 1856); *Time and Faith* (Lond. 1856); Alford's *Greek Testament with Commentary* (Lond. 1856—1861); F. W. Robertson's *Sermons*, 1st and 2d series (Lond. 1856), Baden Powell's *Christianity without Judaism* (Lond. 1857); Reichel's *Lord's Day not the Sabbath* (Dubl. 1859); W. Logan Fisher's *Hist. of the Institution of the Sabbath-day, its Uses and Abuses*, 2d ed. (Phila. 1859); Dr. J. A. Hessey's *Sunday; its Origin, History, and present Obligation*, being the Bampton Lectures for 1860; and the *Edin. Review* for October 1861, p. 535.

Of the British Seventh-day Baptists the principal works are those of Brabourne (1632), F. Bampfield (1677), Cornthwaite (1740), and Burnside (1825). The Roman Catholic doctrine respecting the Lord's Day, is amply stated in *The Catechism of the Council of Trent* (1567), Part III., pp. 351—357, 391—403 of the English transl. (Lond. 1852). As to all shades of opinion, see R. Cox's *Literature of the Sabbath Question* (2 vols. Edin. 1865). Proudhon's work, above referred to, is entitled *De la Célébration du Dimanche considérée sous les Rapports de l'Hygiène Publique de la, Morale, des Relations de Famille et de Cité* (Paris, 1850).

SABBATHAIS ZWI, one of the most remarkable 'Messiahs' of modern times, the founder of a wide-spread sect of semi-Christians and semi-Jews throughout Europe, Asia, and Africa, was born at Smyrna in 1641. A boy of extraordinary gifts, he had at

the age of 15 already mastered the Talmud, and at 18 was an adept in the mysteries of the Cabbala. Very soon incited by fantastic dreams and more fantastic friends, he declared himself to be the Messiah, who had been sent to shake off the thraldom both of Christianity and Mohammedanism from the Jews, and to convert all humanity. The supreme rabbinical council thereupon excommunicated him. He, however, continued to preach his 'mission' as before. He was now declared an outlaw, and his death was decreed, yet nobody dared to touch him. At last, his expulsion from Smyrna was resolved upon by the municipal authorities.

Four apostles—one of them a reconverted Jew, who had previously turned Christian—followed him on his way to Saloniki, where he arrived in 1659, having gathered a vast number of disciples, mostly wealthy, on his road. His extraordinary personal beauty and his fiery eloquence soon brought the most influential Jewish inhabitants on his side, and his cabbalistic formulas and prayers were adopted into the ritual of their synagogue. Two years later, however, he had to leave Saloniki, where powerful antagonists had risen in the meantime, and went first to Palestine and soon after to Alexandria, accompanied by several thousand disciples. Here his power and influence grew so rapidly, that the revenues of the commonwealth to be founded by the new Messiah, and the ways and means of supporting the wars he was going to wage, were seriously taken into consideration. In 1664, no fewer than 80,000 people belonged to the new empire; and in the following year, the beginning of the Messianic reign within a few months, and the rebuilding of the Temple in the next year, were proclaimed aloud in the streets of Alexandria by S. and six disciples, all clad in white raiments, with garlands on their heads. Somewhat later, he returned to Jerusalem; and the resurrection to take place within six years, and the deposition of the sultan whose crown would be placed upon S.'s head, were proclaimed far and near. Upon this all the Jews of Asia, Africa, and Europe, were divided into two camps.

Those who believed, finding all the predicted signs fulfilled now, sold everything they had in order to get ready-money for their journey to, and final abode in, the new capital, Jerusalem; others, and among them some of the highest spiritual authorities, declared all the pretended Messiah's miracles to be cabbalistic tricks, and himself an impostor. Returned to his native place, Smyrna, he was received with full royal honors. Meanwhile, the attention of the Divan was drawn to this movement, and Mohammed IV., then in Adrianople, ordered the grand vizier to secure the person of S., and to commit him to prison, until the investigations set on foot should be concluded. Two agas, however, returned with their janizaries, without having effected the order, not having dared 'to stretch forth their hand against the sacred man.' He now offered to surrender voluntarily. He was committed as prisoner of state to Kuthajah, where he received visits and deputations from all parts. Being at last brought before the sultan, his courage failed him, and he declared himself to be nothing more than a simple rabbi: it was only his disciples, he averred, who had called him a Messiah. The sultan then proposed to test his 'mission.' Three poisoned arrows were to be shot at him. Did these prove harmless, he, the sultan, would at once range himself under his flag. In speechless terror, S., at the instigation of his Jewish interpreter, now took the turban from the head of some official, and placed it upon his own, thereby indicating, as the interpreter declared, that his sole object had been all along to embrace Islam, and to carry over all the Jews with him. The sultan declared himself satisfied, and honored him with the title of an effendi, giving him an honorary post at the same time.

But, extraordinarily enough, the movement was far from having reached its end. The most wonderful stories were circulated among the believers. A fictitious man was supposed by some to have embraced Islam, while the real Messiah had ascended heavenwards. Others believed that Islam was to form part of the new religion; and S., countenancing this view, converted many Jews to Mohammedanism. Nathan, one of his most enthusiastic disciples, traveled about, and caused strife without end, even sanguinary revolts. Many, however, had turned from him by this time, and the voices of the rabbis and their excommunications began to tell more forcibly. Finally, the grand vizier was persuaded to imprison S. once more, and to send him to Bosnia, where he died in a prison in Belgrade—according to some, in consequence of poison, while according to others he was executed in 1677, ten years after his conversion. It is very difficult to judge correctly of a character like his. Even his worst enemies never had a word to say either against his morality or against the extraordinarily brilliant powers of his mind, and his erudition. Probably, he was a self-deceiver, whose plans were not measured by the means in his hands for their execution. His death, however, was only the signal for the reinforcement of his sect, which even many of his former antagonists now joined, and which now, for the first time, was developed into a proper religious system—that of the Sabbathaites or Sabbathians (Shebsen), the chief apostles being Nehemiah, previously a bitter enemy of S. (1677—1690), and Nehemiah Hajun (1708—1717). The latter taught the dogma of the Trinity as part of the new faith; and it became a principle of this religion to accept and to modify itself to the dominant creed of the country—Islam in the East, Christianity in the West. Remnants of it are still in existence in Poland and Turkey. See JEWISH SECTS.

SABBA'TIA, a genus of plants, of the natural order *Gentianaceæ*, natives of North America. They are small herbaceous plants, some with simple, and some with branched stems. They all contain, like many others of the same order, a pure bitter principle, on account of which they are useful in intermittent fevers and as a tonic. They are much employed in the United States.

SABBA'TICAL YEAR (Heb. *Shenath Shabbathon, Shebiith, Shemittah;* Gr. *Hebdomatikos* or *Sabbatikos eniantos*). There are four special injunctions found respecting the celebration of it in the Pentateuch. The first (Exod. xxiii. 10, *seqq.*) ordains that the land, after being sown, and its fruits reaped for six years, should be left to itself in the seventh, so that the poor, and the beasts of the field should eat its spontaneous growth. The same is to be the case with the vine and olive-yards. The second (Lev. xxv. 2—7) views the hallowed period as a 'Sabbath of rest unto the land'—as a solemnity in honor of Jehovah. It is there further enjoined, that the growth of the seventh year be 'meat' both for proprietor, servants, and strangers; that, in fact, it should be common property. A somewhat new significance, but strictly analogous to the first-named ordinance, is given to the institution in the third passage (Deut. xv. 1—11), in which the creditor is enjoined to release the debts owing to him by his poor brother and neighbor. It has been matter of much dispute whether this 'release' implies the entire giving up of the debt, or a mere respite. The Mishna decides in favor of the former; and such were the effects of the law, carried out in accordance with this view, that it was found necessary utterly to paralyze it by an act called the *Prosbul* (Gr. Prosboulé), passed by Hillel the Great.

The fourth passage (Deut. xxxi. 10—13) contains the command to read, in the solemnity of the year of release in the 'Feast of Tabernacles,' the Law before all the people in holy convocation, men, women, children, and strangers. We need only remark here that the fundamental idea of the sabbatical year is identical with that of the weekly Sabbath itself; see also JUBILEE, the highest exaltation, as it were, of the idea of sabbatical rest. As to the practical working of the institution, we learn that it gave rise repeatedly to famine (1 Macc. vi. 49, 53; Jos. *Ant.* xiv. 16, 2, &c.), and that it was altogether so fraught with practical difficulties, that from the time it is supposed to have been inaugurated—viz., fourteen years after the Israelites' first entry into Palestine (seven years' conquest, and seven years' division of the land), it never seems to have been kept before the Exile. It has erroneously been supposed by some that the slaves were set free in the sabbatical year. The passage in question refers only to the seventh year of the individual slave's service. Like the jubilee, it was proclaimed on the tenth day of the seventh month, at the end of the harvest-time. Reasonable doubts have been expressed regarding the 'possibility' of the Jubilee (q. v.) ever having been kept in reality; yet there is no doubt about the rigor with which the sabbatical year was kept up, after the Exile, to a very late period. Alexander, Cæsar, and the late emperors exempted the Jews from tribute during it. The sabbatical year being one of the 'ordinances attached to the land'—i. e., Palestine only—it ceased with the final overthrow of the Jewish commonwealth.

SABBIONE'TTA or SABBIONETA, a city of Northern Italy, province of Cremona, with 2000 inhabitants. It is situated in a marshy district, which affords abundant fodder and pasturage. It was the capital of a principality given by Napoleon I. to his sister Pauline in 1806, and was a place of some consequence; now it is a decayed city, the population of which is daily decreasing.

SABE'LLIUS, a celebrated African heresiarch of the 3d c. was born probably at Ptolemais in the Pentapolis, where, at all events, his opinions were first promulgated. Nothing is known regarding his life—the few statements current on the subject being of a contradictory and untrustworthy character, and it is generally thought that he did not broach his heresy till shortly before his death—the date of which is also unknown. S. is pronounced by Neander 'the most original and profound thinker among the Monarchians'—i. e., the Unitarians; but unfortunately only a few fragmentary notices of his teaching have been preserved, and these by his theological adversaries. It would appear that he did not reject the Scriptural phraseology used in speaking of the Godhead. 'Father,' 'Son,' and 'Holy Ghost' were sacred and venerable names to him as well as to orthodox Christians; but he was strongly opposed to the ecclesiastical conception of this Trinity, as a Trinity of distinct persons, or subsistences (*hypostases*), which he (like many other persons since) held to be absurd and unthinkable, and argued that what is to be under-

stood is a Trinity of manifestation. The single absolute Divine Essence—the *monas* or 'pure Deity,' unfolds itself in creation and the history of man as a Trinity. His words, as quoted by Athanasius, are: *He monàs platuntheisa gegone trias.*

The 'energy' by which God called into being and sustains the universe is the 'Logos,' after whose image men were created; but when they had fallen from perfection, it became necessary for the 'Logos,' or Divine Energy, to hypostatise itself in a human body, in order to raise and redeem them; hence in the man Christ Jesus dwelt the fulness of the Godhead *bodily;* while the same Divine Energy, operating spiritually and impersonally in the hearts of believers, is the 'Holy Ghost.' This is not, perhaps, so very heretical after all. But, on the other hand, we must not overlook the fact, that S. held these Divine 'manifestations' to be merely temporary, and that after the 'Logos' and the Holy Ghost' had done their work, they would be reabsorbed in the absolute Deity—the *trias* would again resolve itself into the *monas;* or, in the language of St. Paul, that 'God would be all in all.' Epiphanius alleges that S. derived his system from an apocryphal 'gospel to the Egyptians;' and there are (as Neander points out) so many points of resemblance in Sabellianism to both the Alexandrian Jewish theology in general, and the particular gospel referred to, that the statement may be regarded as at least indicating the direction from which proceeded the influences that determined the theosophy of the unknown Pentapolitan. The followers of S. were formally suppressed by the Catholic Church in the 4th c.; but his doctrine, which, divested of its Gnostic and Neo-Platonic phraseology about 'emanation,' and 're-absorption,' &c., is substantially Unitarian, has seldom wanted eminent advocates in any subsequent age of Christianity.—Consult Tillemont's *Memoirs;* Lardner's *Credibility of the Gospel;* and the Church Histories of Mosheim, Neander, and Milman.

SABICU (*Acacia formosa;* see ACACIA), a tree the wood of which is remarkably hard and tough. It is a native of Cuba. The wood is of a dull red color, and close short grain. The wood was used to construct the stairs of the Crystal Palace in Hyde Park in 1851, and 'after six months' use, the steps hardly exhibited any signs of wear.'

SABINE, MAJOR-GENERAL SIR EDWARD, a celebrated British physicist, of Irish extraction, was born in 1790. After serving in the royal artillery for some time, he was promoted to the grade of lieutenant, and accompanied Captain Ross (q. v.) and Lieutenant Parry (q. v.) in their expedition (1819—1820) to the north coast of America (see NORTH-WEST PASSAGE), making during the voyage a series of magnetic observations of great value. These observations formed the substance of two papers which he communicated to the Royal Society on his return. A strong desire of continuing the investigation of this and other branches of experimental physics, prompted him to undertake a series of voyages to places between the equator and the north pole, making at each point observations on the length of the seconds pendulum, and on the dip and intensity of the magnetic needle. The fruits of these labors were of high importance, and were published, along with other information, in 1825.

From this period, his history is that of a studious investigator into the laws and phenomena of nature, broken only by a short term of military service in Ireland, during which he rose to the rank of major. In 1836 he communicated to the British Association at Bristol his observations on the declination and intensity of the magnetic force in Scotland; and to the same association, he delivered, at Liverpool, in 1837, a report on the variations of magnetic intensity at different parts of the earth's surface. The rest of his researches into the nature and action of magnetic force will be found in detail in the *Transactions* of the above-mentioned association, of the Royal Society, and in the *Philosophical Transactions.* His labors have led to the discovery of the laws of 'magnetic storms,' of the connection between certain magnetic phenomena and the changes of the solar spots, and of the magnetic action (independently of heat) of the sun and moon on the earth. He deserves almost the sole credit of extending the body of known facts in magnetic science by the establishment of magnetic observatories in all parts of the world, and by the collation of the enormous mass of facts thus acquired. In 1818, S. was elected a Fellow of the Royal Society; in 1850, he became its Vice-president and Treasurer, and in 1861, its President. He was for 21 years one of the general secretaries, and for 8 years sole general secretary of the British Association, and filled the office of President in 1852. In 1856, he was raised to the rank of major-general; in 1869 he was created a Knight-Commander of the Bath; and in 1875 a corresponding member of the French Academy.

SABI'NE, a river of the United States of America, rises in the N.E. part of Texas, and flows S.E. 250 m. to the eastern boundary of Texas, whence flowing southerly, it forms the eastern boundary, and empties itself through Sabine Bay, 18 miles long by 9 miles wide, into the Gulf of Mexico. The S. is 500 miles long, but shallow and unnavigable.

SABI'NI, an ancient people of Central Italy, whose territory lay to the north-east of Rome. The boundaries of the territory cannot be determined with exactness, but it appears to have extended from the sources of the Nar, on the borders of Picenum, as far south as the Anio. The nations conterminous to the S. were the Umbrians on the north, the Umbrians and Etruscans on the west, the Latins and Æqui on the south, and the Marsi and Picentini on the east. The entire length of the Sabine territory did not exceed 85 miles, reckoning from the lofty and rugged group of the Apennines, anciently known as the *Mons Fiscellus* (now *Monti della Sibilla*), to Fidenæ on the Tiber, which is not more than 5 miles from Rome. The principal towns were Reate, Interocrea, Falacrinum, Nursia, Amiternum, Casperia, and Cures, but none of these places were of any size or political importance. The inhabitants had no inducements to congregate in large towns. Their country was an interior region; much of it, especially in the north, very mountainous and bleak, though the valleys were (and are) often richly productive; and thus cut off from the seaboard, and even from that easy access to their neighbors which lowland districts admit of, they (like all the other races who peopled the sequestered regions of the Apennines) scarcely advanced beyond the rude simplicity of their primitive highland hamlets.

The Sabines were a brave, stern, religious race, whose virtues were all of an austere and homely character. Cicero speaks of them as *severissimi homines*, and Livy notes the *disciplina tetrica ac tristis veterum Sabinorum* ('the stern and grave discipline of the old Sabines'), while the poets of the Empire—Horace, Virgil, Juvenal, &c., are fond of contrasting their simple uncontaminated modes of life with the vicious luxury and dissipation of the capital. What part, if any, they had in the foundation of the city of Rome, cannot now be ascertained, as the whole story of the Ramnes, Tities, and Luceres has come down to us in a purely mythical form (see ROME). Their native tutelary deity was 'Sancus,' or 'Semo-Sancus' = Lat. *Sanctus*, the 'Holy' or 'Venerable;' but like the other Latino-Sabellian races, they also worshiped Jove, Mars, Minerva, Sol, &c. That the S. were an ancient people in Italy, is certain. They were probably most nearly allied to the Umbrians, whose tutelary god was also 'Semo-Sancus;' and, in fact, they are generally considered an offshoot of that people; but they themselves, on the other hand, became so numerous that they were obliged to send forth numerous colonies, who founded new nations to the south and east, the Picentes, Peligni, Samnites (q. v.) &c.; while the Samnites (a name essentially the same as *Sabini;* the Greek form *Saunitai* = *Sav-nitæ* = Oscan name *Safini* or *Sabini*) in their turn became the progenitors of the Lucanians, Campanians, and Bruttii. Hence the epithet, *Umbro-Sabellian*, in use among classical ethnologists, to denote the whole of these kindred races, who were also allied, but less closely, to the Latins (see LATINI) and Oscans (see OSCI).

Of the Sabine language, only a few words remain, which, however, seem to indicate that it differed from the Latin only dialectically: thus, Lat. *hircus*, Sab. *fircus;* Lat. *hostis*, Sab. *fostis*, &c.; analogous to the Aberdeen *filk* for 'whilk,' *fat* for 'what,' &c. For further information, see ROME. HISTORY OF.

SABLE (*Martes zibellina*), a species of Marten (q. v.), so nearly allied to the Common Marten and Pine Marten, that it is difficult to state satisfactory specific distinctions. The feet are covered with fur, even on the soles, and the tail is perhaps more

Sable (*Martes zibellina*).

bushy than in the British martens. The length exclusive of the tail, is about 18 inches. The fur is brown, grayish-yellow on the throat, and small grayish-yellow spots are scattered on the sides of the neck. The whole fur is extremely lustrous, and hence of the very highest value, an ordinary S. skin being worth six or seven pounds, and one of the finest quality fifteen pounds. The fur attains its highest perfection in the beginning of winter, and the pursuit of the S. at that season is one of the most difficult and adventurous of enterprises. The S. is a native of Siberia, widely distributed over that country, and found in its coldest regions, at

least wherever forests extend. The progress of geographical discovery in the eastern parts of Siberia has been much indebted to the expeditions of the hardy and daring S.-hunters, exploring new regions at the worst seasons of the year, and spending dreary months at a great distance from all human abodes. The S. is taken by traps, which are a kind of pitfall, it being necessary to avoid injury to the fur, or by tracking it through the snow to its hole, and placing a net over the mouth of the hole. It is a very wary animal, and not easily captured. It makes its nest in a hollow tree, or sometimes, it is said, by burrowing in the ground, and lines it with moss, leaves and grass. From this it issues to prey on hares and smaller animals of almost any kind, its agility enabling it even to catch birds among the branches of trees. It is ready, when food is scarce, to eat the remains of an animal on which a larger beast of prey has feasted, and is said even to satisfy its hunger with berries in winter, when animal food is not to be had.

SABLE, one of the tinctures in Heraldry, implying black. In heraldic engravings, it is represented by perpendicular and horizontal lines crossing each other.

SABLE ISLAND. See NOVA SCOTIA.

SABLES D'OLONNE, LES, a seaport of France, in the dep. of Vendée. It owes its early importance to Louis XI., who excavated the port, and raised the fortifications. In 1688, its merchant marine was more important than that of either Nantes or Rochelle. The commerce is in grain, wines, cattle, fish (sardines), salt, &c. Pop. (1876) 9188, who are almost all engaged in a seafaring line of life.

SABOTS, a species of wooden shoes much used by the French and Belgian peasantry, especially by those who inhabit moist and marshy districts, as an effectual protective of the feet from external moisture. The fabrication of sabots forms an important branch of French industry, and is chiefly carried on in the deps. of Aisne, Aube, Maine-et-Loire, and Vosges. After being made, they are subjected to the smoke of burning-wood, till they acquire that reddish color so much prized in certain countries.

SABRE, a heavy sword, with which dragoons are armed. The back is thick, that a blow may carry the more force, and also to render the weapon useful in the rough thrust of a cavalry charge. A sabre is occasionally curved at the point, in the form of a scimitar.

SABRE-TA'CHE (Ger. *Säbeltasche*, sword-pocket), a useless square accoutrement which dangles against the legs of officers in some cavalry regiments. It purports to be a pocket for the conveyance of dispatches, &c., but probably is never used. The sabre-tache is hung by smaller ornamental belts from the sword-belt, and is itself covered with gold brocade, the emblems of the regiment, and other devices.

SABRINA LAND, discovered in the Antarctic Ocean, March 20, 1839, by Balleny, in lat. 69° 58′ S., long. 121° 8′. See ANTARCTIC OCEAN.

SA'CCHARIC ACID ($2HO,C_{12}H_8O_{14}$) is a product of the action of nitric acid, under certain conditions, on grape and cane sugar, or on starch, gum, and lignine. It occurs as a colorless, inodorous, deliquescent, gummy, uncrystallizable mass, which is freely soluble in alcohol. It is sufficiently powerful to dissolve iron and zinc, with extrication of hydrogen. It has a tendency to form double salts, so that it is probably a bibasic acid.

SACCHARO'METER, an instrument for determining the quantity of sugar in liquids, especially brewers' and distillers' worts. In principle, it resembles the hydrometer, used for ascertaining the strength of alcoholic liquids. It consists of a hollow sphere or oval of thin brass, with a graduated stem and a hook so placed opposite each other, that when placed in water, it floats, and the graduated stem stands upright on the top, and the hook is below, for the purpose of appending weights. The degree to which the stem sinks gives the means of calculating, by tables prepared on purpose, the proportion of saccharine matter present in the liquid.

SA'CCHARUM. See SUGAR-CANE.

SACCOTOO. See SOKOTO.

SACHEVEREL, HENRY, D.D., was born in the year 1672, at Marlborough, where his father was minister of St. Peter's Church, and noted for his attachment to the High Church principles, which were afterwards embraced by his son. The youth was educated at the grammar-school of his native place, and at Magdalen College, Oxford, where he occupied chambers along with the celebrated Addison, who then and for many years afterwards seems to have entertained for him a warm regard. He obtained a fellowship in his college, and took successively the degrees of M.A. (1696), of B.D. (1707), and of D.D. (1708). In 1705, he became preacher of St. Saviour's, Southwark; and in 1709, he delivered the two sermons—one at the assizes at Derby, the other on the 5th November at St. Paul's—which have given him a place in the history of his country. The rancor with which he attacked in these sermons the principles of the Revolution Settlement, asserted the doctrine of non-resistance, and decried the Act of Toleration, excited the indignation of the Whig government of the hour, and led to his impeachment for high crimes and misdemeanors. His trial before the House of Lords took place in the spring of 1710, and resulted in his being found guilty, and suspended from preaching for three years, the obnoxious discourses being ordered to be publicly burned by the hangman. Of the rage of factions on the occasion, the fury of the popular excitement, and the excesses of the High Church party, an account in detail will be found in any history of the period. S. became for the time the most popular man in the kingdom, and the general election which followed was fatal to the government which had prosecuted him. When, in 1713, his suspension as by sentence expired, as a special mark of honor he was appointed by the new House of Commons to preach before them the sermon on the anniversary of the Restoration, and specially thanked on the occasion. A more substantial token of favor was his presentation to the rectory of St. Andrew's, Holborn.

Subsequently—except that there is some reason to believe he was more or less concerned in a plot to restore the Stuarts—he disappears from the sphere of history. He is said, in his later years, to have sought the excitement which may in some sort have become necessary to him, in a series of paltry and undignified squabbles with his parishioners. Nor in this is there anything improbable. His character was essentially a weak, vain, and shallow one, and he remains notable merely as one of those men, intrinsically insignificant, who have had a spurious notoriety and importance thrust upon them by the accident of foolish activity in a special concurrence of circumstances. See Burton's *Reign of Queen Anne* (1880).

SACHS, HANS, the most prolific and at the same time the most important German poet of his time, was born on the 5th of November 1494, at Nürnberg, where his father was a tailor. While at school, he learned the rudiments of Latin, but at no time of his life could he be called a scholar in the strict sense of the term, although he was certainly a well and widely-informed man. About the age of 15, he was sent to learn the craft of shoemaking; his love of verse, however, also led him to become a disciple of Leonhard Nunnenbeck, weaver and *meistersinger* in his native town. On finishing his apprenticeship, S., as was the custom of craftsmen in those days, made a sort of tour or pilgrimage through Germany, frequenting assiduously the verse-making schools or corporations organized by the trade-guilds in the different cities, the members of which, known as *meistersingers*, had, since the disappearance of the older *minnesingers*, or minstrels of chivalry, become the chief representatives of German poetry.

On his return to Nürnberg, he commenced business as a shoemaker, prospered in his calling; and after a long, cheerful, and happy life, died on the 25th of January 1576, at the age of 82. S. was twice married—first to Kunegunda Kreutzer, who bore him five sons and two daughters; and afterwards, in his 66th year, to Barbara Harscher. His grave is still to be seen in St. John's churchyard, Nürnberg. S.'s career as an author is divided into two periods. In the first, he shows an interest mainly in the occurrences that were then agitating Germany. It was the epoch of the Reformation of Luther, whose praises he celebrated (1523) in an allegorical tale entitled *Die Wittenbergisch Nachtigal*, while his poetical fly-sheets (of which about 200 are known) furthered in no small measure the Protestant cause. In the second period, his poetical activity was turned more to the delineation of common life and manners. His poetry is distinguished by its heartiness, good sense, homely genuine morality, and freshness; its clear and healthy humor, and its skilful manipulation of material. It is, on the other hand, deficient in high imagination and brilliant fancy, and contains large tracts of dry, prosaic, insipid verse. S.'s best productions are his *Schwänke*, or Merry Tales, the humor of which is sometimes unsurpassable; but his serious tales, allegorical and spiritual songs, and his dramas, also show a great advance on his predecessors. His special *meistergesänge*, on the other hand, are of little or no value. Manuscript copies of S.'s poems —some in his own handwriting—are to be seen in the libraries at Zwickau, Dresden, Leipzig, and elsewhere.

When S. had reached the 52d year of his career as a poet, he took stock of his work, and found that he had written 34 vols., containing upwards of 6200 pieces, among which were 4275 meistergesänge, 208 comedies and tragedies, about 1700 merry tales, secular and religious dialogues, proverbs, and fables, 7 prose dialogues, and 73 songs, secular and devotional. The first edition of his works was published at Augsburg in 1558, but the best is that of Willer (5 folio vols. 1570—1579); a later quarto edition, known as the *Kemptener*, appeared in 1612—1617, and was republished at Augsburg in 1712. After the middle of the 17th c., when a deep stupor seized the German mind, and it could produce nothing but endless tomes of theology, varied by an oc-

casional hymn of more or less merit, S., with all his poetic brethren, suffered a total neglect, from which he did not recover till Goethe wrote his pleasant poem, *Hans Sachs, Erklärung eines alten Holzschnitts vorstellend Hans Sachs's poetische Sendung* (1776), since which time partial collections of S.'s works have frequently appeared.

SACK, a large bag made of a coarse hempen cloth called sacking or sackcloth. Such bags are used for the conveyance of corn, flour, and other bulky articles. A corn-sack is usually made to contain four bushels, hence it is constantly spoken of as a measure of quantity, two sacks being equal to one quarter of corn.

SACK. A name in common use in the time of Shakspeare, and occurring down to the middle of the 18th c. as denoting a kind of wine. The exact nature of this famous wine, the favorite beverage of Falstaff, and the origin of the name, have been much discussed. Sack or seck seems to be simply an English disguise of the Spanish *seco* (Fr. *sec*), applied to wines of the sherry genus, as distinguished from the sweet wines; a term which we now translate by 'dry.'

SA'CKBUT (Fr. *saquebute*), the name under which the Trombone (q. v.) was known on its first introduction to England.

SA'CKETTS HARBOR, a village and port in New York, U. S., on the south shore of Black River Bay, 8 miles east of Lake Ontario, 170 miles west-north-west of Albany, having a navy-yard, barracks, mills, &c. In the war of 1812, it was an important port, where the frigate *Superior*, of 66 guns, was built in 80 days, and the *Madison* in 45 days, from timber standing in the forest. A man-of-war of 3200 tons, begun before the treaty of disarmament, is still upon the stocks. The town has declined since the war, and has now a population of but (1875) 734.

SACKVILLE, THOMAS, Earl of Dorset, an English poet and statesman, was born at Buckhurst, Sussex, in 1536. He was the only son of Sir Richard Sackville; studied at Oxford and Cambridge, where he acquired a high reputation as a poet both in Latin and English, and afterwards became a student of the Inner Temple. While a member of this society, he wrote, along with Thomas Norton, a blank-verse tragedy called *Ferrex and Porrex* (afterwards called *Gorboduc*), which was performed before Queen Elizabeth at Whitehall in 1561—1562. This work, the plot of which is founded on a British legend, claims particular notice as the earliest tragedy in the English language. It is moulded to some extent on the classic drama, the incidents being moralized at intervals by a chorus. It has no dramatic life or energy, but the style is pure and stately, evincing eloquence and power of thought. S.'s other productions (first published in 1563) are the *Induction*, a poetical preface to the *Mirrour for Magistrates*, and the *Complaint of the Duke of Buckingham*, which was designed to conclude the work. The *Induction* is a noble poem, uniting, as Hallam says, 'the school of Chaucer and Lydgate to the *Fairy Queen*,' and almost rivalling the latter in the magnificence and dignity of its allegoric personifications. The influence of Dante is very perceptible. S. now abandoned literature, and after traveling in France and Italy, returned to England, and entered public life. Soon after his father's death in 1566, he was created Lord Buckhurst, became a favorite with the queen, who employed him in foreign diplomacy, and on the death of Burleigh, succeeded him in his office of Lord High Treasurer (equivalent to Prime Minister in those days), in which capacity he showed himself not inferior in sagacity and fidelity to his great predecessor. On the accession of King James, his patent of office was renewed for life; and in the following year, he was created Earl of Dorset. S. died April 19, 1608, and was buried with ceremony in Westminster Abbey. His works are edited by the Rev. Sackville West, in Smith's *Library of Old Authors* (Lond. 1859).

SA'CO, a river of New England, U. S., rises in the White Mountains of New Hampshire, runs south-easterly through the south-western portion of Maine, through Saco Bay, to the Atlantic Ocean. Its course of 160 miles is almost a continuous succession of falls, the last being but 4 miles from its mouth, affording water-power to numerous factories.

SACO, a town in Main, U. S.. is built on the east bank of the Saco River, at its last falls, 4 miles from its mouth, 14 miles south-west of Portland. It has numerous manufactories, including 5 cotton-mills, which produce 7.000 000 yards annually, 4 saw-mills, and several ship-yards. Pop. (1870) 5755.

SA'CRAMENT (Lat. *sacramentum*, *mysterium*, Gr. *mysterion*), the name given by theological writers to certain religious rites, the number as well as effects of which are the subject of much controversy between various bodies of Christians. The word *sacramentum*, in primitive classical usage, meant either the oath taken by soldiers on their first enrolment, or the sum of money deposited by suitors on entering upon a cause, and forfeited 'to sacred uses' by the unsuccessful party; and the corresponding classical Greek word *mysterion* meant not merely the secret religious ceremonies practised in the worship of certain gods, but also any revealed secret. It is certain, nevertheless, that at a very early period of the Christian Church, both the Latin word and its Greek equivalent came to be applied specially to certain rites of the Christian ceremonial, and chiefly (or as is commonly held by Protestants, exclusively) to those of baptism and the Eucharist. Of the catechetical lectures of St. Cyril of Jerusalem, the lectures devoted to the subject of baptism and the Eucharist are called 'mystagogic lectures.' For our purposes, it will be enough to state concisely what are the views of the several religious communities on this much controverted subject, which formed one of the earliest grounds of division between the Roman Church and the Reformers of the 16th century.

In the Roman Church, it is held that there are seven sacraments, viz.: Baptism, Confirmation, the Eucharist, Penance, Extreme Unction, Holy Orders, and Matrimony. The special teaching of Catholics on each of these rites will be found under the several heads; but there are certain general principles regarding them all, on which the Roman Catholic doctrine differs widely from that of the Reformed communities. Catholics define a sacrament to be a visible or sensible sign permanently instituted by God, and conveying real interior grace to the recipient, and they teach that all sacraments contain within themselves, as instruments, and, when they are received with proper dispositions, produce such grace by the virtue imparted to them by God, and not merely through the faith of the recipient; although they hold that proper dispositions on the part of the recipient, as sorrow for sin, love of God, pious resolves, &c., are conditions indispensable for the efficacy of the sacramental rite. See OPUS OPERATUM. They divide the sacraments into two classes, 'sacraments of the living,' and 'sacraments of the dead.' The first class comprises the Eucharist, Confirmation, Holy Orders, and Matrimony—all which sacraments can only be received fruitfully by persons in a state of grace or justification. The second includes Baptism, Penance, and Extreme Unction, the special purpose of which is to remit sin, and which therefore can be received by persons in a state of sin, but penitent for that sin, and resolved to amend their lives. Of three of the sacraments, viz., Baptism, Confirmation, and Holy Orders, it is held that they imprint a 'character,' and therefore that they can only be received once. The others may be repeatedly received, but under conditions which will be learned under each separate head. Two things are held to enter into the constitution of the sacrament—viz., the 'matter' and the 'form.'

By the former is meant the material element or the physical action whereby that element is applied to the recipient of the sacrament; as water in baptism, oil in extreme unction, and in both the act of washing or of anointing. By the latter is understood the form of words employed by the minister in communicating to the recipient the external rite in which the sacramental act consists. The minister of a sacrament is the person who is supposed to be divinely authorized to impart it. The minister is different for different sacraments, as will be found under each separate head.

The Reformed Churches have for the most part discarded these views. By the majority of them, the sacraments are held to be merely ceremonial observances, partly designed as a solemn act, by which each individual is admitted to membership, or desires to make solemn profession thereof; partly intended to stimulate the faith and excite the fervor and the pious dispositions of the recipient, to which dispositions alone all the interior effects are to be ascribed. As to the number of rites called by the name, almost all Protestants agree in restricting it to two—viz., Baptism and the Lord's Supper; although some of the rites which Catholics regard as sacramental are retained by some of the Protestant communities as religious observances. In the English Church, however, there has always been a school in which opinion tending towards the Catholic view has prevailed. Not only has this school ascribed to the two rites of Baptism and the Eucharist or Lord's Supper (q. v.) the power of producing an interior grace (which in the former is called regeneration); but many of them have been willing to call the other rites, especially confirmation, penance, and holy orders, by the name of sacrament, although of a secondary character, and not 'generally necessary to salvation.' See TRACTARIANISM. The controversy on these questions has been in recent times the subject of more than one proceeding in the ecclesiastical courts and in the Privy Council.

SACRAMENTA'RIAN, the name given in the 16th c. to the party among the Reformers who separated from Luther on the doctrine of the Eucharist. Luther (q. v.) taught the doctrine of the real presence of the body and blood of Christ along with the bread and wine (see LORD'S SUPPER; REAL PRESENCE). The first of his followers who called this doctrine in question was Andrew Carlstadt; and notwithstanding the protest of his leader, Carlstadt had many followers, the most active of whom were Capito and Bucer. The party became so considerable, that in the diet of Augsburg they claimed to present a special confession distinct from that put forward by the general body. The sacra-

mentarian confession is known in history by the name of the Tetrapolitan Confession—so called from the four cities, Strasburg, Constance, Lindau, and Memmingen. The Tetrapolitan Confession rejects the doctrine of a corporeal presence, and although it admits a spiritual presence of Christ which the devout soul can feel and enjoy, it excludes all idea of a physical presence of Christ's body. Simultaneously with this German movement, yet independent of it, was that of the Swiss reformer Zwingli, whose doctrine on the Eucharist was identical with that of Carlstadt, and who himself presented a private confession of faith to the Augsburg diet, in which this doctrine is embodied. The four cities named above continued for many years to adhere to this confession presented to the diet of Augsburg in their name; but eventually they accepted the so-called Confession of Augsburg, and were merged in the general body of Lutherans. On the contrary, the article of Zwingli upon the Eucharist was in substance embodied in the confession of the Helvetic Church.

SACRAME'NTO, a city and port of entry and capital of California, is built on the east bank of the Sacramento River, 125 miles from the sea, lat. 38° 33′ N., long. 121° 20′ W. The streets cross each other at right angles on a level plain, only 30 feet above the sea. The stores and shops are built of brick, the dwellings of wood, with shade-trees and gardens. The principal public buildings are the state capitol, custom-house, and post-office. The chief trade is furnishing supplies to the mining districts, with which it has daily communication by steamers and stages. S. was settled in 1839 by Captain Sutter, a Swiss, who built a fort. In 1848, the first town-lots were sold, and the first house built in 1849. In 1853, the town was inundated to the depth of 5 feet in the streets, which have been raised and protected by embankments. In 1854 it became the state capital. Pop. (1870) 16,283; (1880) 21,420.

SACRAMENTO, a large river in California, U. S., which, with the San Joaquim, drains the Great Central Valley. It rises in the north-eastern part of the state in the Sierra Nevada, by North and South Forks, where, during its south-westerly course of 200 miles, it is called Pitt River and Upper Sacramento; thence it flows nearly due south, receiving numerous branches from the Sierra Nevada on the east, and the coast-range of mountains on the west, until it unites with the river San Joaquim, and flows westerly through San Pablo and San Francisco bays to the Pacific Ocean. It is navigable to Sacramento, 50 miles from San Pablo Bay, and for small vessels 150 miles further, its entire length being about 500 miles.

SACRA'RIUM, a sacred apartment in Roman houses.

SACRED HEART OF JESUS, FEAST OF, a modern festival of the Roman Catholic Church. Its origin is traced to a vision which is recorded of a French nun, of the order of the Visitation, named Mary Margaret Alacoque, who lived at Paray la Moniale, in Burgundy, in the latter half of the 17th century. This devotion was gradually propagated in France, and at length was approved by Pope Clement XII. in 1732 and 1736, and by Clement XIII. in 1765. The festival is held on the Friday after the octave of Corpus Christi. During recent years a fresh impulse has been given to the devotion, and in 1873 numerous bodies of pilgrims resorted to Paray la Moniale; and several dioceses and countries were dedicated to the Sacred Heart by special and solemn ceremonial. The confraternities of the Sacred Heart are very numerous

SACRED MUSIC. Music has, from very early times, been connected with religious rites. It entered into the worship of the Jews, and both sacred and profane history tell us that, in the primitive Christian Church, the service consisted partly of music. Little is known regarding the kind of music used by the early Christian converts; it has been supposed to have been partly Greek, with an intermixture of Hebrew melody. As early as the time of Ignatius, who was a disciple of St. John, the Psalms of David were sung *antiphonally*, as practised to the present day—i. e., by two choirs responding to each other, which had doubtless been formerly the practice among the Jews. At first the whole congregation, clergy and laity, joined in the psalm; but difficulties and abuses having arisen from the growing neglect of musical culture, the Council of Laodicea, in 363, found it necessary, for the securing of decency and order in worship, to prohibit the laity from singing in church except in certain chants of a very simple and popular character. From that period down to the Reformation, the music of the church was almost entirely surrendered to the clergy and trained musicians. See PSALMODY.

The first name of importance in the history of the music of the Western Church is St. Ambrose (q. v.), whose musical service (see AMBROSIAN CHANT) was reformed by Pope Gregory (see GREGORIAN CHANT). The use of the organ in churches dates from about the 9th c., and some centuries later. Counterpoint (q. v.) was introduced to a limited extent into the music of the church. Among the corruptions which followed it, some are of a nature the very mention of which startles us. Not merely were popular melodies of a secular nature often taken and worked up into church music, but the secular words were actually transplanted into the religious compositions, being habitually given out by the tenor voice, while the actual solemn words of the church service were being sung by soprano, alto, and bass. Papal bulls having sought in vain to combat this abuse, it was brought under the cognizance first of the Council of Basel, and then of that of Trent. The Council of Trent prohibited the performance of any mass or motett of which profane words formed a part, and also of music founded on secular themes. Some compositions of Palestrina were singled out for praise, and their author was intrusted with the task of remodelling this part of religious worship. He composed three masses on the reformed principle, one of which, known as the *Missa papæ Marcelli* (so called as being a tribute of gratitude to the memory of that pontiff) may be looked on as having saved music to the church, by establishing a type far higher than anything that had preceded it, and still revered by all lovers of music. The *mass* (including the *offertory* and *gradual*) has always continued to be an important part of the sacred vocal music of the Roman Catholic Church, and affords large scope for the display of the higher qualities of musical composition.

Various new types of music sprang up in the different Protestant churches after the Reformation. The solemn and measured *chorale* (q. v.), or melody to which psalms or hymns are sung in unison, though generally associated with the Lutheran Church of Germany, was in reality handed down from a very early period. Psalmody in its modern sense may be considered to have originated in the 16th c., when Clement Marot, the court poet of Francis I., translated fifty-two of the Psalms into French verse. Psalm-singing was at first a fashionable amusement of the gay courtiers of Francis; but being taken up by the Reformers, was soon discountenanced by the Roman Catholics, and looked on as a badge of Protestantism. See PSALMODY.

In the full choral service of the Church of England, as performed in cathedrals and collegiate churches, the greater part of the prayers and the litany are *intoned* or read in monotone (see INTONING), the monotone being occasionally varied by harmony at the close. The Psalms and *Gloria Patri* are chanted with the accompaniment of the organ, as also are the various canticles; the latter, however, particularly the *Te Deum*, being often sung to rhythmical music of a more elaborate kind, called *services*. The form of the Anglican chant now used for the Psalms seems to have been invented by Tallis. In the single chant, each verse is sung to the same music; in the double chant, the whole occupies two verses. The antiphonal chanting, with the Anglican double chant, has sometimes been objected to as repugnant to the proper expression of the words, as coupling verses between which there is a full stop in the sense, and as placing a full stop when the sense runs on; and among the High Church party there has been a disposition to recur to the Gregorian chants, whose indefinite musical expression, absence of rhythm, and uncertain accent, give them a power of bending to the requirements of the words.

The Gregorian chant has, however, not succeeded in making its way into the service of any of the English cathedrals. The *anthem* forms a part of the complete musical service. It is somewhat similar in character to the motett of the Roman Catholic and Lutheran churches; a sacred cantata, in which the words are taken from the Psalms or other portions of Scripture; and the music is for solo, parts, or chorus, or a mixture of the three.

In the Presbyterian churches of Scotland, psalmody, until recently, formed almost the entire music; but hymns also are now in general use. Hymns predominate among the English dissenters. Some years ago, church music in Scotland had fallen to the lowest state of degradation; but efforts have lately been made, with some success, to raise its character. Even organs, which were proscribed by the early Scottish reformers, and have ever since been in disfavor, have begun to be introduced; and chanting has been admitted into some Presbyterian churches.

Of sacred musical compositions not intended to form part of the service of the church, the most important is the *Oratorio* (q. v.), a composition either entirely dramatic, or combining the drama and epic, where the text is illustrative of some religious subject, and the music consists of recitatives, airs, part-songs, and choruses, accompanied by orchestra and organ.

SA'CRIFICE, one of most important elements of divine worship, common to all nations of antiquity, and therefore traced by some to a primeval revelation. The powers of nature, palpable in their effects for good and evil, could not but inspire man, even in his rudest stage, with gratitude or fear towards the unseen being or beings by whom he conceived them to be actuated. The next and most natural step was the outward manifestation of these feelings by a token which bespoke either thankfulness or the wish of conciliation on the part of the donor. The supreme numina being conceived merely as superior men with exaggerated

human wants, the means taken to gratify them were adapted to this conception. The best and first fruits of the soil, the finest and most immaculate animals of the flock, were offered to the gods, that they might either partake of them bodily, or at least enjoy the sweet smell arising from the altar on which they were burned in their honor; and the deity was supposed emphatically to express its readiness to accept the offering by sending down the fire that was to consume the animal prepared. The more the divine favor was sought for some special purpose, the costlier and more precious became the gift; and nothing short of the most startling proofs of self-abnegation seemed, at times, to satisfy the devotion of man in his uncultivated state. From the simple and child-like notion of establishing a certain kindly and permanent relation between the invisible powers and man, by the yielding up on the part of the latter a certain more or less precious portion of what the former had given him, there grew up such horrible monstrosities, that, in honor of humanity, we should feel inclined to doubt them, were they not so well attested, and did they not, to a certain extent, still prevail in our own days.

Method and system took in hand that undeveloped child-like instinct which touchingly offered the deity a flower, a blooming bough, a golden fruit; and degraded it into mysticism and superstition; ending at last in the theory that the divine revenge was to be gratified, the divine vanity flattered, and the deity made as generally pleased as could be by holocausts of human beings, friends or foes—nay, the dearer the being to the offerer, the more the self-abnegation must become patent, and the more the god must smile upon the donor. The Moloch worship—the mother placing her babe in the arms of the monstrous idol, and seeing it slowly burned before her own eyes—seems well nigh to exhaust all the horrors of human ingenuity.

Turning first of all to those most ancient and hallowed records of humanity contained in the Old Testament, we find the custom of sacrifice almost on its first pages, and spoken of as a rite already established. Sacrifice is the cause of the first murder on record. Abraham is prevented by a voice from heaven from carrying out the slaughter of Isaac, into which he had been 'tempted' by Jehovah; all the patriarchs, in fact, sacrifice, either independently or in ratification of a covenant; and the exodus itself was brought to pass under the pretence of the people having to offer up their wonted sacrifice in the desert.

According to the highest ancient authorities, both Jewish and Christian—of whom we will only mention Maimonides and Ephraem Syrus—the Mosaic sacrifices were neither more nor less than a kind of divine concession to the sensual nature of an uncultivated people, full of Egyptian reminiscences on the one hand, and surrounded by Canaanitish modes of worship on the other. It was, as Ephraem Syrus says, only at a very late period that Moses, by the command of God, in whose eyes the rites of priests and sacrifices have but little value, prescribed these observances to his people, on account of their weakness and hardness of heart—lest they might despise a 'naked' religion, and attach themselves to false gods, whose magnificent and dazzling cultus surrounded them on all sides. In corroboration of this view, the prophets are appealed to, who never cease to inveigh against sacrifice as such, when, according to their view, the people were educated enough to do without this symbol and to worship God in truth and in spirit. (Compare Jeremiah vii. 22; I Samuel xv. 22; Psalms l, 8—10; li. 18, 19; Isaiah i. 11, &c.) But the institution being deemed necessary for the time, legislation had to circumscribe it rigorously, so as to make it as little hurtful as possible. Ceremonies contrary to morals and decency, such as were practised in the temples of Canaan, the abominations of phallic rites, the sacrifices of virginity, and finally, the offering up of human beings, were punished with instant death by the Mosaic law.

How the principal modes of sacrificial offerings, such as they had naturally developed, nearly alike everywhere throughout antiquity, and as they had obtained in the pre-Mosaic times among the Hebrews, were adopted in the Mosaic legislation, and adapted to its exalted religious character, we can only indicate here in the briefest outlines. These pre-Mosaic sacrifices were chiefly of three kinds: first, the 'propitiatory,' i. e., an offering enjoyed by the deity in any form that would be grateful to him, conciliate him, procure his aid and blessing in times of need or for some special undertaking, and would further obtain his forgiveness, if something had been done unwittingly that might have offended him. This kind of sacrifice, whether bloody or unbloody (e. g., harvest sacrifice), appears to have been fully burned (*Olah*). The second kind partook more of the nature of sacrificial meals, in which both the divinity, the priest, the man who offered the sacrifice, together with his friends, took a part. It was a solemn and joyous oblation, expressing the thanks of the individual for some obtained favor, in which he wished others to join. Only the parts supposed to be the choicest were burned upon the altar; the priests received some other parts, and the rest formed the grateful sacrificial repast (*Sebach Shelamim*). The last was the expiatory sacrifice, intended as an equivalent for some deadly crime, which either was not punishable by the existing laws, or which had been committed under circumstances that would not have warranted capital punishment. From the notion, that the blood of the murderer was necessary for 'the cleansing of the blood that is shed' (cf. Numb. xxxv. 33), sprang that other, it would appear, that there was expiatory power in the blood itself; and that further, the blood of an animal was a fitting representative of, and equivalent for that of the human criminal, who had only to transfer, as it were, his sin to the animal by placing his hand upon its head, and perhaps using a formula to that effect.

The flesh of this animal was not deemed fit for the altar, and was probably burned at some other place (*Chattah Asham*). The Mosaic legislation finding such general elements ready, proceeded eclectically. They were partly embodied with considerable alterations, and partly rejected unconditionally. The anthropopathic idea of the 'agreeable smell,' as well as the notion of the expiatory power of the blood, were retained—the latter, however, with this modification, that the poor were allowed to use flour instead of meat for their sin-offerings. But the principal alterations introduced were the abolition of all polytheistic rites from the sacrificial service, of all the immoral, obscene, and horrible ceremonies connected with the heathen practice, and finally, the totally different definition and limits given to the 'sin-offering.' While formerly, everything could be expiated by a sacrifice, henceforth, only unpremeditated sin could by this means be effaced; while there was no expiation for any premeditated crime; the law simply took its course in that case.* Further, many things till then permitted were prohibited, and thus fell under the denomination of 'sin;' and certain purifications—beneficial in themselves—were connected with the expiatory sacrifice, and their practice thus strongly enforced. This extension of the notion of 'sin-offering' rendered a subdivision of it necessary; the more venial, or rather unconscious transgressions, were treated differently from the less pardonable ones in the ritual.

While Mosaism thus seemed, in its adoption of the rite of sacrifice, to make one of the most important concessions to heathenism, this very rite was, on the other hand, calculated to attract the early Hebrews to the worship of Jehovah, and at the same time to wean them from the horrible practices connected with it among the Canaanites. But more; during the primary stages of the people's existence, it served, by inculcating observances which were at once hygienic and symbolic of purity and holiness, as a powerful means of education and culture. In order, however, that these beneficial consequences premeditated by the lawgiver should not be frustrated, it was necessary, above all things, to keep the strictest possible supervision over it; and this was best established by the legal transfer of the whole sacrificial service to one single spot of the land, finally, the temple at Jerusalem. The 'heights' and their 'heathen abominations' were thus theoretically abolished, and the sacrifice that only at one central point could in reality be said to be offered up for the 'whole community of Israel,' went far, under these circumstances, to awaken and to strengthen a common spirit of nationality and patriotism, which was further aided by the periodical pilgrimages. For the details of the Jewish sacrifices, we must refer to the Old Testament generally.

As to the different opinions held by Jewish and Christian authorities regarding sacrifice, when offered up in expiation of a sin either by the people or by individuals, suffice it here to mention that they are divided between the various notions of the offering being either a present to the offended deity, a civil punishment (*mulcta*), or, finally, a kind of substitute for the sinners themselves. The latter is the view held by many of the rabbinical writers as well as church Fathers. The life (Nephesh) of the animal or its blood (Lev. xvii. 11) was distinctly said to make 'the atonement for the soul.' This notion of a representative victim is one that belonged to the whole ancient world, and often finds its expression in the Old Testament. The sacrifice of the covenant (Jer. xxxiv. 18, &c.), the scapegoat (Lev. xvi. 21), and the like, are so many embodiments of this idea; which by Christian divines is held to have found its acme and final fulfilment in the sacrifice of God himself, as the 'Man Christ,' who united in himself the priest, the offerer, and the sacrifice. In fact, the whole institution of sacrifices is throughout the New Testament and the Fathers held to have been merely typical of this final act, by which the sin of man was expiated. See ATONEMENT, MASS.

The Jewish sacrifices, rejected already by the Essenes, ceased with the downfall of the Temple in Jerusalem; although the Samaritans, who claim to retain exclusively the Mosaic covenant, still continue this rite on Mount Gerizim on the Passover. The orthodox Jews, however, include in the prayers for the restora-

* One of the most characteristic exceptions, however, was that in favor of those who had denied the possession of some pledged article, or who had wilfully cheated or robbed their neighbors. If they were eager to make voluntary and ample restitution, 'the door of repentance was open to them,' and they were allowed to make public expiation through sacrifice.

tion of the visible sanctuary on Zion, also that of the restoration of the sacrifices 'in their order and proper rule,' 'of the priests to their service, and the Levites to their songs and hymns,' and each day, Sabbath, or Feast, the sacrifice incumbent upon it is mentioned in the prayers; and on fast-days, especially on the day of atonement, the diminution of bodily substance supposed to arise from the abstinence, the 'fat and blood' may, it is supplicated, be considered by God as tantamount for that of the sacrificial animals which, through their sins, the people are not now deemed worthy of offering up. The modern (extreme) party of reformed Jews, however, repudiate, together with the literal interpretation of the Messianic prophecies, also that notion of the sacrifices ever being restored again.

We can only very briefly touch upon the sacrificial customs among other nations of antiquity. The same feeling of dependence upon supreme, invisible, but ever-present powers, engendered, as we said at the beginning, everywhere nearly the same expressions of awe, gratitude, and the like. The gifts proffered differed, according to the degree of culture, the mode of life, and the products of the soil among the different peoples. No less was the significance attached to the gift different in proportion to the mental development of those who offered; at one time considered as at present, to be taken and sensually enjoyed, as it were, by the Deity, it at others assumed a higher and purely symbolical aspect, as an expression of gratitude, love, repentance.

In the same proportion, the gifts themselves varied, not only respecting their nature, but also respecting their value. While Mongols and Tartars, Lapps and Negroes, most of the ancient nomad tribes in fact, generally sacrificed the milk and the uneatable parts of the animal only, its bones, horns, skin, &c.; the Greeks and Romans offered not unfrequently thousands of the choicest, most immaculate animals, and the sacrificial vessels were with them, as with the Hebrews, wrought of the most precious metals. Votive offerings—arms, spoil, garments, tools, locks, poems, &c.—customary in the better days of Rome and Greece; and the sacrifice of chastity on the part of maidens and women —chiefly the custom of Babylon, Phœnicia, Cyprus, &c., likewise fall under the denomination of sacrifice in its wider sense. Among the Indians, Bactrians, Medes, and Persians, the sacrifices consisted of fruits, libations, animals, and the like, and were of many degrees and numbers. Among the first-named, the study of the Vedas was reckoned as the first round in the sacrificial ladder. With the Persians (see GUEBRES, PARSEES), the priests at the Daruns sacrifice, instituted in honor of Zerdusht the lawgiver, eat small unleavened cakes, and drink Hom-juice, which is to represent the blood of the prophet. They also have sacrifices for the souls of the deceased. The Buddhists offer flowers and first-fruits only; their animal sacrifices are represented by small animal figures kneaded of dough, offered up on certain occasions. Of the 'classical' peoples and their sacrificial debauches, which followed the primeval frugality in their offerings no less than in their lives, we need not speak here, save as far as they, too, indulged in the rite of human sacrifice from their very earliest period to their decadence.

Among the Greeks, the legendary tales of the daughters of Erechtheus, and of Iphigeneia in mythical times, the sanctuary of Zeus Laphystius at Halos and at Lycæa, in Arcadia, the offering up of three Persians by Themistocles before the battle of Salamis, are tokens sufficiently indicative of the generaltity of the practice. Among the Romans, human sacrifices, in use during the Republic—either enthusiastic voluntary deeds of patriotism, or simply a kind of execution in punishment of a deadly sin—were prohibited in later times by the senate; but both Augustus and Sextus Pompeius committed wholesale murders by way of political sacrifice to the gods. That this abomination of slaughtering men in honor of God at stated periods, flourished to an awful extent among our northern ancestors—Scandinavians and Germans, as well as among Gauls and other Celts—need hardly be added. At Upsala, every ninth year, a great sacrifice of expiation was offered up, consisting of nine human beings and sixty-three animals. The Danes, in the same manner, held a sacred sacrifice every ninth year, of ninety-nine men, besides horses, dogs, cocks, and other domestic animals (see the EDDAS; Muller, *Sagenbibliothek;* Pertz, *Mon. Germ. Hist.; Script. passim*, &c.). The German tribes, even after their conversion to Christianity, continued to offer up their prisoners of war, as of yore, just as the Franks brought their sacrifices both to their ancient gods and to Christ. Any illness, danger, sickness—the slightest inducement, in fact, sufficed to move the Gauls towards a human holocaust, in the fashion of the worshipers of Baal and Moloch. At the death of a man, all his possessions, movable and immovable, including slaves, clients, wives, and all, were offered up to his manes. See SUTTLE. That the ancient Mexicans, the negroes, and other wild tribes, were highly proficient in this sort of wholesale slaughter, need hardly be added: the king of Dahomey's practices, and the fruitless remonstrances of our own government, are a too well-known illustration of the firm hold this kind of murder in honor of the Deity has of the human mind. In conclusion, may we not consider the cruelties and massacres committed upon the Jews in the middle ages, in the name of Christ, as a last offspring of that Moloch or Baal worship which seems to be an instinct in the superstitious mind, whether Pagan or Christian?

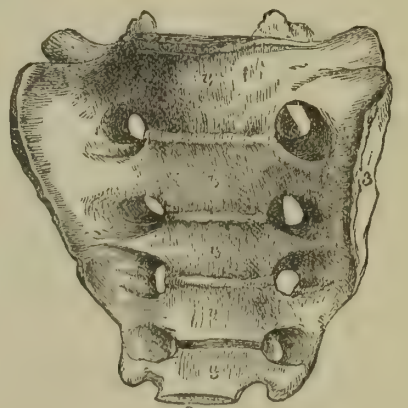
SA'CRILEGE is not now a legal, but is a popular term used to denote the breaking into a place of worship, and stealing therefrom. In England, whoever breaks and enters any church, chapel, meeting-house, or other place of divine worship, and commits any felony therein; or whoever, being in such places, shall commit any felony therein, and break out of the same, is guilty of felony, and liable to penal servitude for life, or for not less than three years, or to imprisonment for a term not exceeding two years, with hard labor. The legal offence comes generally under the head of burglary or house-breaking. A less punishment applies to the offence when committed in dissenting chapels.—In Scotland, there is no increase of severity in the punishment, by reason of the sacred character of the things stolen.

SA'CRISTAN (Lat. *sacra*, sacred things), an official attached to a church, who is charged, under the priest or ruler of the church, with the care of the church, and of all its appurtenances. It is his duty to open and close the church, to take care of the sacred vestments and utensils, and to prepare what may be required for public service. In some Roman Catholic churches, the sacristan is a clerk in minor orders. The English name sexton is derived from this word.

SA'CRISTY, an apartment attached to a church, in which are kept the sacred objects used in the public worship, and in which the clergy and other functionaries who take part in the service assemble and prepare for the ceremonies on which they are about to enter. In many foreign churches, the sacristy is a spacious and costly building.

SACROBOSCO, JOANNES DE (Anglicè, *John of Holywood*), was an English mathematician of the 13th c., entered the university of Paris in 1221, and afterwards became professor there. He died at Paris in 1256. S. was one of the first doctors of the middle ages who made use of the astronomical writings of the Arabians. His treatise, *De Sphæra Mundi*, is merely a paraphrase of a portion of Ptolemy's *Almagest*. No book enjoyed greater renown as a manual among the scholastics. First published in 1472, it passed through more than 20 editions—some even say 65 —with as many commentaries. Other works of S. are *De Computo Ecclesiastico* and *De Algorithmo*, one of the first works on arithmetic in which the numerical notation of the Arabs is employed.

SA'CRUM, or OS SACRUM, is a triangular bone situated at the lower part of the vertebral column (of which it is a natural continuation), and wedged between the two innominate bones so as to form the keystone to the pelvic arch. It is readily seen to consist of five vertebræ with their bodies and processes, all consolidated into a single bone. Its anterior surface (as shown in the figure) is concave, not only from above downwards, but



Sacrum.

1, Surface articulating with last lumbar vertebræ; 2, surface articulating with coccyx; 3, surface articulating with the os innominatum; v_1, v_2, v_3, v_4, v_5, the bodies of the five sacral vertebræ.

also from side to side. The posterior surface is convex, and presents in the middle vertical line, a crest, formed by the fusion of the spines of the vertebræ, of which the bone is composed. The last sacral vertebra has, however, no spine, and the termination of the vertebral canal is here very slightly protected.

Various reasons have been assigned for the peculiar name given from very olden times to this bone. One of the reasons assigned

is, that it was the part used in sacrifices. Another reason is based on the view maintained by the Jewish rabbins, who held that this part of the skeleton, which they called 'luz,' resisted decay, and became the germ from which the body would be raised:

> 'From whence the learned sons of art
> *Os sacrum* justly call the part.'
> Butler's *Hudibras*, cant. ii. part iii.

SACY, Antoine Isaac, Baron Silvestre de, one of the most celebrated orientalists, was born at Paris in 1758. After being grounded in the classics, he commenced at the age of 12 the study of Hebrew, to which, as he advanced in years, he added the other branches of Semitic—Syriac, Aramaic, Samaritan, and finally Arabic. Persian and Turkish he acquired still later; but though one of the greatest masters of Arabic and Persian that ever lived, he never made much progress in Turkish. Modern European languages and jurisprudence formed collateral branches of his stupendous acquisitions. From 1781, he held various appointments under government, chiefly in the Mint. His first appearance in the world of letters dates from 1780, when he commenced to contribute to Eichhorn's celebrated *Repertorium*. In 1785, he was elected a member of the French Academy; and a number of monographs by him followed each other in quick succession in the Transactions of this body, chiefly on Arabic and Persian history, literature, and antiquities.

In 1793, he published his first great work, the *Annales de Mirkhond*, translated, with an extensive commentary, from the Persian. In 1792, he retired from the service of the government, to devote himself exclusively to his favorite studies; in 1795, he was appointed to a Chair in the newly-founded Ecole des Langues Orientales; but refusing to take the oath of hatred against royalty, he was not allowed to teach. In 1803, when the Institute was completely reorganized, he took his seat there again; and shortly after was nominated Professor of Persian at the Collége de France. In 1808, he became a member of the Corps Législatif, and was subsequently attached to the Commission and Council of Public Instruction. In 1822, he was made Administrator of the Collége de France and the Ecole Spéciale des Langues Orientales; and in the same year he founded, with Abel Rémusat, the Société Asiatique. Under the New Orleans Government, to which he soon attached himself, he was nominated Inspector of the Oriental Type of the Oriental Printing-Office, and Perpetual Secretary of the Académie des Inscriptions. Yet, with these numerous offices on his shoulders, to all of which he attended most conscientiously, he never for one instant relaxed in his studies; and the number of his essays, memoirs, pamphlets, papers, &c., besides his larger works, is perfectly prodigious. He died, full of years and honors, in 1838, and was buried in the Père Lachaise. The Academy had a medal struck in his honor, and his bust was placed in the library of the Institute. Oriental studies owe to him more, almost, than to any other orientalist of our age. Irrespective of his own brilliant and numerous labors, he furthered and promoted his favorite science in every possible way—founding, or causing to be founded, oriental chairs in France; and forming such disciples as Freitag, Kosegarten, Rasmussen, Chézy, Quatremère, Jaubert, Saint-Martin, and others of more or less eminence as orientalists.

Among his works we would chiefly enumerate his *Grammaire Arabe*, the most classical work of its kind, and which has given Arabic studies an entirely new impulse, forming, as it were, the turning-point between the ancient and modern oriental philology. Next to this stands his *Chrestomathie Arabe*, with the *Anthologie Grammaticale Arabe*. Among his other writings are *Mémoires sur Diverses Antiquités de la Perse;* the translation of Abdollatis's *Egypt* with notes; his editions of *Calila ve-Dimnah;* of the *Pend-nâmeh*, with a French translation; the *Makamat* of Hairiri; his *Mémoires sur l'Etat Actuel des Samaritains; Exposé de la Religion des Druses;* and his manifold contributions (above 400 in number) to the *Magasin Encyclopédique, Mémoires de l'Institut, Recueil de l'Académie des Inscriptions, Fundgruben des Orients, Annales des Voyages, Journal de la Société Asiatique, Biographie Universelle*, and Eichhorn's *Repertorium für biblische und orientalische Literatur Revue des Deux Mondes*, &c.

SACY, Samuel Ustazade Silvestre de, son of the foregoing, a journalist, was born in 1801. In 1828, he became attached to the staff of the *Journal des Débats*, and has ever since remained faithful to its columns. His has been chiefly the polemical part; and it is supposed, that, not omitting to take part in almost every public question, he wrote about two-thirds of the political articles that appeared in that paper during the second quarter of the present century. From 1852, when the Empire was re-established he relinquished politics, and became the principal reviewer of the paper. In 1848, he was appointed administrator of the Mazarin Library; in 1854 was elected a member of the Academy; in 1864 he became a member of the Council of Education; in 1867 of the Senate. In 1858, he published a collection of his literary articles (*Variétés Littéraires, Morales, et Historiques*, 2 vols.) In conjunction with Ed. Thierry and others, he edited *Rapport sur l'état des Lettres et des Sciences* (1868). He also edited a number of religious works, and in 1861—1864 an edition of the Letters of Madame de Sévigné in 11 volumes. He died Feb. 1879.

SA'DDENING, a peculiar method of applying certain mordants in dyeing and printing cloths, so as to give duller shades to the colors employed than those they ordinarily produce.

SA'DDLEBACK, a well-known mountain of Cumberland, 4¼ m. N.E. of Keswick, 2787 feet high.

SA'DDLERY. Saddlery is next in importance to human clothing, being essential to the employment of horses, therefore its manufacture is carried on in almost every town and village. England, however, exports large quantities of saddlery, nearly all of which is made at Walsall, in Staffordshire, or in the neighborhood. The value of the exports of saddlery and harness amounts to nearly £400,000 per annum. A saddle consists of the wooden frame or *saddle-tree*, the *skirts* or padded *under-flaps*, the *upper-flaps* and *seat*, which are generally made of tanned pigskin, the *girth* or *belly-band*, the *stirrup-straps*, the *stirrups*, and the *crupper-loop*.

SA'DDUCEES (*Zedukim*), a Jewish school or party—not a 'sect,' as they have been generally denominated since Josephus—of the times subsequently to the Syrian wars, and often mentioned in the New Testament, the Talmud, and the Midrash. Their origin, as well as their name, has given rise to many speculations and suggestions, but none can be considered satisfactory. Modern investigators have derived the name from Zadikk, righteous man, a denomination which the S. are supposed to have assumed in contradistinction from the Pharisees, the Separatists, as designating their own rejection of all superfluous and exaggerated religious practices, and their stand upon the words of the law itself.

The tenets of the S. are noticed as contrasted with those of the Pharisees (q. v.).

A misconceived notion of some Church Fathers, to the effect that the S. rejected all the canonical books of the Old Testament, with the sole exception of the Pentateuch, hardly requires refutation. They held the whole of the Old Testament as sacred as the Pharisees, and they quote equally from all its portions in support of their views. They would, if this or any other of those exaggerated accounts of their 'unbelief' had any foundation, not have remained in the Sanhedrim, their members would not have been high-priests, and the Pharisees would not have fought against them about mere trifles and casuistically. But, on the other hand, their sober rationalism could not, apart from their aristocratic tendencies, at a time in which the immense struggle for liberty was still fresh in the people's minds, gain for them that popular sympathy which the Pharisees—eager, jealous, patriotic, pious, learned men of the people, enthusiastic men of progress—so easily acquired and held. Thus Sadduceism, of which we hear so much in the New Testament, and which was combated as 'the leaven of Herod' by Christ, while he only inveighs, as does the Talmud, against the hypocrites among the Pharisees, died out soon after the 1st c. A.D. The term under which they are once mentioned in the Mishna, viz., Karaim, became, at a later period, the name of a Jewish sect, still in existence, who reject all tradition, simply holding by the Written Law as their sole guide. See article Jewish Sects. The Talmud speaks of certain writings of the S., but nothing has survived. A criminal code of theirs, of a somewhat arbitrary nature, is mentioned in *Mes. Taan* iv.

SADI, Sheikh Muslih Addin, one of the most celebrated Persian poets, was born at Shiraz, about the year 1184. Little is known of the circumstances of his life. His father's name was Abdallah, and he was a descendant of Ali, Mohammed's son-in-law; notwithstanding his noble lineage, however, he held but an insignificant position. S. was early left fatherless. He received his education in science and theology at Bagdad, and from here he undertook, together with his master, his first pilgrimage to Mecca; a pilgrimage which he subsequently repeated no less than 14 times. He traveled for a great number of years, and is said to have visited parts of Europe, Barbary, Abyssinia, Egypt, Syria, Palestine, Armenia, Asia Minor, Arabia, Persia, Afghanistan, and India. Near Jerusalem, 'where,' he says, 'I associated with the brutes,' he was taken prisoner by the Crusaders, not while fighting against them, but while practising religious austerities in the desert. He was ransomed for ten dinars by a merchant of Aleppo, who recognized him, and gave him his daughter in marriage: this union, however, did not prove happy. He married a second time, and lost his only son from that marriage. The latter part of his life S. spent in retirement near his native town, and he died, at a very old age, in 690 H., or 1263 A.D.; according to others, however, he did not die until 1291 or 1292 A.D. In person, he is described as having been of rather insignificant appearance, short, slim, and spare, nor is there much to be said for his personal prowess. His was a contemplative, pious, and so to say, philosophical disposition. The years of his retirement from life

he occupied in composing those numerous works which have made him justly famous through East and West.

Although European critics would hardly be inclined to endorse to the full the judgment passed upon him by his countrymen, that he was 'the most eloquent of writers, the wittiest author of either modern or ancient times, and one of the four monarchs of eloquence and style,' yet there is no doubt that this 'nightingale of thousand songs' is deservedly held among the foremost masters of poetry, and that he fully merited the honors showered upon him by princes and nobles, both during his lifetime and after his death. A magnificent mausoleum, with a mosque and college attached to it, was erected in his honor at the gates of Shiraz, and the people, who soon wound a halo of legend around his life, flocked thither in pilgrimage; and so carefully is his tomb guarded, that when visited by Colonel Franklin in 1787, it was in the same state as when S. was buried.

The catalogue of his works comprises 22 different kinds of writings in prose and verse, in Arabic and in Persian, of which *ghazels* and *kassidas* (odes, dirges), form the predominant part. The most celebrated and finished of his works, however, is the *Gulistan*, or Rose-garden, a kind of moral work in prose and verse, consisting of eight chapters, on Kings, Dervishes, Contentment, Taciturnity, Love and Youth, Decrepitude and Old Age, Education, and the Duties of Society, the whole intermixed with a number of stories, maxims, philosophical sentences, puns, and the like. Next to this stands the *Bostan*, or Tree-garden, a work somewhat similar to the *Gulistan*, but in verse, and of a more religious nature. Third in rank stands the *Pend-Nameh*, or Book of Instructions. Elegance and simplicity of style and diction form the chief charm of S.'s writings. In wit, he is not inferior to Horace, with whose writings he, according to one source, may not have been unacquainted, since he is said to have known Latin. The first complete edition of his works, called the *Salt-cellar of Poets*, by Harrington, was published in Calcutta, 1791—1795, and has been reprinted since by native presses in India.

The *Gulistan*, first edited with a Latin translation by Gentius (Amsterdam, 1651), has been reprinted very frequently, and has been translated into a number of European tongues, into English chiefly by Gladwin, Ross, and Eastwick. The *Bostan* was first published complete in Calcutta, 1828 (Vienna, 1858), and has likewise been translated into other languages.

SAFE-CONDUCT, a passport granted, on honor, to a foe, enabling him to pass where it would otherwise be impossible for him to go with impunity. Safe-conducts are granted in war for the purposes of conference, &c.; and to violate the provisions of such a pass has always been esteemed a disgraceful breach of the laws of honor.

SAFE'D, a small town of Palestine, in the pashalic of Acre, and in the ancient province of Galilee, stands on a mountain 2500 feet high, 12 miles N. of Tiberias. The inhabitants, about 5000 in number, are engaged in the manufacture of cloth aud in dyeing, and the country in the vicinity is largely productive of wine and oil. It is an ardent wish of the Jews to die at S., because they believe that the expected Messiah will make it his capital. The Jews possess about thirty synagogues in the town, also a college for instruction in Hebrew and the Talmud. Before 1837, S. was a handsome town; but in that year it was partly destroyed by an earthquake, and more than 2000 people were killed.

SAFES, Fire-proof. The manufacture of iron safes for the preservation of money and valuable papers has become one of great importance. The foundation of the plan on which fire-proof safes are still constructed was laid by a Mr. Richard Scott in 1801. Mr. Thomas Milner in 1840 patented a fire-proof safe embodying the same principle, but with some improvements. In 1843 letters patent were granted to Messrs. Tann for the use of a mixture of pounded alum and gypsum, previously heated and cooled, as a fire-resisting medium placed between two plates of iron, from three to six inches apart, which together form the wall of the safe.

Milner's plan was to fill the jacket formed by the double-plated sides with sawdust, in which were packed a number of small tubes filled with an alkaline solution, and hermetically sealed, or crystals of alum or soda, containing from 40 to 60 per cent. of water of crystallization. In case of fire, and the safe becoming heated, the tubes burst, or the crystals melt, and saturate the sawdust with water, which becomes steam, and passes into the inner chamber of the safe, and thus protects the contents, if inflammable, from fire for a considerable length of time. Fire-proof safes are still made on the same principle. Messrs. Chubb use a mixture of alum and a mineral substance they procure from abroad. Many of the safes now made are rooms rather than boxes. A Safe Deposit Company has recently been formed in England (the idea originating in the United States); and in 1875 there was completed in London a large building, in the highest degree proof against fire or thieves, containing about 10,000 safes, which are let out to the public.—See *Protection from Fire and Thieves*, by G. H. Chubb (1875).

SAFETY-CAGE. See Mining.

SAFETY-FUSE, a species of fuse invented by Messrs. Bickford for use in the Cornish mines, and now generally employed in the chief mining districts, consists of a hollow cord of spun yarn or hemp, tarred on the outside to render it water-proof, and filled with tightly-rammed gunpowder. This fuse ignites steadily at the rate of about two feet per minute, so that the time of the explosion can be easily regulated. The use of this contrivance has contributed to prevent those accidents arising from premature explosions, formerly of very common occurrence in mines. The fuse-tube is sometimes made of gutta-percha.

SAFETY-LAMP. It has been long known that when marsh-gas or light carburetted hydrogen, which is frequently disengaged in large quantities from coal-mines, is mixed with seven or eight times its volume of atmospheric air, it becomes highly explosive, taking fire at the approach of a light, and burning with a pale blue flame. Moreover, this gas in exploding renders ten times its bulk of atmospheric air unfit for respiration, and the *choke-damp* thus produced is often as fatal to miners as the primary explosion. With the view of discovering some means of preventing these dangerous results, Davy instituted those important observations on flame which led him to the invention of the safety-lamp. He found that when two vessels filled with a gaseous explosive mixture, are connected by a narrow tube, and the contents of one fired, the flame is not communicated to the other, provided the diameter of the tube, its length, and the conducting power for heat of its material, bear certain proportions to each other; the flame being extinguished by cooling, and its transmission rendered impossible. In this experiment, high conducting power and diminished diameter compensate for diminution in length; and to such an extent may this shortening of length be carried, that metallic gauze, which may be looked upon as a series of very short square tubes arranged side by side, completely arrests the passage of flame in explosive mixtures. The following are Davy's directions regarding the structure of his lamp: 'The apertures in the gauze should not be more than $\frac{1}{22}$d of an inch square. As the fire-damp is not influenced by ignited wire, the thickness of the wire is not of importance; but wire from $\frac{1}{40}$th to $\frac{1}{60}$th of an inch in diameter is the most convenient.

Iron-wire and brass-wire gauze of the required degree of fineness, are made for sieves by all wire-workers but iron-wire gauze is to be preferred: when of the proper degree of thickness, it can neither melt nor burn; and the coat of black rust which soon forms upon it superficially defends the interior from the action of the air. The cage or cylinder should be made of double joinings, the gauze being folded over so as to leave no apertures. When it is cylindrical, it should not be more than two inches in diameter; for in larger cylinders, the combustion of the fire-damp renders the top inconveniently hot, and a double top is always a proper precaution, fixed at the distance of half or three-quarters of an inch above the first top. The gauze cylinder should be fastened to the lamp by a screw of four or five turns, and fitted to the screw by a tight ring. All joinings should be made with hard solder; and the security depends upon the circumstance, that no aperture exists in the apparatus larger than in the wire gauze.' The cylinder is protected by three external, strong, upright wires, which meet at the top; and to their point of junction a ring is attached, by which the lamp is suspended. The oil is supplied to the interior by the pipe projecting from the right side of the figure, and the wick is trimmed by a wire bent at the upper end, and passed through the bottom of the lamp, so that the gauze need not be removed for this process. When a lighted lamp of this kind is introduced into an explosive mixture of air and fire-damp, the flame is seen gradually to enlarge as the proportion of light carburetted hydrogen increases, until at length it fills the entire gauze cylinder.

Whenever this pale enlarged flame is seen, the miners should depart to a place of safety, for although no explosion can occur while the gauze is sound, yet at that high temperature the metal becomes rapidly oxidized, and might easily break; and a single aperture of sufficient size would then occasion a destructive explosion. In a strong current of air, the heated gas may be blown through the apertures of the gauze before its temperature is sufficiently reduced to prevent an explosion; but such a contingency may be guarded against by placing a screen between the draught and the lamp. It was in the year 1815 that Sir Humphry Davy presented his first communication to the Royal Society respecting his discovery of the safety-lamp; and at the meeting held on January 11, 1816, the lamp was exhibited. Sir Humphry Davy's claim as an original discoverer was immediately challenged by various persons, amongst whom may be especially noticed the late Dr. Reid Clanny of Newcastle, and the great engineer George Stephenson. Clanny's safety-lamp (which is described in the *Philosophical Transactions* for 1813) was based on the principle of

forcing in air through water by bellows; but the machine was ponderous and complicated, and required a boy to work it; moreover, he had been anticipated by Humboldt in 1796 (Weld's *History of the Royal Society*, vol. ii. p. 288, note). Notwithstanding a report of the Royal Society, dated November 20, 1817, and signed by Joseph Banks, P.R.S., William Thomas Brande, Charles Hatchett, and William Hyde Wollaston, which is totally adverse to Stephenson's claims, there is undoubted evidence that, during the very months Davy was at work on the experiments which led to his invention, Stephenson's (familiarly called the *Geordy*) lamp was actually in use at the Killingworth mines. In its general principle it was the same as Davy's, the main difference being that the Stephenson lamp had a glass cylinder inside the wire-gauze cylinder, and that inside the top of the glass-cylinder was a perforated metallic chimney; the air being supplied through a triple circle of small holes in the bottom.

On the subject of this controversy, the reader is referred to Smiles's *Life of George Stephenson*. It has been generally agreed that there is a decided advantage in having a glass cylinder besides the gauze one, to resist strong currents of air; and that glass without gauze is not safe from fracture. In the French and Belgian collieries, Mueseler's lamp is in almost universal use. It consists of a glass cylinder immediately around the flame, and of wire gauze above. An internal metal chimney opening a short distance above the flame creates a strong upward draught, which causes the feed air to yass briskly down from the wire gauze, and so keeps the glass cool and insures thorough combustion. Mueseler's lamp is also used in a few English collieries; but modifications of Davy's, Stephenson's, and in a less degree of Clanny's later lamp are still in general use in England, the best kinds of each having their wire-gauze covers secured by patent lever locks. In the catalogue of the collection of scientific apparatus shown at South Kensington in 1876, there is given an interesting table, with remarks, of the different forms of safety-lamps which either are or have been in use. It was compiled by the North of England Institute of Mining Engineers.

Closely connected in its objects with the safety-lamp is a most ingenious invention patented by Mr. Ansell of Her Majesty's Mint. Its object is to determine, by a simple application of the law of osmotic force, the presence of light carburetted hydrogen in coal mines. Mr. Ansell gives two or three forms to his apparatus, of which the following is the most simple: A thin india-rubber ball is filled with atmospheric air, and is placed on a stand under a lever which slightly presses its upper surface. This lever is connected with a spring, which it liberates when, from any cause, the lever is raised; and the liberation of the spring sets a bell in vibration. If this trap for the discovery of fire-damp is set where that gas is present to any material extent, the noxious gas enters the ball by virtue of osmose, causes it to swell, and when the swelling has attained a certain point, the warning bell rings.

The time is probably not distant when the Electric Light (q. v.) will be used in most but especially in dangerous mines. The great difficulty in the way of so applying it is that it cannot as yet, be economically divided into many comparatively small lights from one source of electricity. As it burns *in vacuo* it can be rendered perfectly safe in an explosive mixture of fire-damp and air. Some 20 years ago Mr. Holmes, the well-known electrician, invented a miner's electric lamp in which the light—equal to that of an ordinary candle—was produced by a small portable galvanic battery. Its cost was estimated at between £3 and £4. More lately MM. Dumas and Benoit have constructed a lamp the light of which is produced by a current of electricity from a Ruhmkorff coil passing through a Geissler's vacuum tube. The tube, however, really contains a highly rarefied gas such as carbonic acid, and the light has only the character of a rich phosphorescent glow. In 1881 the Earnock colliery, near Hamilton, was lighted with electric lamps on Swan's principle.

SAFETY-VALVE is a circular valve placed on an opening in the top of a steam-boiler, and kept in its place either by means of weights piled above it, by a lever of the second kind, with a weight capable of sliding along the arm, or by a lever and spring. In stationary engines, one valve is frequently found sufficient, and the pressure on the valve is produced in the first or second of the methods indicated above. In locomotive engines, on the contrary, there are always two loaded valves: one, called the *lock-up valve*, from its being out of the engineman's reach and control, is placed well forward on the top of the boiler, and kept down by weights; the other, on the hinder part of the top of the boiler, is for safety subjected to a less pressure than the lock-up valve, and is acted on by a lever and spring. The term 'safety-valve' is particularly appropriate to this invention; for whenever the tension of the steam rises above a certain amount (= the weight in pounds with which the valve is held down divided by the area in inches of the undersurface exposed to the steam), the valve is forced upwards by the superior pressure beneath, steam escapes, and the pressure on the boiler being thus relieved, the valve sinks to its place. The only precaution necessary is to be sure that the valves are not too heavily loaded or fastened; and wilful indifference, or disregard of this caution, has, especially in the case of American river-steamers, been productive of serious casualties.

SA'FFI, AZAFFI, or ASFI, a seaport of Northern Africa, in the kingdom of Morocco, and 107 miles W.N.W. of the city of that name. It is surrounded by waste and desert land; and its inhabitants, about 12,000 in number, of whom 3000 are Jews, are said to be the wildest, greediest, and mose fanatical of the kingdom. It was at one time the chief seat of the trade with Europe, and though it has declined with the rise of Mogadore, it still exports silk, wool, leather, gum, and goat-skins. The value of imports is above £100,000 a year; of exports, above £250,000.

SA'FFLOWER (*Carthamus tinctorius*), a plant of the natural order *Compositæ*, allied to Thistles (q. v.), but distinguished by its heads of flowers having only hermaphrodite florets, and the fruit having four ribs, and no pappus. It is an annual, 2—4 feet high, branching towards the top; flowers dark orange, or vermilion. It is a native of the East Indies from which it was probably introduced in a remote age into Egypt and the Levant, where it is now naturalized. It is extensively cultivated in France, and the more southern parts of Europe, and even in some parts of South America, chiefly on account of the corollas of the florets, which are used in dyeing yellow and red. In France, it is drilled or sown broadcast in the beginning of May. The plants are thinned to five or six inches apart; and the flowers are picked by the hand in dry weather, and very carefully dried on a kiln, under pressure, and are thus formed into small round cakes, in which state S. appears in the market. The S. of Persia is generally esteemed the best; but India yields the chief part of that imported into Britain. From its resemblance to saffron, S. is sometimes called *Bastard Saffron*, and it is used to adulterate saffron. The yellow coloring matter of S. is a kind of extractive. The red coloring matter is Carthamine (q. v.). The coloring matter of Rouge (q. v.) is derived from Safflower.

The seeds of S. are bitter and very oily. They are greedily eaten by parrots and many other birds. They are sometimes used as a purgative. The oil which they contain is employed in the East Indies in cases of rheumatism and paralysis.

SA'FFRON, a coloring material, consisting of the dried stigmas of the common yellow crocus, so abundant in our gardens in early spring. It was introduced into Europe from Asia Minor, and is largely cultivated in several countries, but chiefly in Spain. In England, the crocus was unknown until 1339, when it was introduced from the East by a pilgrim; and in 1582 it was extensively cultivated for yielding S., especially in Essex, at the place now called, in consequence, Saffron-Walden. Its cultivation in Britain has almost entirely ceased, and the S. used is imported. S. is not only valuable as a coloring material, but has from very early ages had a great medicinal reputation. Homer mentions it, and Solomon associates it with spikenard and other precious drugs and spices. A large portion of the supply in ancient times was yielded by Cashmere, where it is still extensively cultivated. In addition to its other properties, it is often used as a perfume, and in flavoring as well as coloring confectionery and other articles of food. These latter are now its chief uses in Britain, where its medicinal value has long been declining. The color yielded by S. is a bright golden yellow, and is due to a peculiar principle called *Polychroite*. Its great solubility in water prevents its being used as a dye for fabrics; but its agreeable flavor, and the absence of all injurious qualities, render it of great service in coloring articles of food.

The *S. Crocus* (*Crocus sativus;* see CROCUS) differs from most of the species of that genus in flowering in autumn, not in spring. It has large deep purple or violet flowers, with the throat bearded, and the long drooping trifid stigma much protruded from the tube of the perianth. The stigmas are the only valuable part of the plant.

In its cultivation, the corms are planted in the beginning of summer in rows six inches apart, and three inches from bulb to bulb; the most suitable soil being a sandy loam, very thoroughly tilled. The stigmas are gathered by women and children, and are spread out on cloth or paper, and dried in the sun, or in kilns or drying-houses. The produce of an acre of S. is about five pounds the first year, and 24 pounds the second and third year, after which the plantation must be renewed. The price of a pound avoirdupois of S. fluctuates from £1, 5*s*. to £2, 10*s*.

SA'FFRON-WA'LDEN, a market-town and municipal borough of England, in the county of Essex, 24 miles north-north-west of Chelmsford. The church is an elegant specimen of late Perpendicular. The free grammar-school has an income of £60 a year. The chief trade is in barley, malt, and cattle. Pop. (1871) 5718; (1881) 6056.

SA'GA, an old Norse word, used to denote a tale which, originally depended on, and gradually elaborated by, oral tradition, had at last acquired a definite form in written literature. Such sagas (Norse *Sögur*), along with poetical and legislative writings, constitute the chief part of the old Norwegian-Icelandic literature. They have been divided into historical and legendary. The latter embrace partly stories universally current about heroes of the Teutonic race (e. g., the *Völsunga-Saga*), and partly stories peculiar to the Norse or Scandinavian peoples (e. g., the *Frithjofs-Saga*); while the former handle the events and personages of Norwegian and Icelandic history from the 9th to the 13th c., in numerous biographies and family records. To Danish history belong the *Knytlinga-Saga* and *Jomsvikinga-Saga;* to Swedish, the *Ingvars-Saga;* to Russian, the *Eymunds-Saga*. The Faröe Islanders and the Orcadians have also their own sagas. After the middle of the 14th c., when the motley literature of the church began to exercise an influence, tales were translated from foreign languages into Norse, e. g., the story of *Barlaam and Josaphat* (q. v.), which also received the name of sagas. Bishop P. E. Müller, in his *Sagabibliothek* (Copenh. 1817—1820), was the first who subjected the whole subject of saga-literature to a critical treatment. Since his time, collections both of the historical and legendary sagas, with critical apparatus more or less complete, have appeared in all the countries of the north.—The German *Sage* is the same word, and expresses fundamentally the same idea as the Norse *saga*. The difference is this, that the Germans do not restrict its application to the legendary or traditional literature of their own country, but extend it to that of others.

SA'GAN, a town of Prussian Silesia, 48 miles north-west of Liegnitz, on the Bober, and on the Hannsdorf and Glogau Railway. Pop. (1880) 11,373, who manufacture cotton and woollen cloths, and paper, and trade in yarn, cattle, and corn. In the manufacture of woollen cloths alone, 1600 men are employed.

SAGE (*Salvia*), a genus of plants of the natural order *Labiatæ*, and containing many species, herbaceous and half-shrubby. There are only two perfect stamens, the filaments of which bear at their summit a cross thread—the much elongated *connective*—fastened by a joint, and having one cell of the anther at the upper end, and the other but imperfect cell at the other end. The seeds of many of the species, when steeped in water, become covered with a mucilaginous slime, like quince seeds.—COMMON S., or GARDEN S. (*S. officinalis*), grows on sunny mountain slopes and rocks in the south of Europe, and has long been in general cultivation in gardens. It is a half-shrubby plant, seldom more than two feet high, with ovate-oblong or lanceolate, finely notched, curiously wrinkled, whitish-gray leaves, and racemes of purplish blue, rarely white or red flowers. The whole plant has a peculiar, strong, penetrating aromatic smell, somewhat resembling that of camphor, and a bitterish, aromatic, somewhat astringent taste. It contains much essential oil (*Oil of S.*), which has been sometimes used in liniments for rheumatism. *S. leaves* are much used in flavoring dishes, and in sauces, &c. The leaves and young shoots are used for astringent tonic gargles. *S. tea*, made of the dried leaves and shoots, is a popular astringent and tonic. S. grows best in a dry soil, and is easily propagated by slips or cuttings.—CLARY (q. v.) is a species of sage.—MEADOW CLARY, or MEADOW SAGE (*S. pratensis*), is a common ornament of meadows and borders of fields in most parts of the continent of Europe, and in the south of England. It has bluish purple flowers. It is sometimes fraudulently put into beer, to make it more intoxicating.—The APPLE-BEARING S. (*S. pomifera*) is a native of the south of Europe and of the East, remarkable for its very large reddish or purple bracts, and for the large gall-nuts which grow on its branches, as on the leaves of the oak, and which are known as *S. Apples*, have an agreeable aromatic taste, and are brought to market and eaten.—Some of the species of *Salvia* have very beautiful flowers, and are prized ornaments of gardens and greenhouses.

SAGHALI'EN, spelled in all Russian accounts Sakhalin (q. v.).

SA'GINAW BAY, an arm of Lake Huron, extends south-west, and forms an important indentation of the shore of Michigan State, U.S. It is 60 miles long by 30 wide, with several fine harbors and picturesque islands. The water, like that of the whole lake, is of wonderful clearness and purity. The bay is named from the river Saginaw which falls into it.

SAGO is a nutritive substance obtained from several species of palms, especially the *Metroxylon Sagu*, which abounds in Ceram and the west coast of New Guinea. It grows also in Sumatra, Borneo, Celebes, Timor, Buro, and other islands of the Indian Archipelago. In many of these islands, sago is the chief article of food, and by the Alfoers and Papuans is made either into a gruel or baked into cakes. The sago-tree is first a shrub with several upright green branches, which, at their lower parts, are covered with thorns. After three years, these branches form one stem, and the thorns gradually disappear. The tree attains a height of from 40 to 60 feet, and within the ligneous bark it is filled with fibres and flour. It first blooms when 10 to 15 years old, according to the nature of the soil, flourishing best in a moist situation. After blooming, the flour transpires through the pores of the leaves, indicating that the tree is ripe. It must then be cut down within a year, or the flour will be lost. The stem is cut into lengths, split open, and the pith dug out and placed in a vessel with a sieve bottom. Water is applied to separate the flour and carry it into a second vessel, where it is soon deposited. The water is then run off, and the flour dried and put into little baskets made of sago-leaves. The produce of a tree averages 750 lbs. A large quantity of sago-flour is annually sent from the north-west of Borneo, the north-east of Sumatra, and Siak, to Singapore, the leading market, where it is purified and fitted for use as starch in the calico and other manufactures. In Borneo, much of the sago is granulated; and the Chinese of Malacca prepare pearl-sago which is also sent to Singapore.

Pearl-sago is in small pearly-white spherical grains, varying in size from that of a poppy-seed to a grain of millet. Granulated sago is also in round grains, but of a larger size. There are several varieties which differ much in color, some being white and others reddish-brown like radish-seed. One kind of granulated sago from India has been introduced under the name of tapioca. The method of pearling and granulating sago is not known to Europeans. S. is not entirely soluble in hot water, like ordinary starch, and can therefore be employed in making puddings, &c., and in this way forms a valuable article of food, being cheap, light, nutritious, and easy of digestion. The amount annually imported into Britain is upwards of 19,000 tons, and is valued at about £300,000. See 'Sago' in *Journal of the Ind. Archip.*, vol. iii.; *Tijdschrift van Ned. Indië*, 8th year, vol. i., see 'De Sagoboom.'

SAGOU'IN (*Callithrix* or *Saguinus*), a genus of American monkeys, having a long but not prehensile tail, a small and rounded head, short muzzle, and large ears. They are of small size, and remarkably active and graceful in their movements. They are sometimes called *Squirrel Monkeys*. They are of very gentle disposition, and when tamed, become strongly attached to their masters. Both body and tail are covered with beautiful fur. The SIAMIRI or TEE-TEE (*C. sciureus*), a native of Brazil and Guiana is one of the best known species.

SA'GUA-LA-GRA'NDÉ, a town of Cuba, on the river Sagua, about 12 miles from its mouth, which is on the north coast of the island. It is a town of considerable importance, and is connected by railway with Villa Clara and other places. Pop. about 10,000.

SAGUENAY, a large river of Canada, falling into the estuary of the St. Lawrence, on the north side, about 115 miles below Quebec. It drains the Lake of St. John, which is nearly circular, and almost 30 miles in diameter. Its course from that lake to the Gulf of St. Lawrence is about 100 miles, and is almost a straight line. It flows between precipitous cliffs, has numerous cataracts in its upper part, and is in many places two or three miles broad. In the lower part of its course, it is less wide, but very deep, and large ships ascend it more than 60 miles to load with timber from the settlements on its banks. The name S. is sometimes also given to the principal river which falls into Lake St. John, and which is known to the Indians as the Chomouchouan and as the Assouapmoussoin. It rises about 200 miles to the west of Lake St. John. The average depth in mid-channel is 145 fathoms.

SAGU'NTUM, a wealthy and warlike town of ancient Spain, in Hispania Tarraconensis, stood on an eminence near the mouth of the Pallantias (modern Palancia). Its site is now occupied by the town of Murviedro (q. v.). Founded (according to Strabo) by Greeks from Zacynthus, it became at an early period celebrated for its commerce, and attained to great wealth. But it owes its historical vitality to the circumstance of its siege and destruction by the Carthaginians, under Hannibal, in 218 B.C. Having withstood the siege for the greater part of a year, against an army amounting to about 150,000 men, led by a general of consummate ability and indomitable resolution, the Saguntines, now most severely pressed by famine, concluded, with an act of heroic defiance and self-sacrifice, a resistance that had been characterized by the most brilliant valor. Heaping their valuable effects into one vast pile, and placing their women and children around it, the men issued forth for the last time against the enemy; and the women, setting fire to the pile they had prepared, cast themselves upon it, with their children, and found in flames the fate their husbands met in battle. The destruction of S. directly led to the second Punic war.

SAHA'RA. The immense tract of country to which this name is commonly given, has already been described under the heading AFRICA (q. v.). But the term Sahara is more correctly applied to a region of much more limited extent. The natives divide Africa north of the line into three portions—the Tell, the Sahara,

and the Desert. The Tell extends from the Mediterranean to the Atlas Mountains; the Sahara, from the Atlas to the southern region where all regular supply of water fails; and the Desert, from the southern, and not very clearly-defined frontier of the Sahara, southward almost to the water-shed of the Niger, comprising a district salt and arid, inhospitable to man and beast, although the camel may even here snatch a scanty subsistence. As to physical geography, the S. may be subdivided into the following districts—1. The Hauts Plateaux, or Steppes, a series of high levels skirting the base of the Atlas Mountains. 2. The land of the Dayats or waterless oases, stretching south to the high lands on the south bank of the Wed Mzi or Djidi. 3. The region of the southern oases, to the south of the former, and extending south till it loses itself in the Desert. The idea of flooding the natural depression in the western S. has been proposed by Donald Mackenzie, as a commercial water-way to the interior; the French government in 1880–81 had a party exploring a route for a trans-Saharan railway to unite Algiers with the Senegal and Niger region. The population of S. is estimated at about 2,850,000.—See H. B. Tristram's *Great Sahara*, Nachtigal's *Sahara and Sudan* (1879).

SAHARANPU'R, or SUHURUNPUR, a town of British India, North-west Provinces, the chief place of a district of the same name. It is situated in a plain in N. lat 29° 58′, and E. long. 77° 36′, about one mile east of the Doab Canal. It has a large fort, a military cantonment, and a government dépôt. S. is about 1000 feet above the sea, and the climate is temperate during great part of the year. S. was therefore chosen as a suitable situation for a botanic garden, for plants requiring a milder climate than that of Calcutta, and one was formed in 1817. S. is described as one of the most handsome British stations in India. Pop. (1872) 43,844.

SAHIB (Arabic, companion, master, lord) is in Hindustani, the usual designation and address of a respectable European, equivalent to Mister, Sir, &c. Hence *Sahibâ* is the term for Lady, Madam. In Bengali and Mahrati, the word assumes the form *Saheb*.

SAI'DA. See SIDON.

SAID PASHA. See EGYPT.

SAIGA. See ANTELOPE.

SAÏGON, one of the finest river-ports in Asia, the capital of the French possessions in Lower Cochin China, stands on a small river of the same name, about 35 miles from the Chinese Sea. The city is fortified, and its value as a strategical position is unquestionable. By land it is defended from attack by many miles of jungle and swamp, and the approach from the sea on the south, by the fine river Donnai, could easily be rendered impassable to the strongest fleet. The entrance to the Donnai is at Cape St. Jacques, and its winding course to S., through a rich level country, is from 50 to 60 miles in length, and might be defended by fortifications at every point. It is of easy navigation, and is of sufficient depth to allow vessels of the heaviest burden to sail close to its banks under the overhanging foliage.

The breadth of the river from S. to the sea varies little, but it is never narrower than the Thames at London. It is joined on both sides by many large affluents, and it is the main channel of a river-system that covers the whole country to the south of the capital with a network of water-courses. The city of S. is fortified, and is defended by a permanent force of several large ships of war and a garrison of 10,000 men. At the beginning of the year 1865, the law of conscription, by which one man in seven is chosen from among the natives for military service, was already in force. S. consists of two parts, the Chinese town, four miles inland, filled with an active population busily engaged in trade; and the European, or fortified town on the banks of the Saïgon. The latter, with its fleet of vessels riding at anchor in mid-stream, is already of considerable size. Good roads have been constructed for many miles around, and there are barracks, hospitals, official residences, and other buildings for public purposes. The soil, only about one-fourth of which is under cultivation, is abundantly fertile, and is admirably suited to the production of cotton, sugar, indigo, and tobacco, besides rice, the principal export. Its forests contain magnificent timber, and abound in woods rich in dyes. Many handsome public buildings have been erected. There is a naval yard and arsenal, and ship-building is carried on. Pop. estimated at 70,000.

S. together with part of the territory of which it is the capital, was taken by the French in 1860. Treaties of peace and commerce, concluded with the Anamite government, in 1864, provided that the protectorate of the six provinces of Lower Cochin-China should remain in the hands of France; that three important ports on the coast of Anam should be opened; and that a space of nine kilometres on the shore of each port should be conceded to the French for the establishment of factories; that French merchants and missionaries should be allowed to traverse the kingdom of Anam without hindrance, and that an indemnity of 100 millions of francs should be paid. In 1867, in consequence of fresh aggressions, encouraged by the government of Anam, the French took the town of Vinh-long, and, by a new treaty, added three other provinces to their dominions, which now extend from 9° 5′ to 10° N. lat., and from 105° to 107° E. long. Pop. (1878) 1,592,000. The revenue of the colony is about 15,000,000 francs. The yearly imports and exports are each about 12,000,000 francs.

SAIL. A sail is an expanse of canvas, matting, or other strong material, on which the wind may exert its force and propel the vessel. A sail is extended by means of a mast or yard, or both. It may be of various shapes, and of any size, according to the carrying power of the vessel. A vessel of shallow draught or of narrow beam can bear comparatively little sail; while a vessel of proportionately deep draught and heavily ballasted—as a yacht—or a vessel of great breadth of beam, can carry sail of great area. A sail acts with the greatest power when the wind is directly astern, as in fig. 1; but it can be applied, though with less strength, when on either beam. The action of the wind on an oblique sail is a good example of the resolution of forces. See COMPOSITION AND RESOLUTION OF FORCES, &c. Let TD, fig. 2, be a ship, PAS its sail, WA the direction of the wind, and let

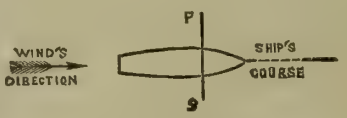


Fig. 1.

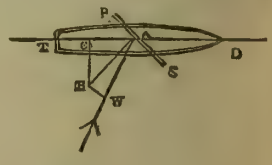


Fig. 2

the length of WA represent the pressure of the wind on the sail. WA can be resolved into AB perpendicular to the sail, and BW parallel to it, the latter of which has no effect in pressing on the sail; therefore AB is the effective pressure on the sail. Were the vessel round, it would move in the direction BA. Let BA be resolved into CA and BC, the former, CA, acting in the direction of the keel or length of the vessel, or in the direction CAD, and the latter perpendicular to it, or in the direction of the breadth. The former pressure, CA, is the only pressure that moves the vessel forward, the other, BC, makes it move sideways. From the form of the vessel, however, this latter force, BC, produces comparatively little lateral motion; any that it does occasion is called *leeway*. It results, therefore, that with the wind exerting an oblique pressure, the actual progress will be to the power of the wind only as CA to WA.

In the East and the Mediterranean, sails are frequently made of strong matting; but among northern nations, and for ocean navigation, very strong cloth, or canvas, called *sailcloth*, is usually resorted to. It is woven narrow; and the many breadths in the sail are joined by carefully made double seams.

Sails are nearly always either triangular or quadrilateral, but not necessarily equiangular. The commoner forms are shown in fig. 3. To give greater strength, a strong rope or cord is sewn

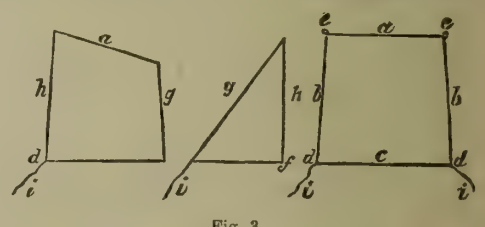


Fig. 3.

a, head ; *b*, leech ; *c*, foot ; *d*, clew ; *e*, earrings ; *f*. clew ; *g*, fore-leech ; *h*, after-leech ; *i*, sheet.

into the outer edge all round the sail; this rope has eyes in it, to which the various ropes employed in connection with the sail are fastened. The top of a sail is its *head;* the bottom, its *foot;* and the sides are *leeches;* the upper corners are termed *ear-rings;* the lower corners of a square sail, and the after lower corner of other sails, *clews;* the front lower corner of a fore-and-aft sail is the *tack*. The ropes from the lower corners, used in tightening the sail against the wind, are the *sheets*.

The sails of a ship are either 'square' or 'fore-and-aft.' The square-sails—beginning from below—are, the *course*, the *topsail*, the *topgallant-sail*, the *royal*, and, though very rarely used, the *sky-scraper*. Each has the name of the mast, on which it is set prefixed, as 'fore-topsail,' 'main-royal,' &c. The square-sails are made fast by their heads to yards, the foot being drawn to the extremity of the yard below. Fore-and-aft sails are the *spanker* or driver, extended by the gaff at its head, boom at its foot, and mast on its fore-leech; the *staysails*, which are suspended by rings to the stays, and the *Jibs* (q. v.).

In a three-masted vessel, the sails of most importance are the main-course, the spanker, the top-sails, the fore-stay-sail, and the

jibs, which can usually be all distended to the full without taking wind from each other. In very light winds, when every breath is of consequence, the area of the sails is increased by setting the *studding-sails*, which are oblong sails set on each side of the square-sails, on short booms run out beyond the yards of the latter. Fig. 4 represents a square-rigged ship with the whole of her canvas shown.

In small craft and boats, the most common sail is a lug-sail (see LUGGER), which is a small square-sail, occasionally supplemented by a shoulder-of-mutton (triangular) sail on a shorter mast at the stern. Cutters or sloops carry a large spanker, with a topsail of similar shape, and jibs; some having the power of setting a large course when the wind is astern; but it is obvious that the course and spanker cannot be used together. A schooner uses the same

Fig. 4.

1, Course; 1*a*, Studding-sails; 2, Fore-topsail; 2*a*, Studding-sails; 3, Main-topsail; 3*a*, Studding-sails; 4, Mizen-topsail; 5, Fore-topgallant-sail; 5*a*, Studding-sails; 6, Main-topgallant-sail; 6*a*, Studding-sails; 7, Mizen-topgallant-sail; 8, Fore-royal-topsail; 8*a*, Studding-sails; 9, Main-royal-topsail; 9*a*, Studding-sails; 10, Mizen-royal-topsail; 11, Fore-skysail-topsail; 12, Main-skysail-topsail; 13, Mizen-skysail-topsail; 14, Fore-topmast staysail jib; 15, Jib; 16, Flying jib; 17, Mizen spanker; 18, Spenser; 19. Main-royal-staysail; 20, Main-topmast-staysail; 21, Mizen-topgallant-staysail.

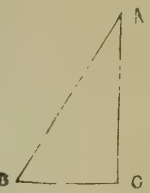
sails as a cutter, except that, in one form she carries a square top-sail and top-gallant-sail on the foremast.

Sails are furnished with rows of short ropes for the purpose of *reefing* them, when their area is too large for the wind. The effect of a sail is increased by wetting it, as the pores of the canvas close more tightly through the swelling of the hemp.

SAILCLOTH, a very strong fabric, woven generally with linen yarn, but in America it has been made wholly of cotton; and in this country, under Armitage's patent, of cotton and linen mixed. Hair—such as of the ox, horse, and deer—has also been used, under Taylor's patent, in 1832, but without success. Linen and hempen cloths are those generally used in all parts of Europe.

SAILINGS, the technical name in Navigation for the various modes of determining the amount or direction of a ship's motion, or her position after having sailed a given distance, in a given direction. The direction of a ship's motion is her *course*, and is expressed in terms of the angle between the line of direction and the meridian; the length of her path is the *distance;* the distance in nautical miles, made good to the east or west, is the *departure*, and is measured along a parallel; the *difference of latitude* is an arc of the meridian intercepted by the parallels, one of which passes through the place sailed from, the other through the place sailed to; and the *difference of longitude* is an arc of the equator intercepted by meridians through the same two places. It will at once be seen that if a ship sails along a meridian, the difference of latitude becomes the course, and there is no departure or difference of longitude; and that if it sails along a parallel the departure will be the same as the distance, and there will be no difference of latitude.

The two general questions which present themselves to the navigator for solution, are—1. Given the course and distance from one place in given latitude and longitude to another place, find the latitude and longitude of the other; and 2. Given the latitude and longitude of two places, find the course and distance from the one to the other. The simplest way in which such problems can be solved is by the method known as *plane sailing*, a method, however, which is only roughly approximate, assuming, as it does, that the surface of the sea is a plane; it is consequently applicable only to short distances and low latitudes where the meridians are nearly parallel. According to 'plane sailing,' the elements of a ship's path are represented by a right-angled plane triangle, as ABC (fig.), where AB is the distance, the angle BAC the course, AC the difference of latitude (AC being a portion of a meridian, and BC of a parallel of latitude), and BC the departure. The two problems given above are in this method merely simple cases of the resolution of a right-angled plane triangle (see TRIGONOMETRY), for if the course and distance are given, the *dif. of lat.* = distance × cos. of course, and *dep.* = dist. × sin. of course; while the idea of *dif. of long.*, as distinct from dep., is quite inadmissible, since the method presupposes that the ship is sailing on an absolutely flat plain. If the ship does not stand on one course, but changes from time to time, the calculation of her final position may be effected, either by the previous method, repeated for each change of course, or more conveniently, by the method of *traverse sailing*. This method consists in the resolution of a ship's course and distance into two courses and distances, the courses being in the direction of some of the four cardinal points of the compass; thus, a ship which has sailed S.-W.-by-S. for 24 miles, has made 20 miles of *southing*, and 13·3 miles of *westing*.



The *traverse table* has consequently six columns, the first containing the courses; the second, the corresponding distances; while the third and fourth contain the difference of latitude for each course, which, if N. is put in one column, and if S. into the other; the fifth and sixth columns, marked respectively E. and W., contain in a similar manner the departure for each course. When the table has been made out for the various courses and distances, the columns of dif. of lat. and departure are summed up, and the difference between the third and fourth, and between the fifth and sixth columns, gives the dif. of lat. and departure between the place sailed from and the place arrived at from which the course and distance made good can be calculated as before. When a current interferes in any way, either by accelerating or retarding the ship's motion, its effect is estimated as in traverse sailing, as if it were one course and distance, the *set* of the current being the course, and its *drift*, i. e., its rate per hour multiplied by the number of hours it has affected the ship, the distance.

Parallel sailing may be employed when a ship sails between two places, on the same parallel of latitude, in which case, if her head be kept accurately and constantly in an east or west direction, she will describe an arc of the parallel between the two places. As in this sailing the departure is the same arc of the parallel that the difference of longitude is of the equator, the *dep.* (which is now the *distance*) = *dif. of long.* × *cos. of lat.* The other elements are found as in plane sailing.

Middle Latitude Sailing is the application of the principle of parallel sailing to the case in which the ship's course is not perpendicular but oblique to the meridian; it is merely an approximate method, coming very close to a true estimate in low latitudes for any course, and in all latitudes for a course nearly E. and W. (i. e., one in which the distance is large as compared with the difference of latitude), but erring widely under other circumstances, though errors may be diminished as much as we please by dividing the distance into portions, and calculating the dif. of long. for each. The object of this sailing is to deduce the dif. of long. from the dep., and *vice versâ*, on the supposition, that the whole departure has been made good along the parallel of latitude which is equidistant from each extremity of the course, a method which, at first sight, would seem to give a correct result, and would do so if the parallels of latitude increased uniformly, which they do not. The dep., when laid off along the parallel of middle latitude, always gives the dif. of long. too small, and hence the limitations above noticed. When the latitudes are of the same name, the middle latitude is half their sum; but when of con-

trary names, it is better to find the dif. of long. for the portion on each side of the equator separately, the two middle latitudes being respectively half the latitude of the place sailed from, and half that of the place sailed to. The formulas are the same as for parallel sailing and plane sailing.

Mercator's Sailing is a perfect method of obtaining the same result as is found approximately by middle latitude sailing, but in the former case the dif. of long. is found from the departure, while in this method, the difference of latitude is employed for the same purpose. A table of meridional parts, as it is called, is necessary; this table shows the number of minutes in Mercator's projection (see MAP) corresponding to each degree and minute of latitude up to 78°, and is employed as follows. The latitude sailed from, and that reached, being known or found, the meridional parts for each are obtained, and their difference, if the latitudes are of the same name, or sum if of opposite names, gives the dif. of lat. We have then a right-angled triangle, with the dif. of lat. and dif. of long. forming the two smaller sides, and the vertical angle representing the course, whence *dif. of long.* = *dif. of lat.* × *tan. of course.* This sailing is the one most generally employed by navigators, but is inferior in practice to middle-latitude sailing, in the cases noticed under that head, for though it be a perfect, and the other merely an approximate method, yet a small error in the course (if large), or in the dif. of lat., becomes greatly magnified in the dif. of long.; while in the case of the latter, a considerable error in departure is hardly magnified, and a large error in the course (if nearly E. and W.) becomes imperceptible in the dif. of long. It is, however, better to work the problem according to both methods, and then estimate the true result as nearly as possible.

Great Circle Sailing (q. v.), the most perfect of all methods for finding a ship's course, is separately noticed. See also SPHEROGRAPH.

The obstacles that interfere with the correctness of the mariner's calculations are chiefly those which affect his data, the course and distance, the more important being the magnetic deviation of the compass produced by the attraction of the ship, errors in the estimated leeway or in the set and drift of currents, &c.; all of which require to be taken into account. The necessity for frequently checking the *Dead-reckoning* (q. v.), by means of astronomical observations, is sufficiently apparent.

SAI'NFOIN, or SAINTFOIN (*Onobrychis sativa*), a plant of the natural order *Leguminosæ*, suborder *Papilionaceæ*, of a genus nearly allied to *Hedysarum* (see FRENCH HONEYSUCKLE), but having one-seeded pods, which are marked with wrinkles or pits, and are more or less prickly-toothed at the margin. It is a spreading perennial, about 2 or 3 feet high, with leaves of 9—15 smooth acute leaflets, and spikes of beautiful flesh-colored flowers, striated with rose-red, on long stalks. It is a native of the continent of Europe and of the south of England, and is much cultivated as a fodder-plant in dry, and particularly in calcareous soils, to which it is admirably adapted. Its cultivation was introduced into England in 1651; and before the introduction of turnip-husbandry, the sheep farmers of the chalk districts depended almost entirely upon it, as they still do to such a degree, that in many leases there is a stipulation for the tenant's leaving a certain extent of land in sainfoin. It is, however, a very local crop, being scarcely cultivated on any but the most calcareous soils, where nothing else is nearly equal to it, although it has been found to succeed well on any soil sufficiently dry.

There is no more nutritious fodder than S., whether for sheep, oxen, or horses. Even the dry stems of a crop which has produced seed are readily consumed by cattle, if cut into small pieces. S. sometimes endures for 10, or even 15 years on the same land—more generally only for 4 to 7 years; and in the eastern counties of England it is often sown instead of clover on light and somewhat calcareous sands and sandy loams, and the ground is ploughed again in two or three years.—The name S. is perhaps rather *Sangfoin*, from the blood-color of the flowers, than *Saint-foin* (Holy Hay).

SAINT A'LBANS. See ALBANS, SAINT. (Other names beginning with *Saint*, and not given under that word, will similarly be found under the other part of the name.)

ST. A'LBAN HALL, OXFORD, takes its name from Robert de St. Alban, a citizen of Oxford, who conveyed the building to the nuns of Littlemore, near Oxford, in 1230. On the dissolution of the nunnery, it was given by King Henry VIII. to his physician, George Owen, D.M., who conveyed it to Lord Williams of Thame, and Sir John Gresham. By their assignees, it was finally transferred to the Warden and Fellows of Merton College, and was some time after established as an academical Hall. The principal of this, as well as of the other four halls, is assisted in his duties by a vice-principal and other officers appointed by himself.

SAINT AMAND, a town of France, in the dep. of Cher, stands on the right bank of the river of that name, 27 miles south-south-east of Bourges. It has a trade in iron. Pop. (1876) 7719.

SAINT AMAND, a small town of France, in the dep. of Nord, 8 miles north-west of Valenciennes. The town contains hot sulphur-springs; and lace, clay-pipes, and porcelain are manufactured. Pop. (1876) 7243.

ST. ANDREWS. See ANDREWS, ST.

SAINT ANTHONY'S FIRE. See ANTONY, SAINT.

ST. ARNAUD. See LEROY.

SAINT AU'GUSTINE, an ancient Spanish town on the east coast of Florida, U. S., is built on the western shore of an estuary 2 miles from the Atlantic, 160 miles south of Savannah. It enjoys a mild and equable climate, and is a resort for consumptive invalids. It was founded in 1565, and is the oldest town in the United States. Pop. (1870) 1717; (1880) 2500.

SAINT AU'STELL, a small town of Cornwall, 13 miles north-east of Truro by railway. Woollen goods are manufactured, and at the bay of St. Austell, from which the town is about a mile distant, there is a pilchard-fishery, and tin and copper are exported. Pop. (1871) 3803; (1881) 3612.

ST. BEES, an ancient village of Cumberland, pleasantly situated on the bay formed by *St. Bees Head*. It is 4 miles south of Whitehaven, and about 10 miles beyond the limits of the Lake district. St. Bees is a station on the Whitehaven and Furness Junction Railway. The parish is very large, comprising town and port of Whitehaven, village of St. Bees, and several chapelries and townships. The village of St. Bees contains about 1100 inhabitants. According to tradition, preserved by the early chroniclers, St. Bees originated in a nunnery founded here, 650 A.D., by an Irish saint named Bega, of whom Sandford's MS. (in the Dean and Chapter Library, Carlisle) records a very pretty legend. It appears to have been destroyed before the reign of Henry I., in whose time we find that Ranulph, Earl of Cumberland reconstituted it as a priory; but after the dissolution of the monasteries, it went to ruin. The institution known as ST. BEES COLLEGE was established in 1816 by Dr. Law, then Bishop of Chester, to supply a systematic training in divinity to young men desirous of ordination, whose means were inadequate to defray the expenses of a university education. The bishops of the province of York had previously been compelled to ordain a number of such men as literates, the poverty of many of the northern benefices not securing a sufficient supply of graduates. A portion of the ruined priory of St. Bees was fitted up by the Earl of Lonsdale as lecture-rooms, library, &c. On the recommendation of the bishop, an incumbent was selected for the perpetual curacy of St. Bees (value, £100 per annum) by the patron, the Earl of Lonsdale, with a view to his holding the position of Principal of the College in connection with the living. The Principal selects his own staff of lecturers. The expenses are defrayed from the fees paid by the students—£10 each term. The College course extends over two years, each divided into two terms, from about January 28 to May 5, and August 25 to December 5. During this period, the standard English divinity works, with the Greek Testament, are chiefly studied, and the composition of sermons, &c., practised.

The students reside in lodgings in the village, under the control of the Principal, and attend the service daily in the parish church, the transepts of which were restored in 1855 for their accommodation. A new lecture-room and library were built in 1863, adjoining the ancient structure. Students are admitted at the age of 21, on producing testimonials of character, &c., satisfactory to the Principal. Graduates of a university where there is no divinity course, are admitted to the second year's course on producing their diploma, along with the usual testimonials as to their fitness for the ministry. Students who have passed the course are not now confined to the northern province, as was the original design, but are admitted into most of the southern dioceses. The average number of students in the college is about 100. Near the church is an endowed grammar-school. St. Bees is in some repute as a sea-bathing place.

SAINT CA'THERINE'S, an incorporated town of the province of Ontario (formerly Canada West), Canada. It is on the Welland Canal, and is a station on the Welland Railway. The town is very flourishing, and has large manufactures of machinery and agricultural implements. The surrounding country is very picturesque. The well-known mineral well of St. C.'s, whose water is of great value as a remedial agent, supplies on an average 130,000 gallons a day. Of these waters, a large quantity, partially evaporated, is sent out through the country. A second well, similar to the first, is also in use. St. C.'s has been called the Saratoga of British America. Its hotels are equal to any in the province. St. C.'s is 33 miles to the south of Toronto, and 12 miles from Niagara Falls. Pop. (1871) 7864; (1881) 9631.

SAINT CROIX, an American river, called also the Passamaquoddy, which, flowing out of Grand Lake, on the eastern border of Maine, runs east-south-east 75 miles to Passamaquoddy Bay, and forms a portion of the boundary between the United States and New Brunswick.

SAINT DOMI'NGO. See HAYTI.

SAINT DOMINGO BARK. See CARIBBEE BARK.

SAINTE-BEUVE, CHARLES-AUGUSTIN, a French poet and critic of great eminence was born at Boulogne-sur-Mer, on 23d December 1804. His father, who died two months before his birth, was *principal des droits réunis* at that port. His mother, a woman of superior character and intelligence, was by family originally English, and through her the boy early acquired a familiarity with the English language and literature. He was educated at an institution of his native place, and afterwards at the Collége Charlemagne in Paris. On leaving college, though his bent towards literature was already pronounced, he was shy of committing himself to it as a profession, and betook himself to the study of medicine and anatomy. Shortly, he obtained a situation at the Hospital St. Louis. Here for some time he worked steadily; but his spare time was occupied with literature; and his articles contributed to the *Globe* on topics of history, philosophy, and criticism, attracted attention, and in particular procured him the acquaintance of the celebrated M. Jouffroy. While he was thus wavering between literature and the claims of a profession distasteful to him, Victor Hugo's *Odeset Ballades* were published, and the impression made upon him by this work, of which he wrote an enthusiastic *critique*, seems to have determined him finally to a life exclusively literary.

He gave up his situation at the hospital, and attached himself to *Le Cénacle*, along with Alfred de Musset, the two Deschamps, and others of the so-called Romantic School. Shortly, he gave to the world his *Tableau Historique et Critique de la Poésie Française, au XVI.e Siècle* (1828—afterwards enlarged in ed. 1843), which at once established his reputation as one of the first critics of the time. His next work *Les Poésies de Joseph Delorne*, though somewhat coolly received by the public, brought him what perhaps pleased him better than any of the applause of the multitude, the emphatic approval of Béranger and others of the literary guild. *Les Consolations*, published in 1830, was considerably more successful in hitting the taste of the public. On the cessation of *Le Cenacle*, after the revolution of 1830, S. attached himself to the *Globe;* and subsequently, he wrote much in the *Revue des Deux Mondes*, the *National*, and the *Constitutionnel*. In 1834, appeared his *Volupté*, a work curious as a study of moral pathology, but more curious than pleasing; and in 1840, he published the first volume of his *Histoire de Port Royal*, a work which, in 1860, he completed in five volumes. On 27th February 1845, he received the most distinguished mark of honor which can fall to a Frenchman of letters, by his election to be a member of the Academy. In 1850, he began to issue, in the pages of the *Constitutionnel*, the famous series entitled *Causeries de Lundi*, the most delightful of all his works, and that by which he is most widely known. After the *coup d'état* of 2d December 1851, he became connected with the *Moniteur*, and was appointed Professor of Latin Poetry at the Collége de France. Of this appointment some fruits are before the world in his *L'Etude sur Virgile*, published in 1857. In 1865, he was called to be a member of the Senate. He died November 1869.

As a poet, S., despite the fine talent he displayed, never succeeded in becoming popular, nor can very high rank be accorded him. But as critic, he was 'himself alone,' and his place is by common consent in the very fore-front of French literature. His sympathies were wide and catholic; in delicacy of perception, and subtlety of refined analysis, he was almost without a rival; his style is piquant, lively, fascinating, instinct with individual expressiveness; and nothing can exceed the felicity with which the interest of criticism proper is combined in his sketches with that of anecdotic biography.

Of his works not already glanced at, the following only need be mentioned: *Poésies Complètes* (1840); *Critiques et Portraits Littéraires* (1832—1839); *Portraits Littéraires* (1844); *Portraits Contemporains; Causeries de Lundi* (1851—1857); *Nouveaux Lundis* (1863); *Souvenirs et Indiscrétions. Le Dîner du Vendredi-Saint* (1872). A selection from the *Causeries de Lundi* has been translated into English, with an introduction, under the title *English Portraits* (1875).—See *C. A. Sainte-Beuve, sa Vie et ses Œuvres*, by D'Haussonville (1875); and an article in No. 281 of the *Quart. Rev.*

SAINTE-CLAIRE DEVILLE, HENRI ETIENNE, French chemist, was born in March 1818, at St. Thomas, West Indies, and was educated in France. On quitting college, he constructed at his own cost a chemical laboratory, and for nine years, without master and without pupils, devoted himself to patient studies and skilful researches. In 1844, he was commissioned to organize the Faculty of Sciences of Besançon, of which, in the following year, he was appointed Dean and Professor. In 1851, he obtained the chair of Chemistry in the Ecole Normale, which he resigned in 1880. In 1853, he became a member of the Faculty of Sciences of Paris. In 1861, he was chosen a member of the Academy of Sciences of the Institute. He died 1st July 1881.

S. D.'s earliest investigations relate to different essences and resins, and the most important are in the department of mineral chemistry. In 1849, he made known the mode of preparation and the properties of anhydrous nitric acid, a compound whose existence had been up to that date ignored. In 1852, he published an important paper on Metallic Carbonates and their Combinations; and in the following year, a new method of mineral analysis, known as the middle way, in which he proposes the exclusive employment of gases and volatile re-agents, against the errors arising from the use of the filter.

About the same time, he began his researches into aluminium, a metal discovered in 1827 by Wöhler of Göttingen, but still very imperfectly known, and set forth its special properties. Being commissioned by Louis Napoleon to seek the best method of obtaining aluminium at a low price, he made numerous experiments, jointly with M. Debray, in the factory at Javel; and after some months, succeeded in producing ingots of the metal, which were shown in the Exposition Universelle of 1855. These experiments, and the properties of aluminium, have been described by S. D. in scientific periodicals; and among his later papers are—on the Three Molecular States of Silicium; on the Metallurgy of Platina; on the Density of Vapors at very High Temperatures; on the Measurement of High Temperatures; on the Permeability of Iron to Gases at a High Temperature; on the Phenomena of Dissociation in Homogeneous Flames; and on the Industrial Preparation of Aluminium and its Compounds. These papers are published in the *Mémoires* and *Comptes Rendus* of the Académie des Sciences de l'Institut, and in the *Annales de Chimie et de Physique*.

SAINTE MARIE-AUX-MINES (Ger. *Markirch*), a town of Germany, in Alsace, on the Liepvrette, 12 miles north-west of Colmar, at the foot of the Vosges Mountains. It formerly owed its prosperity to its silver mines, but these are no longer worked. Its chief manufactures are cotton fabrics of various kinds, paper, and cherry-brandy. Pop. (1871) 12,319; (1880) 11,524.

SAINTES, an old town of France, in the dep. of Charente-Inférieure, on the left bank of the Charente, 43 miles south-east of La Rochelle. In ancient times, this town, under the name of *Mediolanum*, was the capital of the Santones, from whom the subsequent province derived the name of Saintonge. It contains interesting Roman remains, as a triumphal arch, and the ruins of an amphitheater, circus, &c. Pop. (1876) 11,150.

SAINT GEORGE'S ENSIGN is the distinguishing flag of the British navy. It consists of a red cross on a white field, with a union-jack in the dexter chief corner, as shown in fig. 2 of the article FLAG. Formerly it was usual that an admiral, vice-admiral, or rear-admiral should have his flag red, white, or blue, according to the squadron to which he belonged. By a regulation of 1864, this old custom was altered; the squadrons are abolished, and the white Saint George's ensign is the badge of all ships in the navy. The red and blue ensigns are now left to government vessels—not being ships of war—and merchant vessels respectively. The ensign is borne at the peak, or, in harbor, on a flagstaff at the stern; in boats, the latter is the only mode of flying it. A full-dress ensign is the largest flag used, being often but little smaller than the quarter-deck of the ship which hoists it.

SAINT-GERMAIN-EN-LAYE, a town of France, in the dep. of Seine-et-Oise, on an elevation on the left bank of the Seine, 14 miles by railway west-north-west of Paris. It contains three handsome squares, a parish church, with a monument erected by George IV. over the remains of James II., several learned and other societies, and some factories. Pop. (1876) 16,978.

S.-G. had its origin in a monastery built by King Robert in the beginning of the 11th c., on the summit of the hill which was surrounded by the forest of Lyda (*Laye*), and dedicated to St. Germain. The town, as well as the royal château, which was built either during the reign of King Robert, or soon after, was sacked by the English in 1346, in 1419, and in 1438. At S.-G. the marriage of Francis I. was celebrated, and this king rebuilt the château in 1547. From before the time of Philippe-Auguste, S.-G. had been the residence of the French court during a portion of the year, but Louis XIV. transferred the court to Versailles, and from this time the fortunes of S.-G. declined. Later, the château of S.-G. was assigned by Louis XIV. as the residence of the dethroned James II. of England, and here in exile that monarch held his morose court, devoting almost the whole day to religious observances. The château is now used as barracks and for other purposes. The Forest of S.-G. comprises 10,873 English acres.

SAINT HE'LENS, a municipal borough of Lancashire, on a small affluent of the Mersey, 3½ miles north-east of Prescot by railway. It is a straggling, ill-built, but thriving town, with an extensive trade in coal. It has plate-glass, copper, and bottle works; also potteries, breweries, tan-yards, iron and brass foundries. Pop. (1861) 18,396; (1871) 45,134; (1881) 51,234.

SAINT HE'LIERS, capital of Jersey (q. v.), the chief of the Channel Islands, is situated on the south shore of the island, and on the east side of St. Aubin Bay, lat. 49° 11′ N., long. 2° 6′ W. It is defended by Elizabeth Castle, on a rocky island off the shore, approached by a causeway at low water; and by Fort Regent, on the south-east side of the town, built about 1806, on a scarped granite rock, at an enormous expense. In the year 1867 a great extension of the harbor works was found to be necessary. At spring tides, the water rises 40 feet. Victoria College—a handsome edifice, built on an eminence, in 1851—the hospital, the theater, and the churches, are the chief buildings. The area of the town has rapidly increased within recent years. An active trade is carried on with England, France, and India. Pop. of town and parish (1871), 30,756, including a garrison of upwards of 500 men.

SAINT IGNA'TIUS' BEAN. See NUX VOMICA and STRYCHNOS.

SAINT-JEAN-D'ANGÉLY, a small town of France, dep. of Charente-Inférieure, 15 miles north-north-east of Saintes. Pop. (1876) 6309.

SAINT JOHN'S BREAD. See CAROB.

SAINT JOHN'S WORT. See HYPERICACEÆ.

SAINT JOSEPH, a city of Missouri, U.S., on the left bank of the Missouri River, on the eastern border of Kansas, 496 miles by water from St. Louis. Five lines of railway center here, and it has a large wholesale trade, in agricultural products, &c., amounting to 18,000,000 dollars in 1874. It has a court-house, 17 churches, a convent, several large hotels, seven newspapers, three of which are dailies, steam-mills, and factories, and a large trade with the interior of the continent. Pop. (1870) 19,565; (1880) 32,434.

SAINT JUST, LOUIS ANTOINE DE, a notable figure in the first French Revolution, was born at Decize, in Nivernais, 25th August 1767, educated at Soissons by the Oratorians, and afterwards went to Rheims to study law, but soon returned to his native village, where he devoted himself exclusively to literature. When the revolution broke out, S. J. was transported with enthusiasm, and became one of its most ardent apostles. Probably no man in France was a more genuine fanatical believer in the brilliant delusions of the period. Spotless, even austere, in his morals, reserved in manner but eloquent in speech, and rigorously earnest in his convictions, he rapidly rose into consideration among the inhabitants of his native commune, who elected him lieutenant-colonel of the National Guard, sent to Paris in 1790 to assist at the Fête of the Federation. In 1791, appeared his *Esprit de la Revolution et de la Constitution de la France*, in which the various causes of the revolution are sketched in a calm, keen, precise sort of way; and in the following year he was chosen deputy to the convention by the electors of Aisne.

S. J. entered Paris on the 18th of September, fifteen days after the frightful massacres, which Lamartine in his *Histoire des Girondins* with melodramatic inaccuracy represents him as ordering in conjunction with Robespierre! He voted for the death of the king, and in an oration full of stern but exaggerated republican sentiment, gave his 'reasons'. It was this speech that made him famous and influential. The Girondins tried to win him over, but in vain. In all the fierce debates of this period, S. J. took a leading part; but he also displayed a great capacity for administrative organization, and on the 11th of February 1793, carried his project for the formation of a committee to superintend the war. After the fall of the Girondins in June, (S. J. took no part in their overthrow, and never once spoke during the disastrous struggle between the two sections), the civil war broke out, and it is from this point that we date the exhibition of that intense and merciless republicanism which fitted him so well to be the associate of Robespierre. It is commonly thought that S. J. —perhaps because he was so young—was merely an instrument in the hands of Robespierre; but the known facts of his career lead to a very different conclusion, and some writers have not scrupled to make S. J. the real head of the extreme party who exercised government in France during the *Reign of Terror*. Almost all the energetic, or as some would prefer to say, sanguinary, measures drawn up to repress the royalists and timid republicans at home, and to repel the forces of the allied monarchs on the frontier, were devised by him. On the 19th of February he was elected president of the convention. He drew up the terrible report which led to the arrestment and execution of Hebert, Danton, and their adherents. S. J. had no scruples in cutting off his opponents. The intensity of his convictions rendered him indifferent to deeds of cruelty, however appalling. When the political reaction set in, and the party of moderation had got the upper hand in the convention, Robespierre and S. J. were seized and imprisoned (27th July 1794), and ordered to be guillotined next day. S. J. suffered with sullen calmness—not a word escaping his lips. See Ern. Hamels's *Histoire de Saint Just* (Par. 1859.)

SAINT LO, an old town of France, capital of the dep. of Manche, built on a rocky elevation on the right bank of the river Vire, 55 miles by railway south-east of Cherbourg. From the high central part, several streets, more or less steep, branch off in different directions. The town, which is said to owe its origin and its name to a St. Lô, bishop of Coutance, who caused a church to be built here in the 6th c., was destroyed by the Normans in 888, and taken by the English in 1346, and again, in 1417. Noteworthy are the beautiful churches of Sainte-Croix, founded in 805, and of Notre Dame, which dates from the 15th century. Flannels, druggets, and cotton fabrics, cutlery, and leather, are manufactured, and a considerable supply of horses for cavalry are here obtained. Pop. (1876) 9519.

SAINT LOU'IS, a port of entry of Missouri, U.S.; the chief city and commercial metropolis of the central Mississippi valley, stands on the right bank of the Mississippi, 18 miles below its confluence with the Missouri, and 174 miles above the mouth of the Ohio. It is regularly built upon the limestone bank of the river, on two terraces, rising 20 and 40 feet above high water, with wide and well-built streets running parallel to the river, crossed by others at right angles. The principal structures are a city hall, court house, custom house, arsenal, merchants' exchange, mercantile library, city hospital, post-office, marine hospital, university, cathedral, and several of the largest hotels in the world. There are 162 churches and missions, of which 38 are Roman Catholic; numerous general hospitals, asylums, and convents; the St. Louis University, under charge of the Society of Jesus, with 22 professors; the Washington University, Academy of Sciences, German Institute; 84 newspapers and periodicals, of which 10 are daily, and 12 in German; an opera-house, and 5 theaters.

Among the manufactories are flour and lumber mills, sugar refineries, lard and linseed-oil factories, provision packing-houses, manufactures of hemp, whisky, tobacco, and vast iron-foundries and machine shops which in the year 1880 produced goods valued at 250,000,000 dollars. S. L. has a vast trade by steamboats to the whole Mississippi valley, and sixteen lines of railroad center there. It is connected with East S. L., on the opposite bank of the Mississippi, by a remarkable bridge, 2225 feet long, and 54 feet wide, which was finished in 1874; it is constructed of steel and cast-iron. The new custom-house and post-office cost 5,000,000 dollars. S. L. possesses a vast traffic in agricultural produce. In 1764, it was the depot of the Louisiana Indian trading company; in 1768, it was captured by a detachment of Spanish troops; in 1804, was ceded with the whole country west of the Mississippi to the United States; the first brick house was erected in 1813. Pop. (1820) 4590; (1860) 151,780; (1870) 310,864; (1880) 350,522.

SAINT LOUIS, the capital of the French possessions in Senegambia, is situated on a small low island of the same name, at the mouth of the Senegal river. The town covers almost the whole island. With its fortifications, it presents an imposing appearance from the sea, but the interior is mean and dirty. The harbor is good. The principal building is the government house. There are 600 stores for goods. Saint L. possesses a botanic garden, founded in 1822. Pop. about 18,000.

SAINT LUCIE BARK. See CARIBBEE BARK.

SAINT MALO, a fortified seaport of France, in the dep. of Ille-et-Vilaine, at the mouth of the river Rance. It stands on a small island less than three miles in circumference, called *Le Rocher d'Aaron*, which lies close off-shore, and is connected with it by a causeway, 650 feet long, called *Le Sillon*. The island is completely covered by the town; the streets are narrow, filthy, and ill-ventilated, and the houses are built to the height of five and six stories. The harbor is spacious and secure, but its entrance is narrow, and is thickly set with rocks and shallows. It is perfectly dry at ebb-tide, but the flood-tide rises here from 45 to 50 feet. Numerous strong forts, both on the mainland and on the small islands that stud the roads, protect the harbor and town. The harbor works were completed under the second empire, and cost nearly 20 million francs. Ship-building is the principal industry. On the island of Grand-Bé, near the ramparts, is the tomb of Chateaubriand (q. v.). Many vessels are employed in the mackerel, cod, and whale fisheries, and active commerce is carried on. S. M. communicates with Rennes (the capital of the dep.) by railway. Pop. (1876) 10,061. In a single year, S. M. will export goods to the value of £1,500,000, chiefly butter, to Great Britain.

SAINT MI'CHAEL'S, the largest and most important of the Azores (q. v.), and with the exception of St. Mary's, the most

eastern island in the group. Area, 224 sq. m., or 143,000 acres; pop. about 110,000. The island is mountainous, and rises in its highest summit to 3560 feet. Of the whole acreage, 40,000 acres are arable, and about 5000 acres are pretty equally divided between orange gardens and vineyards. Hot springs abound in many parts of the island, and in the western extremity are the Caldeiras or boiling fountains, whence the water ascends in columns to the height of 12 feet and then disappears in vapor. The thermometer ranges from 48° to 84°. The annual value of the exports—by far the larger portion of which consists of oranges, and goes to Great Britain—is about £85,000; and of the imports, mainly from Great Britain, a little more. The chief town is Ponta Delgada (population about 16,000).

SAINT MICHAEL'S MOUNT, a conical and isolated rock in Mount's Bay, Cornwall, 3 miles east of Penzance. It communicates with the shore by a causeway 400 yards long, which, however, is covered with water 8 hours out of the 12. The Mount is 195 feet high, is about one mile in circumference, and is crowned by an old and picturesque castle—now used as a manorial residence—surmounted by a tower, on one angle of which there is a projecting stone lantern, popularly called *St. Michael's Chair*. At the base of the Mount is a fishing village, of about 30 houses. This hill is to the geologist one of the most curious of localities, and, indeed, it is said to have 'excited more geological controversy than any mountain of the world.' At a very early period, S. M. M. was the seat of a religious house, and the apparition of St. Michael is said to have appeared on one of its craggy heights. At the Conquest, the monastery of St. Michael was annexed to the abbey of St. Michael in Normandy. It long remained in the possession of the monks, and afterwards became the residence of several families in turn, until it was sold in 1660 to its present proprietors, the *St. Aubyns*.

SAINT MICHEL, MONT, an extraordinary rock in Cancale Bay, in the north-west of France, 7 miles south-west of Avranches. It is a solitary cone of granite, 2 miles in circumference at the base, and rising to the height of 400 feet. It rises sheer out of a level expanse of sand, and though its elevation is not great, its perfectly flat environment and its pointed crest render it a most striking feature in the landscape. It is crowned by a church and castle, under which are conventual buildings, with their lofty turrets and high walls, and lower down still are the houses of the small town. The sands are covered with water at every tide, except at neap-tides. A good road leading along a causeway about a mile in length connects the island with the mainland. Till 1880 the rock was only accessible by crossing the sands at low water; there being a firm track across the sands at low tide, with quicksands to right and left of it. In the 8th c. an abbey which replaced an ancient temple of Jupiter was founded on the summit of the rock. A church, and an almost impregnable fortress, were afterwards founded by the Normans. After the Revolution the main building was changed into a prison. The castle has recently undergone restoration.

SAINT NAZAIRE, a thriving seaport of France, in the dep. of Loire-Inférieure, at the mouth of the Loire, on the north bank of that river, and 38 miles west of Nantes, with which it is connected by railway. Almost unknown till within recent years, it is now one of the most important ports on the west coast of France. In 1851, it contained 2391, in 1861, 6500, and in 1876, 14,761 inhabitants. Here the government constructed a floating dock of 25 acres area, and another dock, of double the area, is in progress. St. N. is the port for the Trans-atlantic steamers to the West Indies and Mexico. One cause of the rapid rise of this port is, that the navigation of the Loire is becoming year by year more difficult, owing to the sand brought down by the river; so that the chief shipowners of Nantes prefer to leave their vessels at St. N., and have the cargoes transported inland by railway.

SAINT NE'OT'S, a small market town in the county of Huntingdon, 8 miles south-south-west of the town of that name, occupies low ground on the banks of the Ouse. Its beautiful parish church has a tower 156 feet high. St. N.'s has a large iron-foundry, an engine factory, breweries, steam flour-mills, &c. About a mile from the town are large paper-mills. Pop. (1871) 3200; (1881) 4261.

SAINT NI'CHOLAS, a flourishing manufacturing and market town of Belgium, in East Flanders, 20 miles east-north-east of Ghent, on the Ghent and Antwerp Railway. It stands in the midst of the Pays de Waes, a densely peopled and productive agricultural district, and is said to be the seat of the largest flax-market in the world. The market is held in the great square of the town, one of the largest in Belgium, but which, however, is too small to accommodate comfortably the immense numbers who crowd hither on market-days. S. N. is a manufacturing town of the first class; and among the articles largely manufactured are cotton, woollen and silk stuffs, carpets, hats, lace, tobacco, and pipes. There are print-fields, dyeworks, and tanneries, and a flourishing trade is carried on in shawls, linens, and other manufactured goods, as well as in flax, corn, hops, &c. Pop. (1877) 25,440.

SAINT OMER, a town of France, and fortress of great strength, in the department of Pas-de-Calais, on the Aa, 26 miles south-east of Calais by railway. It is surrounded by irregular but well-appointed fortifications, is well-built amid marshes, and contains numerous fountains and more than one important ecclesiastical edifice. Woollen cloths, blankets, pottery, and clay pipes are manufactured, and there is considerable general trade. Pop. (1876) 21,404. A college for the education of English and Irish Catholics was opened at S. O. during the penal times. It was closed, however, during the Revolution; but still exists as a seminary, and is attended by from 15 to 20 students.

SAINT PA'NCRAS, one of the northern districts of London (q. v.).

SAINT PAUL, a city, port of entry, and capital of Minnesota, U.S., is on both banks of the Mississippi River, 2080 miles from its mouth, and 9 miles below the Falls of St. Anthony; lat. 44° 52′ 46″ N., long. 93° 5′ W. It is chiefly built on the east bank upon a plain 80 feet above the river, and 800 feet above the Gulf of Mexico. Hills near the city abound with springs of excellent water. S. P. is at the head of navigation for the large steamboats of the Lower Mississippi and its branches, and the center of a large and growing trade in flour, lumber, furs, machinery, boots and shoes, oil, beer. It has a state-house, cathedral, college, and 4 daily newspapers. Pop. (1860) 10,277; (1870) 20,030; (1880) 41,473. Even since the census it has grown portentously, and in 1883 was said to contain nearly 90,000 inhabitants.

SAINT PAUL DE LOA'NDA, a considerable seaport on the south-west coast of Africa, the principal Portuguese settlement in Lower Guinea, stands at the mouth of the river Bengo, in lat. about 8° 54′ S. It is the largest and most important European settlement on this coast, and contains 12,000 inhabitants, of whom 830 are white, 2400 mixed, and 9000 black. The climate is comparatively healthy, the harbor is beautiful, and protected by one large and two small forts. The houses are good, the streets unpaved, and there are three churches and three market-places. Abundance of fruit and vegetables, bullocks, and goats are obtainable in the markets. Ivory and bees-wax are the principal exports.

SAINT PE'TERSBURG, a maritime government of Russia, one of the Baltic Provinces, between Lake Ladoga on the N.-E. and Lake Peipus on the S.-W. Area, 17,057 square miles; pop. (1879) 1,591,244. The soil is damp and thin, and woods and marshes cover two-thirds of the level surface. In the vicinity of the capital, much ground is laid out in market-gardens. The usual crops are grown, but the quantity of corn produced is greatly less than the quantity consumed. The chief town is the capital, *Saint Petersburg* (q. v.).

SAINT PETERSBURG, the capital of the Russian empire, and of the government of the same name, stands upon, and around the lower branches of, the Neva, and on the shores of the eastern extremity of the Gulf of Finland, 16 miles east of Cronstadt, its port. Lat. 59° 56′ N., long. 30° 19′ E. The Great Neva, the most southern branch of the Neva, divides the city into two great sections—the Petersburg Side on the north, and the Great Side on the south. The former is built on the islands which are formed by the delta of the Neva, the chief of which are the Vassili Ostrov, the Citadel Island, and the islands Aptekarskoi, Kammennoi, Petrovskoi, Krestovskoi, and Elaghinskoi. The Great Side, south of the Great Neva, is compactly built, and contains the residences of the court and of the nobility, and more than half the population The city covers an area of 42 sq. m., stands 56 feet above the level of the sea, upon plains which were formerly malarious marshes, but are now for the most part drained and laid out in meadows and gardens. Pop. (1863) 539,475; (1878) about 900,000.

The climate, severe in winter, is pleasant and mild in summer. The mean temperature in summer is 62°; in winter, 14° F. The extremes of temperature are 99° and—51°. Fourteen arms of the Neva, irrespective of the smaller branches, ramify through S. P., and there are seven canals.

General View of Saint Petersburg.—Approaching the city from Cronstadt (q. v.), the port and fortress of the Russian capital, the first indications of the great city are the gilded dome of the church of St. Izak, and the lofty spire of the Admiralty, which are seen rising apparently from the water's edge. The Admiralty Square, faces the English Quay, on the south bank of the Great Neva, and may be considered the center of the city. From the spire, with its numerous galleries, the whole plan of the city can be clearly seen. Right opposite it is the populus Vassili Ostrov, on the south shore of which are the Bourse, Academy of Sciences, Corps of Cadets, &c. To the north is the Citadel Island, and further north the densely peopled Aptekarskoi Island, and the Kammennoi, and other islands, which are for the most part stud-

ded with wood-embosomed villas, and laid out in charming gardens. Considering the river on the north as the chord, and the Admiralty as the center, the semicircle that might be drawn with a radius of 2½ miles, would pretty nearly describe what is called the Great Side of Saint Petersburg. This section of the city is divided into three or four portions by the Moika, St. Catharina, Fontanka, and New Canals; and it is intersected by three spacious streets, which radiate east-south-east, south-east, and south from the great center, the Admiralty. The streets are named repectively the Nevski Prospekt (Neva Perspective), Gorokhovaia Oulitza (Peas Street), Vosnosenskoi Prospekt (Resurrection Perspective.) Extensive suburbs also are rising on the eastern bank of the Neva, and there are five railway stations.

Streets, Squares, Monuments, Bridges, Churches, &c.—The street architecture of S. P., unlike that of Moscow, with its pale-yellow walls and red and green roofs, is almost destitute of color. Here the rigid, military aspect of the streets, with the houses drawn up in long regular lines of gray, or massed together in blocks like the squares of battalions, is one of the first features of the Russian capital that impress themselves upon a traveler. Except in the more fashionable quarters, the greater number of the houses are built of wood; but owing to the liability of such houses to catch fire, building in this material is very much discouraged. S. P. contains 500 streets, and among these, lanes and alleys are unknown, as, while the finest streets have a breadth of 120 feet, the narrowest are 42 feet broad. The Nevski Prospekt is the most splendid street in S. P.; and for architectural grandeur, as well as for natural beauty, for proportions, and for variety, is considered the finest street in Europe. It is 130 feet broad, and about 4 miles long, is planted on both sides with trees, contains a large number of the most beautiful palaces, of highly ornamented churches, and splendid warehouses, and increases in breadth and magnificence as it advances from the Admiralty. For the first mile, it does not contain more than about 50 mansions, each of which, however, is of colossal magnitude. The houses are built of brick faced with stucco, are three and four stories high, and are in many cases furnished with ornamental porches, colonnades, gilded balconies, and parapets that gird the flat roofs. About ten of the other streets of the city are distinguished for their grandeur, though none of them equals the Nevski Prospekt. There are 64 squares in the city, and of these the Admiralty Square is one of the most famous. It contains one mass of buildings, presenting to the Neva a fine façade, nearly half a mile in length, while its sides are 650 feet long. In the Palace Square, adjoining the Admiralty, stands Alexander's Column, an immense monolith, erected in 1834. It consists of a shaft of red granite, standing on a pedestal of the same material, and supporting a capital, above which rises the figure of an angel and a cross. The length of the shaft is 80 feet, and that of the whole column 150 feet. Peter's Square contains the noble and well-known equestrian statue of Peter the Great, 18 feet high, and erected 1768—1782. The Field of Mars, large enough to allow of 40,000 men being put through military evolutions, contains the bronze statue of Suwaroff, and a monument to Catharine II.—*Bridges.*—Of the 150 bridges that unite the islands, cross the canals, and span the Neva, the Annitchkoff Bridge, leading across the Fontanka Canal, consists of five arches, is 110 feet long, and is decorated with four spirited groups, in bronze, of wild horses and their tamers, by a native artist. The Nikolayevski Bridge, a magnificent structure in granite, and the only permanent bridge save one that crosses the Neva—the others being temporary bridges supported on boats, and removed every autumn and spring—was completed in 1850. It crosses the Neva from the English quay on the south bank to the Vassili Ostrov shore, is 1200 feet long, and consists of 7 elegant arches, supported upon ponderous piers of granite. At the northern end of the bridge, there is a drawbridge which affords a passage to ships. No part of S. P. affords a foundation solid enough to support weighty structures. The foundation for the Nikolayevski Bridge was not obtained until three sets of piles had been driven into the oozy bed of the river, the one on the top of the other, and so close that all the timbers touched each other all the way across.—*Palaces, &c.*—S. P. might be called a city of palaces, from the number of the edifices of that description which it contains. The Winter Palace, destroyed by fire in 1837, but soon after rebuilt, is certainly the largest, and, in one sense, most probably the most magnificent palace in the world. It is 450 feet long and 340 wide, has an imposing façade, and contains 800 inhabitants, and, during the residence of the emperor within it, is inhabited by 6000 people. It has numerous ample halls, decorated in the most artistic manner, and containing collections, furniture, and articles of *vertu* of immense value.

The Hermitage, situated on the Neva like the Winter Palace, is connected with that structure by several galleries. Its gallery of 2000 paintings is famous for its specimens of the Spanish school. The library of this palace contains the collections of Diderot, Voltaire, &c., and possesses in all 120,000 vols. The Annitchkoff Palace is the residence of the cesarewitch. The Imperial Library one of the first in Europe, contains 1,100,000 vols. and 35,000 MSS. The gilded tower of the Admiralty buildings, which is said to be visible from Cronstadt, and certainly forms in these flats a most conspicuous landmark, is 230 feet high. The Old and New Arsenals are surrounded by cannon taken from the Turks and Persians.—*Churches.*—S. P. contains about 350 churches, 300 of which are orthodox. Within the Citadel stands the church of St. Peter and St. Paul, finished in 1727. It is surmounted with a slender tower, crowned by a gilded spire, the whole being 345 feet high. The cathedral of St. Izak, though destitute of architectural beauty, is remarkable for its rude magnificence, and is one of the most considerable buildings of modern times, is 330 feet long, 290 feet broad, and 310 feet high. It is surmounted by a great gilded dome, and by four smaller domes. The domes are made of bronze, and the value of the plate-gold by which they are overlaid is stated at £50,000. Each of its four sides is adorned with a peristyle of 12 or 16 red granite monolith pillars from Finland. Other notable churches are the Cathedral of Our Lady of Kazan, and the Vladimir Church.

Academies, Scientific Institutions, &c.—The Academy of Sciences, with a library of 150,000 books and MSS., was founded by Peter the Great in 1725. In the Institute of Technology, founded in 1829, 200 pupils are taught silk-spinning, the manufacture of cloth, silk, and woollen stuffs, wood-carving, and engraving on copper. The University, founded in 1829, is attended by 1400 students, and has between 80 and 100 professors. The New National Museum of Antiquities, Painting, and Sculpture, completed in 1851, is a noble structure, built entirely of marble and metal. There are numerous benevolent institutions, a number of splendid theaters, and an Italian opera, a magnificent structure.

Manufactures and Commerce.—About 3000 ships annually leave the port. The exports have a value of over £5,000,000; the imports of about £15,000,000 a year. Of the manufacturing cities of Russia, S. P. is one of the most important. The principal private factories are mills for spinning and weaving cotton. The immense imperial establishments produce admirable specimens of Gobelin tapestry, mirrors, articles in bronze, playing-cards, crystal, and porcelain.

S. P. is little more than a century and a half old, and yet it takes rank among the first capitals in the world. It was founded by Peter the Great, May 27, 1703. After a long struggle against the severe climate, insalubrious from the exhalations of wide-extended marshes, and from the arctic rigor which even yet can cover the Neva with ice a yard and a half thick, at length the town was founded and declared the capital in 1712. Under the successors of Peter, the improvement, embellishment, and extension of the city were carried on. Catharine II. constructed the great canals which, while they afford means of ready communication, serve also to drain the marsh-lands, to render the atmosphere more healthy, and to mitigate the rigors of winter. The city suffered great damage and the loss of several hundred lives in 1824 from an inundation of the Neva, and every April, when the ice breaks up, the lower regions of the city are threatened with a similar disaster. At S. P., all the ministers from foreign courts are bound to reside.

SAINT PETER'S LE PORT, or commonly *St. Peter's* the chief town of Guernsey, one of the Channel Islands. See GUERNSEY.

SAINT PIERRE, the chief town, though not the seat of government, of the island of Martinique (q. v.), belonging to France, stands at the head of a bay, 16 miles north-west of the capital, Fort-la-France (formerly Fort Royal). It is the largest town in the Antilles, with a pop. of 30,000 and is the chief entrepôt of those islands.

SAINT PIERRE, a town of the island of Bourbon (q. v.) or Réunion, on the south-west coast, 34 miles south-west from Saint Denis. Pop. 14,135.

SAINT-PIERRE-LÈS-CALAIS, a town of France, in the dep. of Pas-de-Calais. It may almost be regarded as a south-eastern suburb of Calais, to which it nearly adjoins, but has grown to a size exceeding that of Calais itself. It is famous for its manufactures of Tulle (q. v.). Other branches of industry are also actively prosecuted, as the manufactures of leather and beetroot sugar. Pop. (1876) 22,349.

SAINTS, a name applied in the New Testament to the members of the Christian community generally, but restricted by ecclesiastical usage from very early times to those who, whether under the old or under the new dispensation, have been specially remarkable for their personal virtues and their eminent services to the cause of religion. Of the old dispensation, the 'patriarchs and prophets' are commonly designated as saints. But the word is used much more of the Christian Church. In the ages of persecution, the quality which most of all challenged the admiration and reverence of the faithful was natural courage and constancy in the profession and the defence of the Christian faith; and thus

the earliest of those whom the church reverences for sanctity of life, are also, for the most part, reverenced as champions of the faith. In general, however, the saints are distributed into several classes, chiefly in relation to the special services which the church has appropriated to their honor. Thus we find enumerated (1.) Apostles and Evangelists; (2.) Martyrs; (3.) Confessors, a name applied primitively to those who had exhibited great constancy in professing the faith, although without the final crown of martyrdom, but in later times understood of all who, without being martyrs, were eminent for sanctity of life; (4.) Doctors or men eminent for sacred learning; (5.) Virgins; (6.) Matrons and Widows, distinguished for holiness of life.

Anciently the character and appellation of saint was bestowed upon individuals, as it were, by acclamation, and by the common voice of the members of the particular Christian community to which the individual belonged, or to which his merits were most familiar. The earliest examples, as may be seen in the letter of the Church of Smyrna on the martyrdom of Polycarp, of such judgments as to individuals were in the case of the martyrs. Altars were erected at their tombs, and the people assembled for worship on the anniversary of their martyrdom. Even then, however, the letters of St. Cyprian (Epp. 37 and 39) show that caution was observed by the bishops to guard against the recognition of undeserving individuals. The honors of the martyrs, even before the age of persecution had passed, were extended to confessors of the faith, and eventually to all who were eminent for holiness of life, and especially to those who obtained the reputation of performing miracles. The names of those who were so honored were placed in the register (or diptych) of each church. It was not, however, till a comparatively late period that a regular form of procedure was established in the Roman Church for the purpose of testing the claim of individuals to the authentic reputation of sanctity. From the 4th c. downwards, examples of reference to Rome—as, for instance, in the Acts of Virgilius, Bishop of Trent—are cited by Catholic writers. But the first recorded example of a solemn and public decree is in the case of Udulric or Ulric, Bishop of Augsburg, to whom the honors of sanctity were adjudged by Pope John XVI. (see Hardouin, Concil. VI. P. I., p. 727) in the end of the 10th c. (993). Since that time the procedure of the Church of Rome as to the public recognition of the saints has been matured and methodized. It consists of two stages, that are called respectively 'Beatification' and 'Canonization.' The former is but a preliminary process, and consists in a declaration by the pope that the 'beatified' person is entitled, by reason of his (or her) eminent virtues, attested by miracles, to be regarded as a saint, and as such honored and invoked.

This authorization, however, is not in beatification extended to the entire church, but is always limited to a particular church, or province, or religious order; and the nature of the honors permitted to be paid to the beatified person is strictly defined either by the terms of the decree, or by local usage, if such have already existed. But although the effect of a decree of beatification is less comprehensive than that of the subsequent and final declaration in canonization, the preparatory inquiry is in all substantial particulars the same. The details of both are explained at great length and with curious minuteness by the learned Pope Benedict XIV. (Lambruschini) in a special work on the subject, which has the further interest of containing as an appendix the minutes of the entire proceedings in the canonization which took place during his own official connection with that department. The inquiry in both procedures is conducted by the congregation of cardinals, called the Congregation of Rites, and consists first in an examination of the writings (if there be any) of the individual, then of the holiness of his life and conversation, and finally of the miracles alleged to have been performed by him in life, or obtained through his relics and intercession after death. Two such miracles at least must be established by what is considered satisfactory evidence. Upon all these points sworn depositions are required, and all are subjected to a most rigorous scrutiny, in which the office of impugnant is discharged by an advocate called Promotor Fidei, and popularly nicknamed the Devil's Advocate, his duty being to raise every possible difficulty in the way of the acceptance of the evidence of sanctity. This inquiry is generally a very protracted one; and after it has been completed, and its results recorded in writing, the acts are submitted to the cardinals, who meet three times in private congregations, and finally, if all appears satisfactorily established, in a public congregation, by which the decision is made known to the pope. Should the decision be approved by the pope, the solemnization is proceeded with. The solemnity takes place in the Vatican Church.

The cardinal prefect of the congregation of rites hands the pope's brief to the cardinal, arch-priest of the Vatican, by whom it is read; the *Te Deum* is intoned; the image of the beatified individual is uncovered, to receive the veneration of the assembly; high mass, with the Collect, in his honor, is sung; and in the afternoon the pope goes solemnly to the church to pay reverence to the image. The procedure, in case of a martyr, is somewhat different. In both, however, the process is but preliminary to the solemn canonization. The effect of the latter comprises (1.) a declaration that the canonized person is to be recognized as a saint throughout the entire church; (2.) that he is to be invoked in the public prayers; (3.) that churches and altars may be erected in his honor; (4.) that he may be invoked in the mass and public service; (5.) that a festival may be celebrated in honor of him; (6.) that his image may be set up in public; and lastly, that his relics may be preserved and publicly honored. The solemnity of canonization, which is preceded by a new inquiry similar to that of the beatification, and a new judgment of the congregation of rites confirmed by the pope, is one of the most gorgeous in the entire ceremonial of the Roman Church. It takes place in the Vatican Church (St. Peter's), and is generally attended by a large assembly of bishops from various parts of the church. In many respects it resembles that of the beatification, but its distinctive characteristic is the solemn publication, by order of the pope in person, after the hymn of invocation of the Holy Ghost has been sung, of the decree of canonization. This is followed by mass, also celebrated by the pope in person, and sometimes by a homily of the pope in honor of the newly canonized. The Church of St. Peter's is specially decorated at a vast cost for the ceremonial, and the entire expenditure on such occasions has been estimated at not less than £20,000. Roman Catholics hold that in such decrees the judgment of their church is infallible; and to deny that any particular canonized individual is really a saint, is held to involve, if not actual heresy, at least a grievous act of contumacy against the faith of the church. On the doctrine of saint-worship, see INVOCATION OF SAINTS; and on that regarding the honor paid to relics of saints and martyrs, see RELICS.

SAINTS' DAYS, days set apart in honor of particular saints and martyrs. The practice dates from the times of persecution, when the people were wont to assemble at the tombs of martyrs on the anniversary of the martyrdom. In the multiplication of such celebrations, a record of the days fixed for each saint or martyr became necessary. This was called *calendarium*. The days so appointed were celebrated with more or less solemnity, according to the dignity of the saint, or the degree of devotion with which he was regarded. In some cases the saint's day was kept as a holiday of obligation, in which no servile work was permitted to be done. Other days are of various minor degrees of solemnity, and are called double (greater or lesser), semi-double, and simple, from the peculiar form of the office set apart for each. In particular countries, provinces, dioceses, or parishes, the day of the patron saint is specially celebrated; and in all churches the festival of the saint to whom the church is dedicated.

SAINT SERVAN, a seaport of France, in the dep. of Ille-et-Vilaine, stands at the mouth of the Rance, opposite St. Malo (q. v.), to which there is communication by land at low-water. The harbor, called Port Solidor, is secure. S. S., which is frequently spoken of as a suburb of St. Malo, is much frequented as a watering-place, and carries on ship-building and considerable commerce, especially in timber. Pop. (1876) 9912.

SAINT SIMON, LOUIS DE ROUVROI, DUC DE, whose family claimed to be descended from Charlemagne, was born in January 1675. After receiving a careful education under the superintendence of his mother, he entered the army in 1693, but considering his promotion not equal to his deserts, he resigned his commission in 1702, and devoted the remainder of his life to a sort of court statesmanship. S.'s position was as singular and as anomalous as his character. Profoundly ambitious, his pride was yet greater than his ambition. His ideas of aristocratic rights and privileges were perhaps more outrageously fanatical than any ever entertained in modern ages; and the whole aim of his life was to nullify the influence of the parliament, and to place the government of France in the hands of the *grands seigneurs*—the great territorial lords. The middle class he abhorred; and the rise to distinction of any one belonging to that order—any *novus homo*, tortured his patrician soul almost beyond endurance. We have not space (nor would it be worth our while, if we had) to recount his career of haughty and insolent conspiracy against the political rights of commoners, which marks him out as the most thoroughgoing oligarch in principle of whom we have any record. During the latter part of Louis XIV.'s reign, and the regency of the Duke of Orleans, he enjoyed much consideration, and his aristocratic policy more than once enjoyed a temporary triumph; but with the accession to the regency of the Duke of Bourbon he fell into disgrace, and withdrew from public life. He died at Paris, 2d March 1755. S.'s last years were occupied chiefly in the composition of his famous *Mémoires*, a brilliant work of incalculable historical value. The *Œuvres* appeared in 1791 in 13 vols.; an edition by Cheruel and Regnier (20 vols.) in 1856 *et seq.*, and completely revised, in 1873–77. Baschet's monograph *Le Duc de Saint Simon* (1874) revealed that much yet remained to be published; Boislisle undertook in 1880 a fresh issue of the *Mémoires;* and in 1881

Faugère gave us, from the French archives, the first vol. of the *Ecrits inédits de S. S.*

SAINT SIMON and SAINT SIMONIANISM. CLAUDE HENRI, COMTE DE SAINT SIMON, a French social philosopher, founder of the sect named after him, *Saint Simonians*, belonged to a different branch of the same family as the preceding, and was born at Paris, 17th October 1760. Although destined to become the propagator of the most revolutionary and democratic ideas of modern times, he was reared in a perfect hotbed of aristocratic prejudice. Nevertheless, from his earliest years, S. exhibited a decided hostility to the established system of things, mainly, however, it would seem (according to the anecdotes in vogue) from a certain purile vehemence and obstinacy of nature. He was cursed, moreover, with a precocious vanity. What are we to think of a lad scarcely 16 giving his servant orders to rouse him every morning with such a flattering summons as *Levez-vous, Monsieur le Comte vous avez de grandes choses à faire*, especially when, in point of fact, he had *nothing* to do? S. was pretty well educated in philosophy, like most of the young nobles of his time, and had D'Alembert among others for his tutor. At 18 he entered the army, served in America, and distinguished himself on the day when Lord Cornwallis surrendered at York (17th September 1781) with all his forces. Captured by the British on his return home, he was taken to Jamaica, where he remained till the peace in 1783 restored him to liberty and France. But the monotony of garrison life did not suit his restless and impatient spirit, and in 1785 he quitted the service, and traveled in Holland and Spain, busying himself with various industrial schemes, such as connecting Madrid with the sea by means of a canal, and introducing *diligences* into Andalusia—the latter of which proved successful. The great revolution found in him—noble though he was—an enthusiastic disciple, and he voted in his patrimonial canton for the abolition of titles of nobility, but did not take any part in the political events that followed. His energies were devoted to matters more profitable than patriotic—viz., the purchase of confiscated property—and it is unhappily not at all doubtful that when France was laboring in the agony of a mighty struggle after new life, S. was consumed by an ignoble passion for enriching himself. But then, as his disciples have naïvely observed, it was necessary that he should acquire a fortune in order that he might be able to devote himself satisfactorily to ideas.

It was during the revolution, and while suffering a temporary imprisonment in the Luxembourg, that visions of a new social system, based on scientific principles, and not on political conventionalities, first unfolded themselves before his ardent imagination. His ancestor Charlemagne appeared to him one night in a dream, and said: *Depuis que le monde existe aucune famille n'a joui de l'honneur de produire un héros et un philosophe de première ligne. Cet honneur était réservé à ma maison. Mon fils, tes succès comme philosophe égaleront ceux qu' j'ai obtenu comme militaire et comme politique.* S., though now 38 years of age, commenced to study 'science,' of which he was as yet quite ignorant. The plan he adopted was pleasant and ingenious. He took a house opposite the *Ecole Polytechnique*, and invited to his table the professors of mathematics, of physics, and of astronomy, from whose lips—in the intervals of their feeding, he acquired the necessary information. Then he changed his lodgings, and fixed himself near the *Ecole de Medicine*, where, pursuing the same method with the physiologists, he learned from them something of the structure of organized bodies. In 1801, he married, and threw open his *salons* to all the savans and artists of Paris; but his lavish hospitalities—prodigalities, perhaps, they ought rather to be called—soon dissipated the fortune he had amassed during the revolution. Meanwhile a notable social idea seized him. Hearing that the husband of Madame de Stael had just died, he resolved to marry the widow, whom he considered to be the only woman fit to associate with him in his great project for the regeneration of society. To be sure there was a little impediment in the way—viz., his being already married; but in France there is never any difficulty in getting a divorce; and S. was soon as good as a bachelor again. Betaking himself to Coppet, he unfolded his plan to the lady, and begged her concurrence, urging his suit (it is said) by the most impressive considerations: *Madame, vous êtes la femme la plus extraordinaire du monde; comme j'en suis l'homme le plus extraordinaire; à nous deux nous aurions, sans doute, un enfant plus extraordinaire encore.*

Madame de Stael, however, declined to further the philanthropic projects of S. in the way he wanted, and the reformer—now beginning to be in straits—published at Geneva a *Lettre d'un Habitant de Genève a ses Contemporains* (1803), in which he proposes (among other things) that there should be an annual subscription for the benefit of men of genius—mathematicians, physicians, chemists, physiologists, litterateurs, painters, and musicians—that spiritual power should be in the hands, not of the clergy, but of savans, and temporal power in the hands of the landed proprietors, while the privilege of choosing 'chiefs of humanity' should belong to everybody; finally, he asserts that religion is only a human invention. S.'s proposal (so obstinately prejudiced are men against what is right) was not adopted—was not even noticed, either by 'men of genius' or others, and in the course of a few months he was glad to accept the office of copyist at the Mont-de-Piété. Even this humble means of making a livelihood he had to resign from ill-health, and he would probably have died of starvation had he not fallen in by chance with an old revolutionary friend called Diard, who took him into his house and furnished him with means to publish one of his most important works, the *Introduction aux Travaux Scientifiques du Dix-neuvième Siècle* (Par. 1807). The death of Diard, in 1810, once more plunged S. into misery. Soon after, we find him writing to Lacépède, Cuvier, Degérando, Cambacérès, &c., in this style: '*Monsieur,' soyez mon Sauveur, je meurs de faim . . . . Depuis quinze jours, je mange du pain et je bois de l'eau; je travaille sans feu et j'ai vendu jusqu'à mes habits pour fournir aux frais des copies de mon travail.*' There is nothing ludicrous here—it is the plain unaffected agony of utter want. In 1812, his wretchedness came to a crisis; he left Paris, betook himself to Peronne, where he fell dangerously ill, but recovered through the attentions of his family, who now settled a small pension on him; he then returned to Paris.

After the Restoration, he began—in spite of his extravagant vanity—to reap the never-failing reward of enthusiasm and perseverance—a crop of disciples. Of these the most distinguished was Augustin Thierry, who assisted him in the redaction of his *Réorganisation de la Société Européenne*—a work intended to demonstrate the inutility of the Congress of Vienna, and the incapacity of all mere political congresses to establish a durable peace. He proposes the institution of a European parliament, having the right to arbitrate in cases of difference among the various nations, and adds that the first step towards the reorganization of Europe is the union of France and England. In 1817—1818, he published *L'Industrie, ou Discussions Politiques, Morales, et Philosophiques*, partly written by himself and partly by his disciples. The third volume is the work of the celebrated Auguste Comte (q. v.). By this and other literary enterprises S. had exhausted all his funds, and as he saw no prospect of getting any more, he resolved to commit suicide, and actually discharged a loaded pistol at his own head (9th March 1823), which, however, only deprived him of an eye, and not of life. The last, and by far the most remarkable work of S., is his *Nouveau Christianisme* (Par. 1825), which contains his final and matured convictions. According to him, Christianity has been diverted from its original design. Progressive by nature, and meant to be modified by the changing circumstances of times and countries, it has been stiffened into unalterable dogmas by ecclesiastical conclaves. The clergy, whose mission is to instruct, are ignorant of the thoughts and manners of modern times, and have exhibited a complete and deplorable incapacity. Protestantism is no wiser than Catholicism. It has set its face against the fine arts, and has shown a cruel and fatal indifference to the physical amelioration of the poor. But genuine Christianity embraces in its consideration all the needs of humanity. From its grand principle, 'Love one another,' it derives the proposition, that 'religion ought to direct all the social forces towards the moral and physical amelioration of the class which is at once the most numerous and the most poor.' From this premiss is deduced the idea of a social hierarchy based on capacity and labor—the new spiritual church comprising all functions and professions, sanctifying science and industry, regulating vocations, fixing salaries, dividing heritages, and taking the best measures to make the labors of each conduce to the good of all.

S. did not live to carry out his principles in detail as far as they would have logically carried him, dying on the 19th May 1825; but in the writings of Comte we find the legitimate terminus and result of his sweeping speculations. Much in the character and system of S. is unquestionably false, exaggerated, and even laughable; but the man who reckoned among his disciples names like MM. Augustin Thierry, Auguste Comte, Olinde Rodrigues, Bailly (de Blois) Léon Halévy, Duvergier, Bazard, Enfantin, Cerclet, Buchet, Carnot, Michel Chevalier, Henri Fournel, Dugied, Barrault, Charles Duveyrier, Talabot, Pierre Leroux, Jean Reynaud, Emile Péreire, Félicien David, Saint Cheron, Guéroult, Charton, Cazeaux, Dubochet, and Stéphane Money—is one whom posterity will not willingly forget.

SAINT THO'MAS, one of the Danish West Indian Islands, forms one of the group of the Virgin Islands (q. v.), and lies 38 miles east of Puerto Rico. Area, 23 sq. m.; pop. (1st October 1870) 14,007. The surface is hilly and the soil poor. Water is exceedingly scarce; the chief town of the island, Charlotte Amalie, (q. v.), being dependent for its supply upon tanks of collected rain-water. The cultivation of vegetables, grass, and a small quantity of cotton, employs the scanty rural population; but the products are small, and nothing is exported. The port, Char-

lotte Amalie or St. Thomas, is a station for steam-packets from Southampton to the West Indies, and is an important entrepôt of West Indian produce. In October 1867 a fearful hurricane took place. In January 1868 Denmark agreed to a treaty for the sale of St. T. and St. John to the United States; but as the United States legislature declined to ratify it, the treaty never took effect.

SAINT THOMAS, an island off the west coast of Africa in the Gulf of Guinea, belonging to Portugal, 260 miles south-west of Fernando Po. Area about 120 sq. miles. Of its inhabitants, 1000 are white and mulattoes, and 12,000 are blacks. Sugar was formerly grown extensively; coffee is now the chief article of export. In 1876 slavery in St. T. was abolished by the Portuguese government. The chief town is St. Thomas or Chaves, a bishop's see, with about 4000 inhabitants, who live in miserable wooden huts, and few of whom can write or even read.

SAINT VI'NCENT, one of the British islands in the West Indies, 100 miles west of Barbadoes. It is one of the Windward Group. Area, 147 sq. m.; pop. (1881) 40,548, of whom about 2500 were whites, and 7000 colored persons, the rest being blacks. The island is one of the most beautiful of the group to which it belongs. It is traversed from north to south by a chain of volcanic mountains, which rise in the volcano called the Souffriere to the height of 3000 feet. Many of the valleys are fertile, and the shores are rich and productive. About 2-5ths of the entire area, or 35,000 acres of the 84,000, are under cultivation. Much rain falls, often to the serious injury of the crops and of the roads, but the climate is nevertheless healthy. The standard of the morality, as well as of the culture of the inhabitants, is low. In 1880. the revenue amounted to £32,035, and the public expenditure to £32,-891. The value of total imports was £150,950; of exports, £158,-947, the principal article exported being sugar. In the same year, vessels having a total tonnage of 118,433 tons entered and cleared the ports, the chief of which, and the capital of the island, is Kingston q. v.).

SAINT VINCENT, Cape, in Portuguese *Cabo da Sao Vicente*, a promontory forming the south-western corner of Portugal and of Europe, off which several important naval battles have taken place. On June 16, 1693, Admiral Rooke, with 20 English men-of-war, was here attacked by a vastly superior French fleet, and defeated with the loss of 12 men-of-war, and 80 merchantmen which were sailing under his convoy; on January 16, 1780, Admiral Rodney here destroyed several Spanish ships; on February 14, 1797, the great battle of Cape St. V. between 15 British line-of-battle and 6 frigates, under Admiral Jervis (afterwards created Earl St. Vincent), and 27 Spanish line-of-battle and 12 frigates, resulted in the total defeat of the latter and capture of 6 of their largest ships (of which, however, 4 only were ultimately secured). The effect of this last victory was to frustrate the formidable Spanish-French scheme of invading England. The fourth naval fight off Cape St. V. took place between the fleet of Queen Maria of Portugal, commanded by Sir Charles Napier (q. v.) and that of Dom Miguel, in which a portion of the latter was destroyed, and the rest captured, 5th July 1833.

SAINT VI'TUS DANCE. See Chorea.

SAIS, an ancient Egyptian city, called in the hieroglyphs *Sa*, and existing at the time of the old monarchy, was situated on the right bank of the Canopic branch of the Nile, in 31° 4′ N. lat. It is at present called Sa el Hagar, or Sa of the Stone, from some modern stone buildings in the neighborhood. There are, however, no remains of temples or palaces on the site; all that remains being a wall of unburnt brick 70 feet in thickness, perhaps the periobolos of the temple. Traces of the Temenos, 720 feet long, still exist, and of the citadel, but the temples and tombs which stood within the city walls have been completely stripped; many fine statues of basalt of the 26th or Saite dynasty, from this spot, being found in the different collections of Europe. S. gave its name to a nome, and also to two Egyptian dynasties, the 24th and 26th, founded by natives of the city. The goddesses principally worshiped there were Neith or Minerva, and Ceres or Isis.

Neith was said to be the mother of the sun, and is constantly called in the hieroglyphical legends the mistress of S.; and an inscription in the temple of Neith is said to have declared of her, 'I am past, present, and future, no one has lifted my veil, the fruit I have brought forth is the sun.' At S. there was also a sepulchre of Osiris. The tombs of the kings, contrary to Egyptian and resembling the Greek custom, were within the walls. The tomb of Amasis consisted of a stone edifice with columns, and a chamber with doors. S. was important as a religious capital. Towards the decline of the monarchy, it rose to great splendor. The 26th dynasty transferred hither the capital of the kingdom. Amasis transported a monolithic shrine of granite from Elephantine to S. after three years' labor, employing 2000 men in the undertaking. Solon and Pythagoras visited S., and Plato was instructed in its colleges. There seems to have been a considerable Greek population in the city; but although S. continues to be mentioned after the 26th dynasty, its political importance then declined, and Memphis became the seat of government. The intercourse between S. and Athens subsequently gave rise to the idea of Athens having been colonized from it. Lepsius, *Briefe*, p. 12; Wilkinson, *Modern Egypt*, vol. i. p. 183; Heriodt. ii. 28, 59, 169; Strabo, xvii. p. 801; Champollion, *L'Egypte*, ii. p. 219; *Lettres*, p. 50.

S'AIVAS is the name of one of the three great divisions of Hindu sects. See India. The word designates the votaries of S'iva, and comprises different special sects, which varied in number at different periods of medieval Hinduism. To judge by the number of shrines dedicated to S'iva in his form as Linga, it would seem that the worship of this deity was the most prevalent of all the modes of adoration; but these temples are scarcely ever the resort of numerous votaries, and they are regarded with comparatively little veneration by the Hindus. In Upper India, the worship of S'iva has, indeed, never assumed a popular form. No legends are recorded of this deity of a poetic or pleasing character; the S., unlike the Vaishnavas, have no works in any of the common dialects, such as the *Râmâyan'a*, the *Vârttâ*, or the *Bhaktamâeâ;* no establishments in Hindustan, like S'rînâth or Purî; and their teachers of repute, like S'ankara (q. v.), are too philosophical and speculative to be really popular. The worship of S'iva seems, therefore, to have been, from a remote period, more that of the learned and speculative classes, than that of the masses of the people. In a renowned work called the *S'ankara-dig-vijaya*, or the victory of S'ankara over the world, composed by Anandagiri, one of the disciples of S'ankara, several subdivisions of the S. are named—viz., the *S.*, properly so called—who wore the impression of the Linga on both arms—the *Raudras*, who had a trident stamped on the forehead; the *Ugras*, who had the drum of S'iva on their arms; the *Bhâktas*, with an impression of the Linga on their foreheads; the *Jangamas*, who carried a figure of the Linga on their head; and the *Pâs'upatas*, who imprinted the same symbol on the forehead, breast, navel, and arms. The present divisions of the S., however, are the following: the Dan'd'ins and Das'nâmi-Dandins; the Yogins; the Jangamas; the Paramahansas; the Aghorins; the Urdhabâhus; Akâs'mukhins and Nakhins; the Gûdaras; the Rûkharas, Sûkharas, and Ukharas; the Kârâlingins; the Brahmachârins; and the Nâgas.

The *Dan'd'ins*, or staff-bearers, properly so called, are the representatives of the fourth order, or mendicant life, into which a Hindu is to enter after he passed through the stages of a religious student, householder, and hermit. The Dan'd'in is distinguished by carrying a *dan'd'a*, or small staff, with several projections from it, and a piece of cloth dyed with red ochre—in which the Brahmanical cord is supposed to be enshrined—attached to it. He shaves his hair and beard, wears only a cloth round his loins, and subsists upon food obtained ready-dressed from the houses of the Brahmans once a day only, which he deposits in the small clay-pot that he always carries with him. He should live alone, and near to, but not within a city; this latter rule, however, is rarely observed. The genuine Dan'd'in is not necessarily of the S'aiva sect; but those who worship S'iva, especially in his form as Bhairava, or the Terrific, have, at the ceremony of initiation, a small incision made on the inner part of the knee, the blood drawn by this process being deemed an acceptable offering to the god. The *Das'nâmi-Dan'd'ins* are included in this class; but they admit none but Brahmans into their body, and are considered to be the descendants of the original members of the fraternity, who refer their origin to the celebrated *S'ankara* or *S'ankarâ-châryа* (q. v.). He is said to have had four disciples, who are called Padmapa'da, Hastâmalaka, Sures'wara or Mandana and Trot'aka. Of these, the first had two pupils, Tîrtha and As'rama; the second two, Vana and Aran'ya; the third had three, Saraswatî, Purî, and Bhârati; and the fourth had also three, Giri or Gir, Pârvata, and Sâgara. These ten constitute collectively the Das'nâmi (from *das'an*, ten, and *na'man*, name); and when a Brahman enters either class, he attaches to his denomination that of the class of which he becomes a member; as Tîrtha, Giri, &c. The philosophical tenets of this sect are mainly those of the *Vedânta* (q. v.), as taught by S'ankara and his disciples; but they generally superadd the practice of the *Yoga* (q. v.), and many of them have adopted the doctrines of the *Tantras*(q. v.).

The *Yogins* are, properly speaking, followers of the *Yoga* (q. v.) system; and the term implies a class of men who practise the most difficult austerities, in order to become absorbed into the universal spirit, and thus liberated from repeated births. The votaries of S'iva, so called, hold that, by dint of these practices—such as continued suppressions of respirations, sitting in 84 different attitudes, fixing the eyes on the top of the nose—they will be finally united with S'iva, whom they consider as the source and essence of all creation. The principal sect of this class is that of the *Kânphât'â Yogins*, who trace their origin to a teacher named *Gorakhnâth*, who seems to have lived in the beginning of the 15th

c., and according to his followers, was an incarnation of S'iva. A temple of Gorakhnâth exists at Gorakhpur; a plain called Gorakhkhetr; is near Dwârakâ, and a cavern of his name at Haridwâr. The Yogins of Gorakhnâth are called Kânphâtâs, from having their ears bored and rings inserted in them at the time of their initiation. They may be of any caste; they live as ascetics, single or in colleges; officiate as priests of S'iva in some places; mark the forehead with a transverse line of ashes, and smear the body with the same substance; they deal in fortune-telling, profess to cure diseases with drugs and spells; and some play and sing, and exhibit animals.

The *Jangamas*, or *Lingavats*, are likewise not an important division of the S'aiva sect. Their essential characteristic is the wearing of the Linga emblem on some part of their dress or person.

The *Paramahansas* are ascetics who pretend to be solely occupied with the investigation of Brahman, and to be equally indifferent to pleasure or pain, insensible of heat or cold, and incapable of satiety or want. In proof of this, they go naked in all weathers, never indicate any natural want, and receive from their attendants what is brought to them as their alms or food.

The same apparent worldly indifference characterizes the *Aghorins;* but they seek occasions for its display, and demand alms as a reward for its exhibition. Their practices, too, seem to betray that originally their worship was not of an inoffensive kind, but required even human victims for its performance. They eat and drink whatever is given to them, even ordure and carrion; and in order to extort money from the credulous, they resort to the most disgusting devices.

The *Urdhabâhus* are solitary mendicants; they extend one or both arms above their heads till they remain of themselves thus elevated. They also close the fist, and the nails being suffered to grow, completely perforate the hand. They usually assume the S'aiva marks, and twist their hair so as to project from the forehead, in imitation of the matted hair of S'iva.

The *Akâs'mukhins* hold up their faces to the sky till the muscles of the back of the neck become contracted and retain it in that position.

The peculiarities of the other sects we cannot afford space to specify; they are equally trifling, and sometimes disgusting.—For fuller details on the Sa'ivas, see H. H. Wilson, *A Sketch of the Religious Sects of the Hindus;* Works, vol. i. (edited by Dr. R. Rost, Lond. 1862), pp. 188, ff.

S'AKA. See S'ALIVAHANA.

S'AKAT'AYANA is the name of a celebrated Hindu grammarian, who preceded Pân'ini (q. v.) and Yâska (see NIRUKTA), for he is quoted by both these authors. His grammatical work, however, seems to be lost, for no portion of it has as yet been forthcoming; and an attempt recently made to identify with it a grammar of a S'âkat'âyana, copies of which are met with at the India Office Library, London, and at Madras, has signally failed. The latter S'âkat'âyana is a Jaina (q. v.), who is not only later than Kâtyâyana (q. v.), but, in all probability, a modern writer.

SAKHALI'N, commonly written SAGHALIEN, native name TARAIKA, a long and narrow island, runs from north to south close off the shores of Asiatic Russia, in the south-west of the Sea of Ochotsk. It formerly belonged partly to Russia and partly to Japan, but the whole of the island now belongs to Russia, Japan having surrendered its portion in 1875. The estimated area is 27,600 sq. m. Pop. (1872) 13,000. It is 588 m. in length, and about 120 m. in extreme breadth. Lat. 45° 54′—54° 24′ N. In lat. 52° the island approaches to within six miles of the mainland, from which it is separated by the shallow Mamia Strait. A mountain-chain with craggy summits, which in lat. 52° are covered with snow throughout the year, traverses the island from north to south. There are no important natural harbors. The chief rivers are the Ty, falling into Patience Gulf, and 90 feet wide and 7 feet deep at its mouth, and the Tymy flowing north-east. The rivers and the coasts swarm with fine fish. Immense stores of fish are preserved in a frozen state during winter, and upon these the natives and their dogs in great part subsist. On the east coast of the island the vegetation, especially in the north, has a stunted appearance. On the west coast luxuriant grass clothes the valleys, and forests of pine, fir, birch, larch, oak, and maple trees cover the mountains. Among the animals are the reindeer, the stag, roe, elk, and musk ox. In the northern part of S. the climate is even more rigorous than at Nikolaevsk (q. v.). At Aniva Bay in the south, the coldest day in the winter of 1853—1854 showed a temperature of — 13° F. The inhabitants carry on an inconsiderable barter trade with their fish, furs, and seals. Coals have been discovered in several localities and explored by the Russians. Ravenstein's *Russians on the Amur* (Trübner & Co., Lond. 1861).

SAKHALIN ULA HOTUN, now commonly and more properly called Aigun, a town of Manchuria, on the right bank of the Amur, 14 miles below the junction of the Dzeya with that river. Lat. 50° 15′ N., long. 127° 40′ E. It is the chief place of the Manchu on the Amur, and is sombre in appearance, though it contains many gaily painted temples. The great quadrangle, containing the government and other buildings, is 230 yards square, and is surrounded by double rows of palisades. Paper lanterns hang across the streets, and fantastic figures—dragons, &c.—cut in paper, are fixed to poles aboves the shops. Millet, tobacco, and other products, are grown in the vicinity for export. Pop. 15,000.

SAKI, a kind of beer which the Japanese make from rice. It is the common alcoholic liquor of Japan. It is clear, and has a peculiar taste, which Europeans generally reckon unpleasant. The Japanese usually heat it before drinking, and pour it into flat cups or saucers of lacquered wood. It produces a very speedy and transient intoxication.

SAKI (*Pithecia*), a genus of American monkeys having the tail, which is not prehensile, covered with very long hair, whence they are often called *Fox-tailed Monkeys*. The head is round, and the muzzle short, the ears not unlike those of the human race. The whole body is covered with long hair.

S'AKTAS, is the name of one of the great divisions of Hindu sects (see INDIA). The term is derived from the Sanscrit *s'akti*, which means 'power, energy;' but, in its special application, denotes the energy of the deity, and particularly that of the gods of the Hindu triad, Brahma, Vishn'u, and S'iva. This energy, originally spoken of as the wish or will of the Supreme Being to create the universe, and afterwards dilated upon it in metaphorical and poetical speech, assumed at the Pauranik period (see *Hindu Religion* under INDIA) the form of a separate deity, thought of as the wife of the god to whom it belongs. Accordingly, Saraswatî (q. v.) became the S'akti or wife of Brahman; Lakshmî (q. v.), the S'akti or wife of Vishn'u; and Devî, or Durgâ, or Umâ (q. v.), the S'akti or wife of S'iva. *S'âkta*, properly speaking, means, therefore, a worshiper of any of these female representations of the divine power; but, in its special and usual sense, it is applied to the worshiper of the female energy or wife of S'iva alone; and the S., properly so-called, are, therefore, the votaries of Durgâ, or Devî, or Umâ (q. v.). Since S'iva (q. v.) is the type of destruction, his energy or wife becomes still more so the type of all that is terrific; and, in consequence, her worship is based on the assumption that she can be propitiated only by practices which involve the destruction of life, and in which she herself delights. That such a worship must lead to the brutalization, and degenerate into the grossest licentiousness, of those addicted to it, is but natural; and it will easily be understood that the S'âkta religion became the worst of all forms which the various aberrations of the Hindu mind assumed. Appealing to the superstitions of the vulgar mind, it has its professors, chiefly amongst the lowest classes; and, amongst these again, it prevails especially in Bengal, where it is cultivated with practices even scarcely known in most other provinces. The works from which the tenets and rites of this religion are derived, are known by the collective term of *Tantras* (q. v.), but as in some of these works the ritual enjoined does not comprehend all the impure practices which are recommended in others, the sect became divided into two leading branches, the *Dakshin' âchârins* and *Vâmâchârins*, or the followers of the right-hand and left-hand ritual.

The *Dakshin' âchârins* are the more respectable of the two. They profess, indeed, to possess a ritual as pure as that of the Vedas. Nevertheless, they annually decapitate a number of helpless animals, especially kids, and in some cases pommel the animal to death with their fists, or offer blood without destroying life—practices contrary to the Vedic ritual. The *Vâmâchârins*, on the other hand—the type of the S.—and amongst these especially that branch called Kaula or Kulîna, adopt a ritual of the grossest impurities. Their object is, by reverencing Devî, who is one with S'iva, to obtain supernatural powers in this life, and to be identified after death with S'iva and his consort. 'According to the immediate object of the worshiper,' Professor Wilson says, 'is the particular form of worship; but all the forms require the use of some or all of the five letters M—viz., Mânsa, Matsya, Madya, Maithuna, and Mudrâ—i. e., flesh, fish, wine, women, and certain mystical gesticulations. Suitable *mantras* (or formulas) are also indispensable, according to the end proposed, consisting of various unmeaning monosyllabic combinations of letters, of great imaginary efficacy. Where the object of the ceremony is to acquire an interview with, and control over, impure spirits, a dead body is necessary. The adept is also to be alone, at midnight, in a cemetery or place where bodies are burned or buried, or criminals executed; seated on the corpse, he is to perform the usual offerings, and if he does so without fear, the Bhûtas, the Yoginîs, and other male or female goblins, become his slaves. In this, and many of the observances practised, solitude is enjoined; but all the principal ceremonies comprehend the worship of S'akti, and require for that purpose the presence of a female as the living representative and type of the goddess. This worship is mostly celebrated in a

mixed society, the men of which represent Bhairava (or S'iva as the Terrific), and the women, Bhairavî (S'akti or Devî as the Terrific). The S'akti is personated by a naked female, to whom meat and wine are offered, and then distributed amongst the assistants; the recitation of various Mantras and texts, and the performance of the Mudrâ, or gesticulations with the fingers, accompanying the different stages of the ceremony; and it is terminated with the most scandalous orgies amongst the votaries.'

The same author adds that, 'in justice to the doctrines of the sect, it is to be observed, that these practices, if instituted merely for sensual gratification, are held to be as illicit and reprehensible as in any other branch of the Hindu faith;' but full assent must be given to his remark which follows a text quoted by him in support of this view, for he says: 'It is only to be added that if the promulgators of these doctrines were sincere, which is far from impossible, they must have been filled with a strange frenzy, and have been strangely ignorant of human nature.'

'The members of this sect are very numerous, especially amongst the Brahmanical caste; all classes are, however, admissible, and equal at the ceremonies of the sect. The particular insignia of these S'aktas, are a semicircular line or lines on the forehead, of red sanders or vermilion, or a red streak up the middle of the forehead, with a circular spot of red at the root of the nose. They use a rosary made of the seeds of the eleocarpus, or of coral beads, but of no greater length than may be concealed in the hand; or they keep it in a small purse, or a bag of red cloth. In worshiping, they wear a piece of red stlk round the loins, and decorate themselves with garlands of crimson flowers.' Two other sects are likewise mentioned as belonging to the S., the *Kânchuliyas* and *Karârins*, but it is doubtful whether they are still in existence. The former are said to have belonged to the south of India; and the latter seem to have been worshipers of Devî in her terrific forms, the offering to her of human sacrifices being the principal feature of their ritual. If there are still any votaries of this sect, Professor Wilson believes that they are the miscreants who, more for pay than devotion, at certain festivals, inflict upon themselves bodily tortures, such as piercing their flesh with hooks or spits, reclining upon beds of spikes, gashing themselves with knives, &c.—See H. H. Wilson, *A Sketch of the Religious Sects of the Hindus;* Works, vol. i. (edited by Dr. R. Rost, 1862), pp. 240, ff.

S'AKUNTALA is one of the most pleasing female characters of Hindu mythology. She is mentioned as a water-nymph in the *Yajurveda* (see VEDA); she is the subject of a beautiful episode of the *Mahâbhârata* (q. v.), and is spoken of in the *Purân'as;* but her name has become especially familiar in Europe through the celebrated drama of Kâlidâsa (q. v.), which, introduced to us by Sir William Jones in 1789, became the starting-point of Sanscrit philology in Europe. The principal features of the legend of S., as narrated in the *Mahâbhârata*, are the following: S. was the daughter of the saint Vis'wa'mitra (q. v.) and the Apsaras, or water-nymph, Menakâ. Abandoned by her parents, she was adopted by the saint Kan'wa, who brought her up in his hermitage as his daughter. Once upon a time, King Dushyanta went a-hunting in the forest, and accidentally coming to the hermitage of Kan'wa, saw S,, and fell in love with her. He persuaded her to marry him according to the rite of the Gandharva marriage, and promised her that the son she would bear him should be the heir to his throne, and that he would take her home as his queen to his royal city. Kan'wa, who had been absent while this event happened, returned to the hermitage, and through his divine knowledge, knew the whole secret, though it had not been confessed to him by S'akuntalâ. She in due time was delivered of a son, and remained at the hermitage until the boy was six years old; but as Dushyanta, unmindful of his promise, did not send any messenger for her, Kan'wa directed her to proceed with her boy to the residence of Dushyanta. This she did; but when she arrived at his residence, she was repudiated by the king. Nor did her speech, however touching and eloquent, move his heart, until at last a heavenly voice assured him that S. had spoken the truth, and that he saw before him his lawful son. Thereupon, Dushyanta recognized S. as his queen, and her son as his heir. The latter was named Bharata, and became the founder of the glorious race of the Bhâratas.

In the drama, Kâlidâsa's genius had full scope to work out the incidents of this legend, so as to display the accomplished female character of S., and likewise to show that the obstacle which arose to her recognition was not the fault of Dushyanta, but the consequence of a curse which S. had incurred from a wrathful saint who, when once on a visit to Kan'wa's hermitage, had considered himself neglected by her. Since, in the drama, Dushyanta recognizes S. by means of a ring he had given her at the hermitage, the name of the drama is *Abhijnâna-S'akuntala*, or 'the drama in which S'akuntalâ (is remembered) by a token.' There are two versions in which this drama now exists—an older and a more recent one. The latter was first edited at Calcutta, 1761, then at Paris, 1830, by A. L. Chézy, who also gave a French translation of it; later and better editions of it (Cal. 1860 and 1864) were prepared by the Pandit Prem Chunder Tarkabâgish, under the superintendence of Professor Edward B. Cowell, the Principal of the Sanscrit College at Calcutta. The older version has been edited by Dr. O. Boehtlingk (Bonn, 1842), by Professor M. Williams (Hertford, 1853), and by a Bombay Pandit at the Induprakâs'a press (Bomb. 1861). The first English translation of it is that by Sir William Jones (Cal. 1789); the second was made by Professor M. Williams (Hertford. 1856); it deserves the highest acknowledgment, on account of the consummate taste with which it has rendered the metrical part of the original. Among the various German, Italian, Danish, and other translations of this drama, the German translation by Ernst Meyer (Stutt, 1852) is worthy of especial notice.

S'AKYAMUNI, or the SAINT S'AKYA, is a name of *the* Buddha, the founder of the Buddhist religion. See BUDDHISM.

SAL (*Vateria robusta*), a tree of the natural order *Dipteraceæ*, one of the most valuable timber trees of India. Great sal forests exist along the southern base of the Himalaya Mountains, but in many places they have been nearly cut down. The care of government is now extended to their preservation.

SALAA'M (*Selám*, Arab. = Heb. *Shalom*, peace), the general term of salutation among the Mohammedans. They are generally very formal in their social manners, although their demeanor and conversation are unrestrained enough, both among men and women. Several of their social usages in this respect are founded upon religious precepts; among these is the custom of greeting each other with the words: 'Es-selámu aleikum' (Peace be with you), which is answered by: 'With you be peace and the mercy of God, and His blessings!' This salutation is neither to be addressed to nor to be received from any non-Mohammedan. The reply, when one Moslem salutes another, is obligatory, while the address itself is rather arbitrary. Should the saluted refuse to reply, then the other may revoke his salutation, as he does in the case of his discovery that the person saluted is not a true believer, with the words: 'Peace be on us and on all the righteous worshipers of God.' Generally, the rider salutes the person on foot, the passer-by those who sit down or stand still; the smaller party salutes the larger, the young the older, &c. Salutation is to be the first and the last thing on entering a house. The following is the rising scale of the different modes of obeisance with the Moslem: 1. Placing the right hand upon the breast; 2. Touching the lips and the forehead or turban (or forehead and turban only) with the right hand; 3. Doing the same, but slightly inclining the head during that action; 4. The same, but inclining the body also; 5. The same, previously touching the ground with the right hand; 6. Kissing the hand of the person to whom the obeisance is paid; 7. Kissing his sleeve; 8. Kissing the skirt of his clothing; 9. Kissing his feet; 10. Kissing the ground. This, however, is to be understood (against De Sacy) as merely touching the ground previous to touching the lips and forehead with the right hand. The first five modes are accompanied by the 'Peace be with you,' and the reply given above. The sixth mode is observed by servants or pupils to their master, wife to husband, and children to father, and sometimes mother, by the young to the aged, and the less learned to the learned and pious (Lane, *Notes to Arab. Nights*, &c.).

SA'LAD, the name given to a preparation of raw herbs for food. It derives its name from the fact that salt is one of the chief ingredients used in dressing a salad. The principal salad herbs are lettuce, endive, chicory, celery, mustard, and cress; water-cress, onions, radishes, chervil, and a few savory herbs used to give flavor. They are usually cut up, and mixed with salt, vinegar, oil, and other condiments, according to taste. Sugar is also frequently added. Cresses, seed-leaves of mustard, &c., are often eaten without any addition. Salad has always been a favorite food with civilized nations, and has very little varied in its composition. The Romans used it, and made it thus: Cultivated endive was cut small after careful washing and draining, then gravy and oil were poured over it; and finely-minced onions were strewed over the whole; then a little vinegar and honey was added, and the salad served up. The great value of salads is in the fact that they are uncooked, and consequently contain a larger quantity of mineral matter, such as potash, soda, &c., than if boiled. Salads are sometimes prepared with animal food, such as boiled lobsters, crabs, eggs, &c.

SALADIN, the name given by western writers to SALAH-ED-DIN YUSSUF IBN AYUB, the sultan of Egypt and Syria, and the founder of the Ayubite dynasty in those countries. As the great Moslem hero of the third crusade, and the beau-idéal of Moslem chivalry, he is one of the most interesting characters presented to us by the history of that period. He belonged to the Kurdish tribe of Ravad, and was born at Tekreit (a town on the Tigris, of which his father Ayub was *kutwal* or governor under the Seljuks)

in 1137. Following the example of his father and uncle, he entered the service of Noureddin (q v.), prince of Syria, and accompanied his uncle in his various expeditions to Egypt in command of Noureddin's army. S. was at this time much addicted to wine and gambling, and it was not till, at the head of a small detachment of the Syrian army, he was beleaguered in Alexandria by the combined Christians of Palestine and Egyptians, that he gave indications of possessing the qualities requisite for a great captain.

On the death of his uncle, Shîrkoh, S. became grand-vizier of the Fatimite calif, and received the title of *El-melek-el-nasr*, 'the Victorious Prince;' but the Christians of Syria and Palestine, alarmed at the elevation of a Syrian emir to supreme power in Egypt, made a combined and vigorous attack on the new vizier. S. foiled them at Damietta, and transferred the contest to Palestine, taking several fortresses, and defeating his assailants near Gaza; but about the same time his new-born power was exposed to a still more formidable danger from his master, Noureddin, whose jealousy of the talents and ambition of his able young lieutenant, required all the skill and wariness at S.'s command to allay. On Noureddin's death, in 1174, S. began a struggle with his successor, which ended in his establishing himself as the Sultan of Egypt and Syria, a title which was confirmed to him by the calif of Bagdad. The next ten years were occupied in petty wars with the Christians, and in the arrangement and consolidation of his now extensive dominion. The plundering by the Christians of a rich pilgrim caravan on its way to Mecca, an infringement of the treaty with S., brought down upon them the latter's vengeance; their army suffered a dreadful defeat at Tiberias (4th July 1187); the king of Jerusalem, the two grand-masters, and many other warriors of high rank were taken captive; Jerusalem was stormed (2d October), and almost every other fortified place in Palestine was taken. The news of this great success of the infidels being brought to Western Europe, aroused the enthusiasm of the Christians to its highest pitch, and a powerful army of crusaders, headed by the kings of France and England, speedily made their appearance on the scene of strife. They captured Acre in 1191, and Richard Cœur-de-Lion, at the head of that portion of the crusading army which adhered to him, continued the war with success, twice defeated S., took Cæsarea and Jaffa, and finally obtained a treaty for three years (August 1192), by which the coast from Jaffa to Tyre was yielded to the Christains. In the following year, S. died at Damascus of a disease under which he had long suffered.

S. was not a mere soldier; his wise administration left behind it traces which endured for centuries; and the citadel of Cairo and sundry canals, dikes, and roads are existing evidences of his careful attention to the wants of his subjects. In him the warrior instinct of the Kurd was united to a high intelligence; and even his opponents frankly attribute to him the noblest qualities of medieval chivalry, invincible courage, inviolable fidelity to treaties, greatness of soul, piety, justice and moderation.

The Ayubite dynasty of which he was the founder ruled over Syria till 1259, when it was dispossessed by the Perso-Mongols, and over Egypt till the rise of the first Mameluke kingdom under Ibeg in 1250.

SALAMA'NCA, one of the three modern provinces of Spain, into which the ancient kingdom of Leon (q. v.) was divided. Area about 4940 sq. m.; pop. (1877) 285,509.

SALAMANCA, a famous town of Spain, capital of the modern province of the same name, stands on three rocky hills on the right bank of the Tormes, 50 miles east-north-east of Ciudad Rodrigo. Prior to its almost total destruction by the French in 1812, it was renowned for the number of its splendid edifices and institutions, and even yet it is a rich mine for the architect, abounding as it does in magnificent specimens of simple and florid Gothic, as well as of the richest cinque-cento. It is surrounded by a wall, pierced with nine gates, and a part of which is very old. The narrow, crooked, dark, and steep streets, containing many old and stately structures, the residences of the old nobility, give to the town an antique and venerable look. Besides the old cathedral, a simple and massive edifice, it contains five other churches of the 12th century. The new cathedral, begun in 1513, is a magnificent structure in florid Gothic, in the adornment of which painting, gilding, and sculpture have been largely and most successfully used. At the close of the 18th c., S. contained 27 parish churches, 39 convents, and 25 colleges. Of the colleges, 20 were destroyed by the French while the town was in their possession, as well as about 20 of the convents, for the purpose of obtaining materials for the erection of fortifications, and for firewood.

The university of S., with which the university of Palencia (q. v.) was incorporated in 1243, was founded in 1200. It consisted of a number of colleges, divided into *Mayores* and *Menores*, or larger and smaller colleges. Of the former, there were only six in Spain, and four of these were at S.: the other colleges were 21 in number. In the 14th c., the university was attended by 17,000 students; the attendance is now only 200. The library, according to the most recent statements, contains 30,000 volumes and 1500 MSS. The school of S. is interesting to British subjects as having, from an early period, included a college for Irish students, which supplied many of the ecclesiastics who continued to minister to their countrymen during the penal times, and which is still in existence. One of the most highly-prized works in Roman Catholic divinity is the great collection of Controversial and Moral Theology, by the members of the college of Carmelite friars in S., who are known by the name of *Salmanticenses*, or the *Salamanca Theologians*. The *Plaza Mayor* is the largest square in Spain, and when fitted up as a bull arena, as it was so recently as 1863, it accommodates from 16,000 to 20,000 persons. The bridge across the Tormes rests on 27 arches, and is of Roman foundation. Manufactures of cloth, leather, and earthenware are carried on. Pop. (1878) 18,007.

S., the ancient *Salmantica*, was a Roman *municipium*. In the vicinity was won one of the most famous victories of the Peninsular War, by the British under Wellington against the French under Marmont, 22d July 1812.

SALAMA'NDER, in the superstitions of the middle ages, denoted a being possessing the shape of a man, whose element was the fire, or who at least could live in that element. Paracelsus placed salamanders among the elementary spirits.

SALAMANDER (*Salamandra*), a genus of Batrachians of the family *Salamandridæ*, to which Newts (q. v.) also belong. The name is, indeed, sometimes extended to the whole family; newts being called *Aquatic Salamanders*, and the name *Terrestrial S.* being given to this genus, the species of which inhabit water only in their tadpole state, and return to it only to deposit their eggs, generally living in moist places, as under stones, roots of trees, &c. The general form is very similar to that of newts, but the tail is round, not flat as in newts. Several species are found in Europe; none of them, however, in Britain. The SPOTTED S. (*S. maculosa*), six or eight inches long, black, with bright yellow stripes on its sides, and livid blue beneath, is widely spread

Spotted Salamander (*S. maculosa*).

throughout Europe. The BLACK S. (*S. atra*) is much smaller, black, the body and tail ringed, the tail almost as if formed of beads. It is abundant in the Alps and mountains of Southern Germany. Other species are found in Spain, Italy, &c.; Asia and North America also produce numerous species. Salamanders feed on worms, slugs, snails, and insects. They are inert and sluggish creatures, and timid to the utmost extent that their stupidity permits. The brain is very small. They are perfectly harmless, although exuding, when alarmed, from pores on the back and sides, a milky humor, which is injurious to very small animals. But they have long had, and still retain, a popular reputation of extreme venomousness, and are therefore objects of the utmost dread to the vulgar in almost all countries which they inhabit. Strange fables have been current concerning them from remote ages, particularly concerning the icy cold which envelops their body, and enables them not only to endure fire without burning, but to extinguish fire. Pliny, indeed, records that he tried the experiment, and the poor S. was burned to powder; yet the fable continued to be credited until very recent times.

SA'LAMIS (modern name, *Koluri*), in ancient times called also *Pityoussa* (Island of Pines), an irregularly-shaped, mountainous island of Greece, off the coast of Attica, and forming with it the Bay of Eleusis. Its area is about 30 sq. m., and it has a modern population of about 4000, the chief town being Koluri, on the west coast. It had anciently two principal towns, Old and New Salamis, the former on the south, and the latter on the north-east coast. S. is remembered chiefly on account of the great naval battle between the Greeks and Persians, which was fought (480 B.C.) a few days after the battle of Thermopylæ, in the narrow strait between the east coast of S. and the west coast of Attica. The Grecian fleet, consisting of about 360 vessels, was drawn up at the entrance of the bay forming the harbor of New Salamis, Themistocles being leader of the Athenian contingent, and Adimantus of the Corinthian, while the whole was under the command of the Spartan Eurybiades. Great dissensions prevailed among the Grecian leaders, which would probably have

led to a general break-up, had not Themistocles by a stratagem induced Xerxes, king of the Persians, to bring up his fleet, and give immediate battle to the Greeks. Xerxes drew up his ships, numbering at least 1000, during the night previous to the battle, opposite the Grecian fleet, along the coast of Attica, almost completely blocking up both entrances to the straits; and confident of victory if he himself superintended operations, he took his seat on a throne erected on a lofty height on the Attic coast, almost opposite New Salamis. Both Greeks and Persians fought with great bravery, but the latter were entirely defeated, owing, perhaps, chiefly to their immense, unwieldy fleet being compressed into so small a space, which rendered it almost unworkable, and completely at the mercy of their opponents. The only name mentioned on the Persian side with distinction is that of Artemisia, queen of Halicarnassus, who is said to have fought with desperate bravery. The loss of the Greeks is said to have been 40, and that of the Persians 200 ships, exclusive of those which were captured.

SAL AMMO'NIAC (known in Chemistry as HYDROCHLORATE OF AMMONIA) is an article of considerable importance in the Materia Medica. It is obtained on a large scale by decomposing with common salt (chloride of sodium) the sulphate of ammonia, which is formed in the manufacture of coal gas, or the carbonate of ammonia, obtained by the distillation of bones. It is sold in large, crystalline, grayish-white, semi-transparent cakes, convex on one side, and concave on the other. It is inodorous, but possesses an acrid, bitter, and nauseous taste. Its specific gravity is 1·45; it volatilizes without decomposition when heated, and is freely soluble in water. Its aqueous solution, when heated with caustic potash, evolves gaseous ammonia; and when treated with nitrate of silver, yields a white, curdy precipitate of chloride of silver. This salt is largely given in France and Germany in cases of pneumonia, and of inflammation of the serous membranes, in mucous diarrhœa, in chronic rheumatism and gout, and in passive dropsies. Neligan recommends it in cases of low fever, in subacute laryngitis, in chronic affections of the liver, and in facial neuralgia. It may be given in doses varying from 10 to 30 grains, dissolved in some aromatic water. As a local external application, it is of great value in promoting the absorption of effused blood; and there is probably no remedy so effectual for that common but disfiguring affection popularly known as a *black eye*, as a moderately strong solution of this salt, kept constantly applied as a lotion. If it is desired to apply cold to any part of the body, an excellent Refrigerant (q. v.) may be obtained by dissolving five parts of this salt and five parts of nitre in sixteen parts of water.

S. A. is employed for various purposes in the arts. It is used in soldering, and in the tinning of copper and iron to prevent the oxidation of the surface to be tinned. It is exported from Britain to Russia, where it is used by dyers.

It occurs as a mineral, as an efflorescence on the surface of rocks, or as a sublimate in fissures, crystallized in small crystals, or forming crusts, stalactites, &c. It is found in volcanic regions, but is produced during the time of the quiescence of active volcanoes, rather than during their eruptions. It occurs in Britain, near burning beds of coal. It is found in Persia, Tartary, Siberia, and many other countries, where there are no active volcanoes. Formerly, all Europe was supplied with it from the neighborhood of the temple of Jupiter Ammon in Egypt whence its name.

SALDA'NHA BAY. See CAPE OF GOOD HOPE.

SALE, GEORGE, an eminent oriental scholar, was born towards the end of the 17th c., and died at London in 1736 under forty years of age. Almost nothing is known of his private life. He is supposed to have been born in Kent, and he received his education at the King's College, Canterbury. Brought up to the law, he is believed to have practised it almost to the end of his life. That he spent five-and-twenty years in Arabia, as Voltaire and many after him asserted, is a complete fiction. He assisted in getting up the *Universal History*—together with Swinton, Shelvocke, Campbell, George Psalmanazar, and A. Bower, each remarkable enough in his way—for which he wrote the cosmogony and several portions of oriental history. He was also one of the authors of the *General Dictionary;* but he is best known by his unrivalled translation of the Koran, 'with explanatory notes taken from the most approved commentators, to which is prefixed a preliminary discourse' (1734). This 'preliminary discourse,' which is of great value, and proves S. to have been deeply versed in oriental literature, treats, among other things, 'of the Arabs before Mohammed, or, as they express it, in the "time of ignorance"—their history, religion, learning, and customs; of the state of Christianity, particularly of the Eastern churches, and of Judaism, at the time of Mohammed's appearance; and of the methods taken by him for establishing his religion, and the circumstances which concurred thereto; of the doctrines, precepts, and peculiarities of the Koran, and of the principal Mohammedan sects.'

S.'s work was translated into French by Duryer (Antw. 2 vols. 1770). This translation formed a new epoch in the study of Islam and its literature; and though many other translations have been attempted since, in nearly all European and oriental languages, it still bears the palm. See KORAN. That his contemporaries fastened the charge of heresy upon one who spoke philosophically and humanely of other creeds, is not to be wondered at. After his death, a catalogue of his oriental MSS. was published, and the contents are now in the Radcliffe Library, Oxford.

SA'LEM, a town in the south of India, capital of the collectorate of the same name. The collectorate is the chief seat of the Indian *steel manufacture*—a branch of industry as curious as it is ancient. The town stands in an elevated valley, 1070 feet above sea-level, bounded on the north and south with hills, 193 miles south-west of Madras. It is well built. Cotton and silk are grown in the highly cultivated country around. Pop. 50,000.

SALEM, capital of Oregon, U. S., stands on the Willamette River, and on the Oregon and California railway, 50 miles south of Portland. Settled in 1834, and incorporated in 1853, it became state capital in 1860. Pop. (1870) 1139; (1880) 5000.

SALEM, a city and port of entry of Massachusetts, U. S., 14 miles north-east of Boston, on a peninsula 2 miles long by ⅘ths of a mile broad, with irregular but well-built streets, and a fine harbor, from which was formerly carried on a large trade with China, the East Indies, and Eastern Africa. The principal institutions of S. are: the East India Marine Society, whose extensive and unique museum of oriental curiosities is now united with that of the Peabody Academy of Science; the Essex Institute, with a library of 18,000 vols., and a picture-gallery; and the Salem Athenæum with a library of 13,000 vols. There is a normal and high school, 5 newspapers, 7 banks, 20 churches, a cotton-mill, with 65,000 spindles, and manufactures of chemicals, varnishes, leather, shoes, machinery, &c. S. was settled in 1626, and is the oldest town, except Plymouth, in New England. The first church was organized in 1629. In 1692, a great witch-mania broke out, and 19 persons were hanged for 'witchcraft.' In the war of the revolution, S. sent out 153 privateers, which took 455 prizes. Pop. in 1860, 22,-252; in 1870, 24,117; in 1880, 27,598.

SALE'MI, a town of Sicily, in the province of Trapani, 39 miles south-west from Palermo. Pop. about 12,000.

SALE OF GOODS is a contract by which the seller, in consideration of a price, transfers the property in the goods to the purchaser. Where the consideration is not money but goods, the contract is called exchange or barter. The law on the subject is not the same in England and Scotland. In England, when the bargain is struck, and the sale relates to specific goods—that is, goods already made, and existing, and identified—the property vests at once in the purchaser, so that in the event of any damage or destruction happening to the goods, the loss is that of the purchaser and not of the seller, even though the goods have not been delivered, and whether the price has been paid or not. The contract may be made either by word of mouth or by writing; but when the price exceeds £10, the statute of Frauds enacts that the contract shall not be binding unless it is in writing. If, however, the buyer shall have accepted part of the goods sold, and actually received the same, or if he shall have given something in earnest to bind the bargain, or in part payment, then a verbal contract will be binding though the price exceeds £10. Many nice questions have occurred and constantly recur as to what amounts to an acceptance and delivery of the goods, so much so, that the general policy of restricting the proof of the contract to writing in any case has been much complained of in late years; and efforts have been made, but as yet in vain, to repeal the statute of Frauds, which, it is said, encourages rather than discourages fraud. When a contract of sale is made, the duty of the seller is to deliver the goods as soon as the buyer has performed all the conditions agreed upon. If no time was specified for delivery, then he must deliver the goods in a reasonable time. In general, if nothing is agreed to the contrary, the seller need not deliver till the price is paid; but he must do so if the bargain was, that delivery was to take place before payment, in other words, if the sale was on credit. On the other hand, it is the duty of the buyer to accept the goods and pay for them. If either party fail at any stage in his performance of the duties arising out of the contract, the other may bring an action which varies according to the nature of the breach of contract.

One valuable right of the seller, when he has sent his goods to the buyer, and they are not delivered, is to stop them *in transitu*. Stoppage *in Transitu* (q. v.) is chiefly resorted to when the seller hears of the bankruptcy of the buyer after he has sent him goods. The law regulating the S. of G. by Agents (q. v.) or documentary titles is contained in the Factory Acts, 1823–25–42–77. See FACTOR. The chief difference between the laws of England and Scotland is that in Scotland no writing in necessary to make the contract binding, whatever the price; and that property in the

goods does not pass until they are actually or constructively delivered. See Paterson's *Compendium*, 2d ed. ss. 520—544.

SALE OF LAND differs from sale of goods in several respects. An agreement for the sale of land must be in writing, otherwise it cannot be enforced. When once a contract for the sale of land has been entered into, a Court of Equity will, contrary to the general rule which prevails when a contract is broken, enforce specific performance of the contract; that is, will compel the seller or buyer to carry out his contract, and transfer or accept conveyance of the land. When a sale of land is agreed upon, and nothing is said as to the matter, it is understood, as part of the contract, that the vendor shall be able to make a good title; and a doubtful title cannot be forced on the vendee even though it is accompanied with an indemnity. The rule is, that the abstract of title—i. e., a short account of the series of former transactions relating to the possession and property—must go back for sixty years. The expense of making searches into registers during that period falls on the purchaser. It is the duty of the purchaser's solicitor to prepare the draft of the conveyance, and tender it for approval to the vendor's solicitor; and unless there is an agreement to the contrary, the purchaser pays the expense of the conveyance. When the vendor has delivered possession of the estate to the purchaser without receiving the purchase-money, he still retains a lien on the estate for the unpaid price.

In England there is no general register which contains copies of all the deeds relating to land, so that everything depends on the preliminary inquiries between the two parties, and the certainty that the purchaser has obtained all the material information that exists. The consequence is, that the sixty years' title or previous history of the estate involves the parties in great expense. This expense requires to be renewed on every fresh sale, for a solicitor who neglects to go through the same train of inquiries as his predecessor at the time of the last preceding sale would be personally liable for any loss that occurred thereby. The great expense attending the conveyance of land has of late years been loudly complained of, and the manufacturing interest, familiar with the rapidity of similar transactions relating to goods, have demanded a simplification of the process. In order to meet this demand, which has been largely shared by the public in general, two acts of parliament were passed in 1862, for the purpose of founding a Land Registry, and enabling an owner of land to have his title examined and registered once for all, so that in the event of future transactions he may be saved the expense and delay required under the old system. These acts of parliament were not compulsory, and little progress was made, but the legislature has been maturing a scheme for making them compulsory in all but trifling sales of land. In Scotland, the law relating to the sale of land has always been on a more satisfactory footing, for there are registers in which an intending purchaser can with certainty find all the deeds, and nearly every burden that can attach to the land he wishes to buy; so that he can almost at a glance ascertain what are the dangers and drawbacks attending the transaction. See REGISTRATION OF DEEDS AND WRITS. In Scotland the expense of the conveyance of land falls on the vendor, if there is no agreement to the contrary, and the vendor's solicitor prepares and tenders the draft conveyance, while the purchaser pays his own solicitor for perusing and approving the draft conveyance; but in practice the expenses of conveyance are usually equally divided between vendor and purchaser.

SA'LEP, the tubers of many species of *Orchis* and other *Orchideæ*, dried and used as an article of food. Of the two tubers usually found at the roots of these plants, only one is gathered for salep, the younger and more solid of the two. The tubers are gathered when the stalk is about to fall. They vary from the size of a cherry-stone to that of an olive. They are cleaned, dipped for a few minutes in boiling water, and dried as quickly as possible, by which process they are rendered hard and horny. The greater part of the salep of commerce is brought from the East, and much of it from Persia; it is supposed to be obtained from species of *Eulophia;* but most of the European species of *Orchis* are used for it.

Before coffee became so common in Britain, salep was an article of considerable importance, and large quantities were imported from Turkey, Persia, and India. In France it is still in considerable request. For use it is ground into a fine powder, and mixed with boiling water, sugar and milk being added according to taste. As a diet drink, it was considered very nutritious and wholesome, and forty years ago it was sold, ready prepared, to the working-classes of London, early in the morning, from numerous street stalls. Its principal constituents are *bassorine*, starch, and phosphate of lime.

SALE'RNO (ancient *Salernum*), a city of Southern Italy, chief town of the province of S., on the gulf of the same name, 32 miles E.S.E. of Naples, with a population (1881) of 31,245. A Gothic wall, built of huge stones without mortar, encircles it; the streets are paved with lava, and, with the exception of the two principal ones, are narrow, irregular, and dirty. It has a strong castle, and a very small harbor. The old and beautiful Gothic cathedral was erected by the Normans, and has around it a portico of porphyry and granite pillars brought from Pæstum by Robert Guiscard. It has many famous sepulchres, among others, those of Robert and Guillaume Guiscard, of Margaret of Anjou, and of Gregory VII. It was celebrated in the middle ages for its school of medicine (the *Schola Salernitana*), founded by Robert Guiscard about the end of the 11th c., and which was long the first medical school in Europe. The university has fallen into decay. In its neighborhood, which produces excellent wine, are the ruins of Pæstum, which was destroyed by the Saracens in the 9th century. Of ancient Salernum or Salurnum, there still exist the Temple of Neptune, that of Ceres, and the ruins of an amphitheater and of a theater. S. was founded by the Greeks; it became important under the Roman empire, then passed into the possession of the Goths, and of the Lombards. Robert Guiscard made himself master of it in 1076. Charles V. united it to the kingdom of Naples.

SALERNO, GULF OF (anc. *Sinus Pæstanus*, on whose shores, in early times, the Greek city of Pæstum [q. v.] stood), is a nearly semicircular indentation on the western shores of Southern Italy, south-east of the Bay of Naples, from which it is separated by the promontory ending in Point Campanella. The Gulf is 36 miles wide at its entrance, and sweeps inland for 24 miles. On its shores are the towns of Amalfi and Salerno.

SALES, FRANCIS DE, a most distinguished saint of the Roman Catholic Church, was born August 21, 1567, at the family castle of Sales, near Annecy in Savoy. He was the heir of the family honors, and his education was designed by his father to fit him for the career of distinction to which his position seemed to entitle him. From the provincial colleges of La Roche and Annecy, he was sent to Paris in 1578, where he entered the then brilliant school of the Jesuits, and completed under their care the course of rhetoric and philosophy. In 1584, he went to Padua, for the course of civil law, and pursued his studies there with great distinction till 1591. At this time, his father, who had obtained for him a place in the senate, proposed to him a very brilliant and advantageous marriage, but he had already resolved to devote himself to the ministry, and with much difficulty obtained his father's consent to enter into orders in the diocese of Geneva. He soon became distinguished as a preacher, and the zeal with which he discharged the ordinary duties of his ministry was no less remarkable. Very soon after his ordination, he was employed by his bishop in a mission for the conversion of the Calvinistic population of Chablais, which had been recently annexed to the duchy of Savoy, and in which the duke was desirous of having the Catholic religion re-established. The success of this mission was almost unprecedented. With a companion equally devoted, he traveled on foot from town to town, and in a short time he succeeded in reclaiming many to the church. One of the most remarkable incidents of his mission was a conference with the celebrated Calvinist leader, Theodore de Beza. Of this interview, very different accounts are given by the rival partisans; but all agree in admiration of the gentleness and enlightened liberality of Francis de Sales. At the termination of this mission, Francis was, in 1596, appointed coadjutor to the Bishop of Geneva, Mgr. Granier, with the title of Bishop of Nicopolis. It was with much difficulty that the pope, Innocent IX., induced him to accept this dignity. Some time afterwards, having occasion to go to Paris, he was invited to preach the Lent in the chapel of the Louvre; and his lectures, which were partly controversial, were reputed to have had so much influence in bringing about the conversion of several of the Huguenot nobles, that the king tried to induce him to accept a French bishopric; but in vain.

He returned to his diocese; and soon afterwards, on the death of Mgr. Granier, he succeeded to the bishopric of Geneva. His administration of this charge, upon which he entered in December 1602, was beyond all praise. Being again invited to preach the Lent at Dijon, in furtherance of the plans of Louis XIV. for the conversion of the Huguenots, he was again pressed by that monarch to accept a French bishopric. But he again declined this honor, as he also declined in 1607 the offer of the cardinalate from the pope Leo. XI. It was about this time that he published his well-known *Introduction to a Devout Life*, which has continued to the present day one of the most popular manuals of piety and the ascetic life. Among his measures for the renovation of the monastic spirit, a very important one was the establishment of a congregation of nuns of the order of the Visitation, under the direction of the now celebrated Madame de Chantal, with whom he long maintained a correspondence on every subject connected with the spiritual and religious life, which was published in 1660, and which still remains a subject of almost undiminished interest for the spiritualist. In 1608, his infirmities compelled him to solicit the assistance of a coadjutor in the charge of his diocese. He continued, however, to labor to the last. His last sermon was

delivered at Lyon on Christmas eve in 1622; on Christmas-day he was seized with paralysis, and on the 28th of the same month, he expired. He was buried in the church of the Visitation in that city, but his remains were afterwards translated to Annecy. More than forty years after his death, in 1665, he was solemnly canonized as a saint by Alexander VII. His festival is held on January 29, the day of the translation of his relics to Annecy. His works were published in a collected form in 2 vols. folio at Paris in 1641; but the separate works (especially the *Devout Life*, which has been translated into almost every European language), have passed through innumerable editions, and still retain their popularity.

SALEY'ER ISLANDS, THE, lie in the Indian Ocean, to the south of Celebes. Upwards of thirty of the group are small, hilly, densely wooded, and, with few exceptions, uninhabited. Great Saleyer, in 5° 44′—6° 26′ S. lat., and 120° 23′—120° 37′ E. long., is upwards of 40 miles in length, and 7 in breadth, the area being 336 sq. miles. The mountains on the east coast rise abruptly out of the sea, and along the west is a slip of level land planted with cocoa-nut trees. Pop. 60,000. Great Saleyer and the smaller islands produce fine timber, including ebony and teak. Indigo, coffee, and mustard are grown; but millet, maize, earth-fruits, and cotton are the staple cultures, the grounds being carefully fenced. Agriculture is the chief employment, and fishing, making salt, &c., are also carried on. The exports are cocoa-nuts, cocoa-nut oil, cotton, and cotton-fabrics. Imports—rice, gambir, tobacco, yarns, iron and copper wares. Since the Netherlands' government made Macassar a free port, sea-going ships are not permitted to anchor at Saleyer; and the trade is carried on by small vessels, which sail between that island, the Bight of Boni, Sumbawa, Bali, Borneo, Java, Macassar, and Singapore. The sea is rich in various kinds of fish—a long and thin species, the Saleyer, giving a name to the island.

The S. I. are governed by fourteen rajahs, superintended by a Netherlands' agent. The natives are Mohammedans, each large village having a mosque and priest. The high priest resides near the political agent, has a seat in the council, and is consulted on religious questions. Some of the rajahs and notables have tables and chairs, tea and dinner services, silver spoons and forks, mattresses, cushions, and even satin bed-curtains.

SA'LFORD, a municipal and parliamentary borough, Lancashire, is considered as virtually a portion of the city of Manchester (q. v.).

SA'LICIN ($C_{26}H_{18}O_{14}$) is a member of the group of organic compounds to which the term *glycosides* has been recently applied by chemists—a group which is specially characterized by the fact, that each of its members, when exposed to certain chemical agencies, breaks up (usually after the absorption of water) into glycose (or grape-sugar) and other compounds. It occurs in the bark of the various species of willow and poplar, in the blossoms of several species of *spiræa*, and probably in the animal secretion known as *castoreum*. It may be obtained in small, colorless, glistening prisms of an intensely bitter taste, which are readily soluble in hot water and in alcohol, and moderately soluble in cold water, and are insoluble in ether and oil of turpentine; and its solutions exert a left-handed rotatory action upon a ray of polarized light. When heated to 248°, salicin fuses; and at a higher temperature, it is entirely decomposed. It dissolves in strong sulphuric acid, the solution being of a purple or blood color. Salicin is manufactured to a considerable extent as a cheap substitute for quinia. There are various modes of extracting it from the macerated bark; and 1 lb. of the bark of *Salix pentandra* yields, according to Erdmann, 5 drachms of salicin. If it is not so certain in its action as a febrifuge as quinia, there can be no doubt that it is an excellent tonic; and it possesses this advantage over the latter substance, that it is less liable to irritate the stomach. Dr. Neligan, in his excellent work on *Medicines*, states that he has used it very extensively as a tonic in the debility following acute diseases, particularly in cases accompanied by irritability of the digestive organs, and considers its powers to be fully equal to those of sulphate of quinia. As a tonic, two grains may be given three or four times a day; as a febrifuge, from one to two scruples in divided doses, during the intermission. *Salicylic Acid*, a derivative of S., is a powerful anti-ferment and antiseptic. It may be obtained from carbolic acid.

SA'LIC LAW. The code known as the *Salic Law* is a collection of the popular laws of the Salic or Salian Franks (see FRANKS) committed to writing in barbarous Latin in the 5th c., while the people were yet heathens. There exist several texts of this code, and considerable obscurity rests over its history. It relates principally to the compensation and punishment of crimes, and there is a chapter containing provisions regarding the succession to what are called *Salic Lands*, which seems to have been inserted at a later date. It is difficult to determine precisely what these lands were. The *terra salica* was probably so called from its being more especially attached to the *sal* or hall of the lord or proprietor (some derive *salic* as applied to the people from the same word); it thus came to designate inherited land as opposed to property acquired otherwise. Although the Frankish law did not in general exclude females, the succession to these salic lands whatever they were, was confined to males, probably from the importance of securing the military service of the chief proprietors. It was but a doubtful analogy that led the rule of succession to Salic lands to be extended to the succession to the French crown, and it seems to have been only in the 14th c. that the exclusion of females from the throne became an established principle. The accession of Philip the Long was probably the first occasion on which it received public sanction, and the fact that Edward III. rested his claim on female succession, doubtless led to that instance being regarded as an unquestionable precedent for all future time.—See Hallam's *Europe in the Middle Ages;* Guizot, *Essais;* and the *Lex Salica with the Glosses*, by Hessels (1880).

SA'LIENT, in Heraldry, an attitude of a lion or other beast, differing but slightly from *Rampant* (q. v.). He is supposed to be in the act of springing on his prey, and both paws are elevated. Two animals *counter-salient* are represented as leaping in opposite directions.

SALIENT, in Fortification, is that which points outwards from the interior of any work. For example, the central angle of a bastion, pointing towards the enemy, is a salient angle.

SALI'FEROUS SYSTEM, the name given by the earlier English geologists to the New Red Sandstone (q. v.) formations, because the deposits of salt in England occur in these strata. As, however, this substance has been found associated with strata of all ages in different parts of the world, the name has been given up.

SA'LIFIABLE BASE, a term applied in chemistry to any substance capable of uniting with an acid to form a salt.

SALI'NA, or SALINI, one of the Lipari Islands (q. v.).

SA'LINE PLANTS are those which require for their healthy and vigorous growth a considerable supply of *chloride of sodium* (common salt) and other salts, and which are therefore limited to peculiar situations. Few of them are strictly aquatic plants, except the marine Algæ, or Sea-weeds, which grow immersed in salt-water, either always or in certain states of the tide, and derive their nourishment from it through their fronds, and not by roots from the rock to which they are attached. Grass-wrack (q. v.), however is an instance of a phanerogamous plant living entirely and always immersed in salt-water. Other phanerogamous plants grow chiefly or only on the sea-shore and in salt marshes. Some of these, however, as the sea-kale, may be cultivated in gardens remote from the sea, but they succeed best when liberally supplied with salt. Asparagus is another well-known garden-plant, which derives much benefit from similar treatment. Some of the Saltworts (q. v.) and other saline plants yield much soda when collected and burned, and the produce was at one time largely imported into Britain from Spain and other countries under the name of Barilla (q. v.). The dry steppes of Russia and Tartary, having in many places a strongly saline soil, are covered with a very peculiar vegetation. Among the ornaments of these steppes is *Halimodendron argenteum*, a shrub of the natural order *Leguminosæ* often cultivated in gardens for its beautiful rose-colored flowers and silvery gray leaves. Saline plants have their whole tissues impregnated with salt.

SALINE POWDER, COMPOUND, is a very popular and harmless form of aperient medicine. The ordinary method of preparing it is by drying, at a gentle heat, and then pulverizing 4 oz. of pure chloride of sodium (common salt), 4 oz. of sulphate of magnesia (Epsom salts), and 3 oz. of sulphate of potash. These salts must then be mixed and triturated together, and kept in an air-tight vessel. Two or three drachms dissolved in half a pint of water, and taken before breakfast, usually act efficiently. Dr. Neligan states that if 4 oz. of sulphate of soda be used instead of the sulphate of potash, and a sufficiently high temperature be employed to expel all the water of crystallization from the different ingredients, one drachm of the resulting compound acts as energetically as two or three drachms of the ordinary powder.

The following is a more agreeable form than the preceding, and equally efficacious. Take half an ounce of carbonate of magnesia, and an ounce of each of the following substances—viz., sulphate of magnesia, bicarbonate of soda, tartrate of soda and potash, and tartaric acid. Expel all the water of crystallization, and mix. This powder, if kept dry, effervesces when mixed with water, and one or two teaspoonfuls form the average dose. The addition of a drop of oil of lemon and a little powdered white sugar to each dose, makes this one of the most agreeable laxatives that can be prescribed.

SALINS (anc. *Salinæ*), a town of the dep. of Jura, France, 52 miles north-by-west from Geneva, on the Furieuse, a feeder of the Doubs. It is situated in a narrow rocky gorge between two lofty hills, looking upon a fertile and beautiful valley. It derives

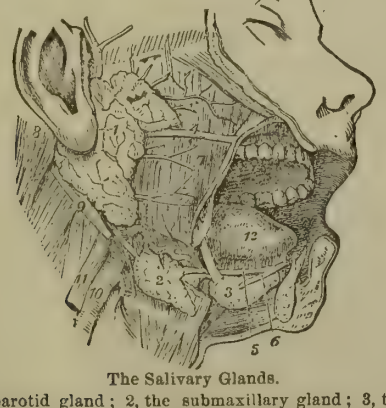
its importance from its salt-works, from which also it has its name. The salt is obtained from brine-springs, and the evaporation of the brine is mostly carried on in a great building, in the valley below the town, which has long borne the name of the *Salines Royales;* but that of the weaker springs is conveyed in pipes to the forest of Chaux, 15 miles off, where it is first slowly evaporated in *maisons de graduation*, and afterwards by boiling. There are iron-works, soda-factories, tanneries, and quarries of gypsum in S. and its immediate neighborhood. Pop. (1876) 5577.

SA'LISBURY, or NEW SARUM, the capital of Wiltshire, is an episcopal city, and a municipal and parliamentary borough, and stands in a fertile valley on the Avon, at the junction of that river with two of its affluents, 83 miles south-west of London by the South-western Railway, and 23 miles north-west of Southampton by a branch of the same. Its several parts are connected by three bridges. The town dates from 1220, in which year the cathedral was founded, and the inhabitants of Old Sarum (see SARUM, OLD) two miles to the north, removed to S., attracted to the new site by the abundant supply of water. At the foundation of the town, the ground was divided into squares or 'chequers' as they are called, to which the town is indebted for its appearance of airiness and regularity. The cathedral, the principal building of S., is one of the finest specimens of Early English in the country. It was begun in 1220, and was finished in 1258. The spire, which was added after the building was completed, is the 'most elegant in proportions and the loftiest in England.' Its height from the pavement is 400 feet, only 60 feet less than that in Strasburg. The cathedral is 449 feet long; height in the interior, 81 feet; width of great transept, 203 feet. It is in the form of a double cross, is perfect in its plan and proportions, and in the main uniform in style. The west front is still rich, beautiful, and graceful, though now denuded of statues, upwards of 100 in number, with which it was once enriched. The cathedral has been recently restored. The manufactures of cutlery and cloth, for which it was once famous, have long declined and its trade is now chiefly in retail. Pop. (1871) 13,839; (1881) 15,659. It returns two members to parliament.

SALISBURY PLAIN, an extensive tract of undulating chalk country, in Wiltshire, between Salisbury and Devizes, about 20 miles long from north to south, and about 14 miles broad. Its rolling surface resembles that of the ocean heaving after a storm. On this plain, about 8 miles north of Salisbury, is Stonehenge (q. v.). Until within recent years, the expanse of S. P. remained in a state of nature, and was covered with a fine turf, which afforded pasture to sheep. The natural features of the plain, however, are now much changed. North and south of Stonehenge, wild slopes of thistle-covered turf still extend; but both east and west of it, the country is laid out in cultivated fields; and within gun-shot of the desolate old relic, is a neat modern farm-house.

S'ALIVAHANA is the name of a Hindu prince who is said to have reigned in Magadha or South Behar. He instituted an era which bears his name, and the beginning of which took place when 3179 years of the Kali-yuga, or the present mundane age, had expired; that is, 78 years after the beginning of the Christian era. This era is called S'âliyâhana S'âka, or simply S'âka. Thus 1865 of the Christian era would be tantamount to S'âka (i. e., in the S'aka era) 1787. The S'âka year is the same as, and begins with, the common solar year.

SA'LIVARY GLANDS. Under this name we designate three pairs of glands—the parotid, the submaxillary, and the sublingual,



The Salivary Glands.

1, the parotid gland; 2, the submaxillary gland; 3, the sublingual gland; 4, Steno's duct; 5, Wharton's duct; 6, Bartholin's duct; 7, masseter muscle; 8, mastoid process; 9, digastric muscle; 10, internal jugular vein; 11, external carotid artery; 12, the tongue.

each gland having an efferent duct, which conveys the glandular secretions into the mouth, where, when mixed with the mucus secreted by the follicles of the mucous membrane lining the mouth, they constitute the ordinary or mixed saliva.

The *Parotid Gland*, so called from the Greek words *para*, near, and *ous*, the ear, is the largest of the three glands occurring on either side. It lies upon the side of the face immediately in front of the external ear, and weighs from half an ounce to an ounce. Its duct is about two inches and a half in length, and opens into the mouth by a small orifice opposite the second molar tooth of the upper jaw. The walls of the duct are dense and somewhat thick, and the calibre is about that of a crow-quill.

The *Submaxillary Gland* is situated, as its name implies, below the jawbone (part of which is cut away in the figure), and is placed at nearly equal distances from the parotid and sublingual glands. Its duct is about two inches in length, and opens by a narrow orifice on the top of a papilla, at the side of the *frænum* of the tongue.

The *Sublingual Gland* is situated, as its name implies, under the tongue, each gland lying on either side of the *frænum* of the tongue. It has a number of excretory ducts, which open separately into the mouth.

The minute structure of the parotid gland is described in the article GLANDS, and the other salivary glands are similarly constituted. True salivary glands exist in all mammals, except the cetacea, in birds, and reptiles (including amphibians), but not in fishes; and glands discharging a similar function, occur in insects, many molluscs, &c. The chemical and physical characters of the saliva are sufficiently described in the article DIGESTION.

The most common disease of the parotid gland is a specific inflammation, which has been already described in the article MUMPS. The term *Parotid Tumors* is given to tumors of various kinds occurring in front of the ear and over the parotid gland. With regard to surgical interference, Liston recommends that 'if there be reason to suspect that the disease is of a malignant nature, and not thoroughly limited by a cellular cyst, no interference is admissible; if, on the contrary, it be at all movable, has advanced slowly, possesses a smooth surface, and is firm, then an operation may be contemplated.'

Certain functional disorders of the salivary glands require notice, of which the most important is that known as *Salivation* (q. v.), or *Ptyalism*, which consists in a much increased secretion of saliva. *Deficient Secretion* is indicated by clamminess or dryness of the mouth, and is common in low forms of fever. It is important as indicating the condition of the system, and seldom requires treatment. If it should occur as an original affection, it must be treated by local Sialogogues (q. v.), such as liquorice, horse-radish, pellitory, &c. *Alteration of the Saliva* is not unfrequent in disease. For example, it sometimes loses its alkaline character, and becomes acid, as in acute rheumatism, diabetes, &c.; whilst in other cases, it becomes so fœtid as to be a source of annoyance both to the patient and his friends, as, for example, in scurvy, various forms of dyspepsia, salivation, &c. The undue acidity may be corrected by the administration of carbonate or bicarbonate of soda, while the fœtor may be relieved by attention to diet, and by the use, both local and general, of creosote, nitromuriatic acid, charcoal, chlorate of potash, &c.

Ordinary inflammation of these glands (distinct from mumps) may proceed from cold or local injury, but it is often produced by decayed teeth.

SALIVA'TION, or PTY'ALISM (from the Gr. *ptyalon*, the saliva), is the term employed to designate an abnormally abundant flow of saliva. It most commonly arises from a specific form of inflammation of the parotid glands, induced by the action of mercury, in which case it is termed mercurial salivation; but it occasionally arises from the action of other drugs, especially iodide of potassium; and sometimes it occurs without any apparent cause, in which case it is said to be *idiopathic* or spontaneous.

Mercury, in some form or other, is so common an ingredient in the quack medicines whose advertisements are unfortunately allowed to occupy a large space in many of our newspapers (especially in those medicines which are falsely stated to be of purely *vegetable origin*), that a popular knowledge of the most remarkable manifestations of this powerful mineral should be as widely diffused as possible. When this medicine is given in such a way as to excite salivation, a metallic taste in the mouth is soon recognized by the patient, and a remarkable but indescribable smell, known as the mercurial fœtor, may be detected in his breath; the gums become swollen and spongy at their edges, and usually present a few slight ulcers; and an increased flow of saliva takes place, accompanied by pain in the teeth on pressure. If these symptoms be not checked (and *a fortiori* if more mercury be given), the tongue, cheeks, and throat swell and ulcerate, and the saliva that flows away amounts to several pints in the course of the day. This peculiar action of mercury varies extremely in different persons. Dr. Watson, in his 14th Lecture, records several remarkable cases in which a single small dose of mercury produced the severest salivation. Cases of the opposite kind, in

which no impression on the gums or salivary glands can be made by the freest use of mercury, are by no means uncommon. It is worthy of notice that salivation is rarely produced in children below the age of ten years.

Until a comparatively recent period, profuse salivation was deemed the only certain indication that the system was duly under the influence of mercury (and, indeed, it was believed that the cause of the disease was carried out of the body with the saliva); but now it is well known that all that is requisite is, that the gums should become distinctly tender, and that the mercurial fœtor should be unmistakably present, and that those symptoms should be kept up for a certain time. Unfortunately, however, the physician cannot always stop the action of the mercury at that definite stage, and salivation to a distressing extent often occurs, even when the greatest care has been taken in the administration of the medicine. To check this excessive salivation, the internal administration of chlorate of potash in scruple doses, three times a day, together with the frequent use of a gargle of the same salt has been recommended by several high authorities. Dr. Watson strongly advocates the use of a gargle composed of one part of brandy to four or five of water, and the application of moistened tannin to the gums; and when there is much external swelling, he applies eight or ten leeches beneath the edges of the jaw-bones, followed by the application of a soft hot poultice to the neck.

It is worthy of notice that, in the confluent form of small-pox, there is almost always more or less abundant salivation, which lasts for several days; and if it cease abruptly, the peril is usually great. Moreover, there is a more or less marked tendency to salivation in scurvy, hysteria, hydrophobia, some forms of mania, and not unfrequently in pregnancy.

Various cases of spontaneous salivation have been collected by Dr. Watson in his 44th Lecture. In one instance of a girl ten years old, under his own care, no less than three pints of saliva were excreted in twelve hours. Medicine had no effect; but the salivation finally ceased spontaneously after a severe attack of influenza. In these cases, astringent washes, as a solution of alum, or the infusion of catechu, or a few drops of creosote suspended by mucilage in water, are deserving of trial.

SA'LIX. See WILLOW.

SA'LLEE, or SLA, a seaport town of Morocco, in the territory and former kingdom of Fez, 106 miles west from Fez. It stands on a low sandy point of the shore of the Atlantic, at the mouth of the Bu-Regreb, on the northern side of the river, whilst opposite to it, on the southern side, is the town of Rabat. Both S. and Rabat were bombarded and nearly destroyed by the French in 1851. S. was in former centuries noted as a haunt of pirates, and a *Sallee Rover* was the dread of peaceful mariners in the Atlantic and Mediterranean. It is particularly noted for the carpets which it produces, of fine texture and bright colors. They are mostly used in Morocco itself. The chief export from S. is wool. Pop. estimated at about 12,000, of whom 3000 are Jews.

SA'LLOW, the popular name of a number of species of Willow (q. v.), trees or low shrubs with downy branches, and generally ovate or obovate, wrinkled leaves, having stipules. The GRAY S. (*Salix cinerea*) is one of the most common British species,

Gray Sallow (*Salix cinerea*).

growing in moist and swampy places. Other common species are the ROUND-EARED S. (*S. aurita*) and the GREAT ROUND-LEAVED S. (*S. caprea*), the latter remarkable for preferring a dry soil, and becoming a small tree, the wood of which is used for the handles of agricultural implements. The LONG-LEAVED S. (*S. acuminata*) differs from the other kinds in its lanceolate leaves. It is frequent in Britain. None of the sallows produce such long and slender twigs as the osiers, nor are they adapted for any but the coarsest wickerwork, and some of them are so apt to break that they cannot easily be used in that way. But shoots of two years' growth are split up, and used for making hoops of barrels.

SALLOW-THORN (*Hippophaë*), a genus of plants of the natural order *Elæagnaceæ*, consisting of large shrubs or trees with gray silky foliage, and entire leaves. They have diœcious flowers: the perianth is tubular, becomes succulent, encloses an achenium, and forms an acid fruit. Few species are known: one only is European, *H. rahmnoides*, sometimes called the SEA BUCKTHORN, a large shrub or low tree, a native of the sandy sea-

Sallow-thorn (*Hippophaë rhamnoides*):
a, Branch of the female plant, in fruit; *b*, branch of male plant, in flower.

coasts of England and the continent of Europe. It is found also throughout great part of Tartary. It is sometimes planted to form hedges near the sea, growing luxuriantly where few shrubs will succeed. The berries are orange-colored. They are gratefully acid. They are used for making a sauce in the south of France: a rob or jam is made of them on the shores of the Gulf of Bothnia, to impart flavor to fresh fish; and a preserve or jelly made from them is a favorite luxury of the Tartars. The *stellate* hairs of the underside of the leaf, covering it like scales, are a beautiful microscopic object.

SA'LLUST, CAIUS CRISPUS, a Roman historian, was born 86 B.C., at Amiternum, in the Sabine country. Though of a plebeian family, he rose to official distinction, first as quæstor about 59, and afterwards as tribune of the people in 52, when he joined the popular party against Milo, who in that year had killed Clodius. His reputation for morality was never high; and his illicit connection with Milo's wife is assigned as the cause of his being expelled in 50 from the senate, although his attachment to Cæsar's party is a more plausible reason of his expulsion. In the civil war, he joined the camp of Cæsar; and in 47, when Cæsar's fortune was in the ascendant, he was made prætor-elect, and was consequently restored to his former rank. When in Campania, at the head of some of Cæsar's troops, who were about to be thence transhipped to Africa, he nearly lost his life in a mutiny.

In 46, however, we find him engaged in Cæsar's African campaign, at the close of which he was left as governor of Numidia. His administration was sullied by various acts of oppression, particularly by his enriching himself at the expense of the people. He was, for these offences, accused before Cæsar, but seems to have escaped being brought to trial. His immense fortune, so accumulated, enabled him to lay out those magnificent grounds, still known as the gardens of Sallust, on the Quirinal, to retire from the prevailing civil commotion into private life, and to devote his remaining years to those historical works on which his reputation rests. He died 34 B.C., four years before the battle of Actium. His histories, which seem to have been begun only after his return from Numidia, are: 1st, The *Catilina*, or *Bellum Catilinarium*, descriptive of Catiline's conspiracy in 63, during the consulship of Cicero; 2d, The *Jugurtha*, or *Bellum Jugurthinum*, commemorating the five years' war between the Romans and Jugurtha, the king of Numidia. These, the only genuine works of S. which have reached us entire, are of great but unequal merit. The quasi-philosophical reflections which are prefixed to them are of no value, but the histories themselves are powerful and animated, and contain effective speeches of his own composition, which he puts into the mouths of his chief characters. With its literary excellence, however, the value of the *Jugurtha* stops, as in military, geographical, and even chronologi-

cal details, it is very inexact. His now lost work, *Historiarum Libri Quinque*, is believed to have described the events occurring between Sulla's death, 78 B.C., and the year of Cicero's prætorship, 66. The *Duæ Epistolæ de Republica Ordinanda*, and the *Declamatio in Ciceronem*, are of doubtful authenticity.

Apart from his literary qualities, which are rather those of an artificial than a natural writer, and which are not enhanced by his affectation of brevity, and his love of archaic expressions, S. has the merit of having been the first Roman who wrote what we now understand by 'history.' In official public life, he was more of a politician than a statesman, and the views which he supported were liberal, not so much because he loved the people, as because he hated the nobility. The best editions of his literary remains are those of Corte (Leip. 1724), Gerlach (Basel, 1823—1831), Kritz (1828—1834), Fabri (1831), Dietsch (1842), and the German critical edition of 1859.

SA'LLY-PORT, a gate or passage by which the garrison of a fortress may make a sally (through Fr. from Lat. *salio*, I leap or spring) or sudden attack on the besiegers. The name is applied to the postern leading from under the rampart into the ditch; but its more modern application is to a cutting through the glacis, by which a sally may be made from the covert-way. When not in use, sally-ports are closed by massive gates of timber and iron.

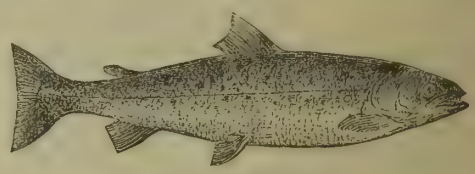
SALMASIUS. CLAUDIUS, the Latinized name of a celebrated French scholar, CLAUDE DE SAUMAISE, who was born at Semur, 15th April 1588. His father, Benigne de Saumaise, a man of superior erudition, was his first teacher. At the age of ten, young S. translated Pindar, and composed Greek and Latin verses. He studied philosophy at Paris, under the superintendence of Casaubon. From Paris he proceeded to Heidelberg, where he devoted himself to the science of jurisprudence, and publicly professed Protestantism, to which form of the Christian religion he had been secretly attached for many years. So insatiable at this time was his thirst for knowledge—book-knowledge, at least—that he was wont to devote two whole nights out of three to hard reading, in consequence of which he brought himself to within an inch of the grave. In 1608, he published from MSS. two treatises of the sectary, Nilus, Archbishop of Thessalonica, and a work of the monk Barlaam on the primacy of the pope. In 1629, appeared his chief work, *Plinianæ Exercitationes in Caii Julii Solimi Polyhistora* (2 vols., Par. 1629); after the publication of which, he set himself vigorously, and without the help of a master, to acquire a knowledge of Hebrew, Arabic, Coptic, and other oriental tongues. In 1631, he was called to Leyden, to occupy the chair that Joseph Scaliger had held there, and it is from this period that his European reputation as a scholar and critic dates. Various efforts were made (1635—1640) to induce S. to return to France, but he declined them on the ground that his spirit was too 'liberal' for his native land.

Queen Christina of Sweden, however, managed to bring him to Stockholm, and fix him there for a year (1650—1651), after which he returned to Holland. He died of a fever caught by imprudently drinking the waters at Spa, 6th September 1658. S. was certainly a great scholar of the old-fashioned clumsy sort; but neither his wit nor his acumen was sufficiently keen to give an intellectual and critical value to his lucubrations; and though all his distinguished contemporaries, Casaubon, Gronovius, Grotius, Vossius, &c., deluged him with praise; though Balzac pronounced him *infallible;* though the curators of the university of Leyden declared that 'their university could no more do without Salmasius than the world without the sun;' though Queen Christina went the length of saying, with truly royal flattery, 'that she could not live without him'—he is remembered, not for his inexhaustible stores of erudition, his editions of the classics, or his treatises on classical antiquities, but for his controversy with John Milton, scarcely his inferior in scholarship, and infinitely his superior in power of brain, and in all the arts of literary warfare. The question at issue was the lawfulness of the execution of Charles I. Apart altogether from the merits of the case, the great poet utterly overwhelmed his adversary, partly by the magnificence of his language and sentiments, and partly by the unscrupulous fury of his invective. S. also is grossly abusive and acrimonious in his treatise (*Defensio Regia pro Carolo I.*, 1649): *asinus* (ass), *pecus* (beast), and such-like expressions being showered about quite freely; but he is deficient in logic, in real force of sarcasm, and in intellectual vigor generally.

SA'LMON (*Salmo*), a genus of fishes of the family *Salmonidæ* (q. v.), which as characterized by Cuvier, has teeth on the vomer, both palatine bones, and all the maxillary bones; and includes numerous species more recently divided by Valenciennes into three genera, *Salmo*, *Fario*, and *Salar:* the first characterized by a few teeth at the end of the vomer; the second, by a single line of teeth running down the vomer; the third, by two rows of teeth on the vomer, without any remarkable group at its upper end. To many naturalists, however, this division seems too artificial; and the characters, although excellent for distinguishing species, not such as ought to divide genera; an opinion confirmed by the fact, that the teeth are numerous along the vomer in the young of the species, as the Common S., which finally retain only a group of them at the end. The division made by Valenciennes separates the S., the Salmon Trout, and the Gray or Bull Trout, the only British species which ascend rivers from the sea, into the two genera *Salmo* and *Fario;* whilst the Common Trout is referred to *Salar*. A much more natural division, having regard to characters really conspicuous and important, and to the habits of the species, is the simple one of Mr. Pennell (*The Angler Naturalist*, 1863), which is really nothing more than a formal recognition of groups practically recognized by every one acquainted with the fishes which compose them: '1. The Silver, or Migratory species (i. e., those migrating to and from the sea); 2. The Yellow, or Non-migratory species; 3. The Charrs, or Orange and Red-colored species.' The present article is devoted to the first of these groups. The second is noticed in the article TROUT; the third in the article CHARR.

By far the most important of the three *Salmonidæ* which ascend the rivers of Britain from the sea is the SALMON (*Salmo salar*), in commercial importance far superior to any other fresh-water fish, both on account of the abundance in which it is procured in the northern parts of the world, and of its rich and delicious flavor. From ancient times it has furnished important supplies of food; and the S. fisheries of Britain have long been a subject of anxious attention to the legislature. Even rivers of Iceland now yield a rent, and are regularly netted for the supply of the British market, to which the S. are brought, as from other northern regions, fresh, in ice. Many rivers and streams, also, are rendered valuable by the S. which periodically visit them, as affording sport to anglers with which nothing of the same kind is deemed worthy of comparison, and those of Norway, as well as those of Britain itself, are now frequented by British anglers.

The S. is one of the largest species of the genus, having been known to attain the weight of 83 lbs., whilst S. of 40 or 50 lbs.,



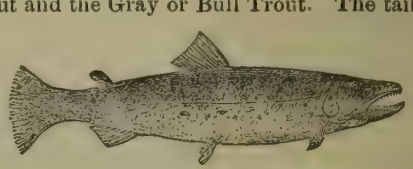
Salmon (*Salmo salar*).

and even upwards, are occasionally brought to market. Very large S., however, are not common, owing to the eagerness with which the fishery is prosecuted. No fish is more symmetrical or beautiful than the S.; and its form is admirably adapted to rapid motion even against powerful currents, by the regular tapering from the front of the first dorsal fin both to the snout and to the tail, but more suddenly in the former direction, by the nearly equal convexity of back and belly, and by the perfect smoothness and want of angularity. The head is about one-fifth of the whole length of the fish. The under-jaw of the male becomes hooked during the breeding season with a kind of cartilaginous

Salmon Trout (*Salmo trutta*).

excrescence, which is used as a weapon in the combats then frequent, wounds so severe being inflicted with it that death sometimes ensues. The lateral line is nearly straight. The scales are small, and the color a rich bluish or greenish-gray above, changing to silvery-white beneath, sprinkled above the lateral line with rather large black spots.

The opercular bones show a rounded outline at the hinder edge of the gill-covers, which at once distinguishes this species from the only other British species that can be confounded with it, the Salmon Trout and the Gray or Bull Trout. The tail is forked in



Gray, or Bull Trout (*Salmo eriox*).

the young S., but becomes nearly square in the adult. The mouth of the S. is well furnished with teeth; a line of teeth on each side of the upper jaw; an inner line on the palatine bone,

two or three in the adult state at the end of the vomer, two rows on the tongue, and one row along the outer edge of each lower jaw-bone. This array of teeth indicates voracity, and the S. seems to prey readily on almost any animal which it is capable of capturing, though it is a somewhat singular fact, that the stomach when opened is rarely found to contain the remains of food of any kind: two or three herrings of full size have, however, been found in its stomach; the sand-launce and other small fishes seems to constitute part of its food; and when in fresh water, the minnow, trout-fry, or the fry of its own species, worms, flies, &c. The angler catches S. with the artificial fly, or with the minnow or the worm; and no bait is more deadly than the roe of the S. itself, the use of which is indeed prohibited in British acts of parliament intended for the protection of the S. fisheries. The eggs of crustaceans have also been found in the stomach of the S. in such quantities as to show that they form a very considerable part of its food.

The S. is found on the coasts of all the northern parts of the Atlantic, and in the rivers which fall into that ocean, as far south, at least, as the Loire on the European side, and the Hudson on the American. Slight differences can be noted between the American and the European S., but they are not generally thought sufficient to distinguish them as species. The S. frequenting one river, are, indeed, often characteristically different from those of another river of the same vicinity. The S. is not found in the Mediterranean nor in the Black Sea, nor in any of the rivers falling into them; and in the Arctic Ocean and its rivers, as well as in the northern parts of the Pacific Ocean, other species of the same genus take its place. The preservation of S. in a fresh state by means of ice, being an invention of recent times, this fish never appeared at the luxurious tables of ancient Rome except dried or salted, although its excellence was well known, the Romans having become acquainted with it in their northern conquests. S. is in perfection for the table only when recently taken from the water; whilst the fatty 'curd' remains between the flakes of its flesh, which, however, begins to disappear within 12 hours, although otherwise the fish is quite fresh. Hence the peculiarly high value formerly ascribed in London to *Thames salmon*.

The S., after its first migration to the sea, passes a great part of its life in it, although under the necessity of periodically ascending rivers, in which the S. that ascend to spawn or for other causes in autumn, often remain during most of the winter. S. return, in preference, to the same rivers in which they have passed the earliest part of their existence; as appears both from records of marked S., and from the characteristic differences already alluded to. S. ascend rivers to a great distance from the sea, as the Rhine to the Falls of Schaffhausen, and the Elbe to Bohemia. The speed with which they glide through the water in their most rapid movements is very great; it is said to be not less than 1500 feet in a minute, or at the rate of 400 miles a day; but this, of course, is sustained only for a few moments, and the ordinary rate of progress in ascending rivers is supposed to be from 10 to 25 miles a day. The fish, also, almost always chooses to lie for a time in

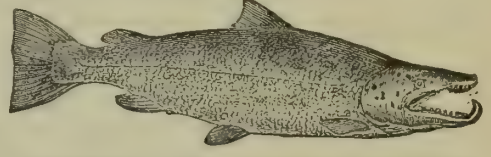
Salmon-ladder.

some spot, waiting a fresh flood in the stream. The perpendicular height which the S. can pass over by leaping, when there is abundance of water in the river and sufficient depth in the pool below the fall, seems to be not more than 12 or 14 feet; they attempt higher leaps, but often fall back exhausted, or fall on adjacent rocks, where they die or are captured. They do, however, rush up steep and broken cataracts of much greater height. The ascent of many rivers by S. has been stopped by high weirs and other obstructions; but very simple and effectual means have been devised for preventing this by *fish-stairs* or *fish-ladders*, which are often very conveniently formed by partitioning off a portion of the fall, and intersecting it from alternate sides, two-thirds of its width, by transverse steps of wood or stone, so as partially to divide it into a succession of falls. The S. soon find out the ladder, and leap up from one step to another. By this, the interests of manufacturers and of fishery proprietors are in some measure reconciled.

As the time of spawning, approaches, S. undergo considerable changes of color, besides the change of form already noticed in the snout of the male. The former brilliancy of the hues gives place to a general duskiness, approaching to blackness in the females, much tinged with red in the males; and the cheeks of the males become marked with orange stripes. S. in this state are 'foul fish,' being considered unfit for the table, and the killing of them is prohibited by British laws, notwithstanding which, however, multitudes are killed by poachers in some of the rivers, nor do those who eat them either fresh or 'kippered' (i. e., dried) seem to suffer from any unwholesomeness, such as is sometimes alleged to belong to them, although they are greatly inferior in quality to S. in other states. S., which have completed their spawning, continue for sometime, at least if in fresh water, very unfit for the table. Their capture is prohibited by British laws. They are called '*foul-fish*,' or more distinctively, '*spent fish*,' or *Kelts;* the males are also called *Kippers*, *kip* being a name for the cartilaginous hook of the under jaw, and the females *Shedders* or *Baggits*. Such names, originally local, have become of more general use from having been introduced into acts of parliament. The name *Kelt*, in particular, is now very commonly employed. When they remain for a considerable time in fresh water after spawning, kelts recover very much, and increase in weight, whereas, before spawning, there is a diminution of weight. 'A well-mended kelt' approaches in quality to a good or 'clean' S., although far from being equal to it.

The time of spawning is from the end of autumn to the beginning of spring, or even the beginning of summer; differing considerably in different rivers, whilst in each river it is prolonged throughout months, the elder and stronger fish of the former year probably ascending to spawn first. The difference of season in different rivers is probably to be accounted for by the temperature of the water, as affected by latitude, and by the relations of the river to lakes, to low warm plains, and to snow-covered mountains.

S. spawn on beds of fine gravel, in shallow parts of rivers, such



Old Male Fish, or Kipper, during the Spawning-season.

as are used for the same purpose by trout. Some beds of this kind, in salmon-frequented rivers, have been notable from time immemorial as favorable spawning-places; and large numbers of fish, both the S. and its congeners, deposit their spawn in them every year. The spawning female approaches the bed, attended by at least one male fish, sometimes by more than one, in which case fierce combats ensue; she makes a furrow in the gravel with her tail, and deposits her spawn in it, on which the male afterwards pours the vivifying melt. It was formerly believed that the furrow was in part made by the snout of the fish, and to this the snout of the male at the spawning season was supposed to be particularly adapted; but it has been found by observation that the snout is not used in this work. The eggs, when deposited and vivified, are covered by the action of the tail of the female; the male doing nothing but depositing his melt, and fighting with any other of his sex that may attempt to dispute his place.

The time occupied by a female S. in spawning is from three to twelve days. After spawning, the S. generally soon descends to the sea. The descending *kelts* are very ravenous, and therefore a great annoyance to anglers who desire to take none but *clean* fish, and must return the kelts to the water.

The eggs deposited in the spawning bed are liable to be devoured by trouts and other fishes, which are ever ready, and by insect larvæ of many kinds, which work their way even through the gravel; ducks and other waterfowl also search there for their food; and sometimes a flood changes the bed so much as either to sweep away the eggs, or to overlay them with gravel to a depth where they are never hatched, or from which the young can never emerge. The number of eggs hatched in ordinary circumstances must be small in proportion to the number deposited, and by far the greater part of the fry perish before the time of descent to the sea.

In from thirty to sixty days after the deposition of the eggs in the spawning bed, they begin to show signs of life, and the eyes appear as small specks. The time which elapses before the egg

is hatched varies according to the temperature of the water, and therefore is generally shorter in England than in Scotland, 140 days being sometimes requisite in cold climates and late springs; whilst it has been found that in a constant temperature of 44° F. sixty days are enough, and in a higher temperature eggs have been hatched even in thirty days. A temperature above 70° F.

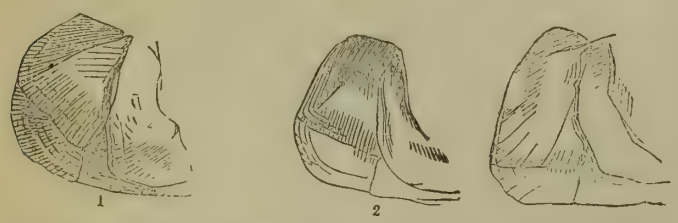
Salmon Ova, and Newly Hatched Fish.

(Copied from the *Field* newspaper.)

1, egg of salmon, natural size, just taken from the parent fish; 2, the same, with the eyes of the young fish just becoming apparent; this takes place about the thirtieth or thirty-fifth day, according to the temperature; 3, the young fish coiled up in the egg, and just ready to be hatched; 4, the young fish emerging from the shell; 5, the empty egg-shell, showing longitudinal rent made by the young fish; 6, young salmon about two days old, natural size; 7, the young salmon (about two days old), magnified; the umbilical vesicle, containing the yelk and the oil globules, and blood-vessels ramified on its surface; also the head with the huge eyes and badly-developed mouth (a portrait); the fins and the thin transparent body, the fins not as yet being developed into their proper shape, are carefully delineated.

is, however, fatal to them. S. eggs are easily hatched in an aquarium, in which proper care is taken to prevent stagnation of the water, so that the conditions may resemble those of a bed of gravel in a running stream. Many interesting observations were thus made by the late Frank Buckland on the development of the young S., of which the results were from time to time given to the world through the columns of the *Field* and *Land and Water* newspapers, and his excellent work on *Fish-Hatching*.*

The young fish lies coiled up in the egg, which it finally bursts in its struggles to be free, and it issues with a conical bag (umbilical vesicle) suspended under the belly, containing the red yolk of the egg and oil globules, which afford it nourishment during the first five or six weeks. The mouth is at first very imperfectly developed, as are the fins, and the whole body has a shape very different from what it is soon to assume, and is very delicate, and almost transparent. The slightest injury is fatal. The length, at first, is about five-eighths of an inch. About the seventh or



Gill-covers of Salmon (1), and Salmon Trout (2). Gill-covers of Bull Trout.

eighth week, the young S. has changed into a well-formed little fish about an inch long, with forked tail, the color light brown, with nine or ten transverse dusky bars, which are also more or less distinctly visible in the young of other species of this genus, just as the young of many feline animals exhibit stripes or spots which disappear in their mature state. The fry, previously very inactive, now begin to swim about, and seek food with great activity, and are known as PARR, or SAMLET, and also in some places by the names *Pink*, *Brandling*, and *Fingerling*. The Parr was formerly supposed to be a distinct species (*S. salmulus*), an opinion to which many anglers, eager to enjoy their summer holidays, and catching parr by scores with the artificial fly or worm when they can catch nothing else, have clung tenaciously, after it has been shown to the satisfaction of all naturalists that the parr is nothing else than the young salmon. The honor of proving this belongs to Mr. Shaw, of Drumlanrig, Dumfriesshire, by experiments made in 1834—1836. They have been fully confirmed at the salmon-breeding ponds of Stormontfield, on the Tay.

It was long urged, to prove the parr a distinct species, that the male parr is very often found with the milt perfect, to which, however, it was replied that the female parr is almost never found with perfect roe. But the remarkable fact has now been abundantly proved that the male parr is capable of impregnating the roe of the female S., and thus a provision seems to be made in nature to prevent an otherwise possible loss of roe. And, indeed, ridiculous little parrs seem to be always ready at hand to perform this service during the combats of the great fish, or in their absence. Another remarkable fact has been discovered, that some parrs descend to the sea in their first year, whilst others remain in the fresh water, and in the parr state, without much increase of size for another year, and a few even to the third year. At Stormontfield it has been found that about one-half of the parrs migrate when a year old. No reason can be assigned for these things; the facts alone are known to us, and have but recently been established.

The parr attains a size of from 3½ to 8 inches. When the time of its migration comes, usually in May or June, it assumes brilliant silvery hues, the fins also becoming darker, and is then known as a *Smolt*. Groups of smolts, 40 to 70 in a group, now descend, not very rapidly, to the sea. They remain for a short time in brackish water, and then depart from the estuary. Of their life in the sea nothing is known, except that they increase in size with wonderful rapidity; for it has been found that smolts which had been marked, returned to the same river in six or eight weeks as *Grilse* of three to five pounds, or, after a longer period, even of eight or nine pounds. Some reascend the rivers when only a pound and a half or two pounds weight, and these are in some places known as *Salmon Peal*. Grisle are captured in great numbers in the latter part of summer and in autumn, but very few are seen in the earlier part of the fishing season.

The grilse usually spawns on its first return to the fresh water—often remaining there for the winter, and on again descending to the sea assumes the perfect characters of the mature salmon. Little increase of size ever takes place in fresh water; but the growth of the S. in the sea is marvelously rapid, not only on its first migration, but afterwards. A kelt caught by the late Duke of Athole on 31st March weighed exactly ten pounds. It was marked, and returned to the Tay, in the lower part of which it was again caught, after five weeks and two days, when it was found to weigh twenty pounds and a quarter.

The statistics of S. fisheries are, like those of other fisheries, very imperfect. It is impossible to ascertain the total annual value of the S. fisheries even of Great Britain and Ireland; but it must be reckoned by hundreds of thousands of pounds. 'From the Reports of the Irish Commissioners, we learn that, in 1862, apparently an ordinary year, three Irish railways conveyed 400 tons, or about 900,000 lbs. of salmon, being equal in weight and treble in value to 15,000 sheep, or 20,000 mixed sheep and lambs. In Scotland, the Tay alone furnishes about 800,000 lbs., being equal in weight and treble in value to 18,000 sheep [and lambs]. The weight of Salmon produced by the Spey is equal to the weight of mutton annually yielded to the butcher by each of several of the the smaller counties. . . . . And in making comparisons between the supplies of fish and of flesh, it must be kept in mind that fish, or at least salmon, though higher in money value, cost nothing for their keep, make bare no pasture, hollow out no turnips, consume no corn, but are, as Franklin expressed it, "bits of silver pulled out of the water." '—(Russel, *The Salmon*, p. 12). In 1880, the number of boxes of S. sent from Scotland to London was 17,408; from Ireland, 9666; from England, 1993. The other British species yet to be noticed in this article are reckoned with the S. itself in all that relates to S. fisheries.

The S. fisheries of the British rivers have in general much decreased in productiveness since the beginning of the present century, which is very much ascribed to the introduction of fixed or standing nets along the coast, by which S. are taken in great numbers before they reach the mouths of the rivers to which they are proceeding, and in which alone they were formerly caught; it having been discovered that S. feel their way, as it were, close along the shore for many miles towards the mouth of a river, feeding, meanwhile, on sand-launces, sand-hoppers, and other such prey. It is also partly owing to the destruction of spawning fish by poachers; and in no small measure to the pollution of rivers consequent on the increase of population and industry, and to the more thorough drainage of land, the result of which has been that rivers are for a comparatively small number of days in the year in that half-flooded condition in which S. are most ready to ascend them. The last of these causes is the most irremediable; but if the operation of the others were abated, it would not of itself be sufficient to prevent a productiveness of our rivers much greater than the present. The efforts which have begun to be made by breeding-ponds (see PISCICULTURE) to preserve eggs and fry from destruction, and so to multiply far beyond the natural amount the young S. ready to descend to the sea, promise also such results as may yet probably make the supply of S. *far* more abundant than it has ever been. There is reason to think that the produc-

* See the *Acclimatization of the Salmonidæ at the Antipodes*, by A. Nicols (1882).

tiveness of the waters may be increased as much as that of the land.

The stake net is the most deadly of all means employed for taking S.; and its use is prohibited in estuaries and on some other parts of the coast. It consists of two rows of net-covered stakes so placed between high and low water marks, that S. coming up to them, and proceeding along them, are conducted through a narrow opening into what is called the *court* of the net, from which they cannot find the way of escape. The *cruive*, which is now illegal in all parts of Britain, is an enclosed space formed in the wall of a dam or weir, into which the S. enter as they ascend the stream, whilst a peculiar kind of grating prevents their return. The nets employed for catching S. in rivers and estuaries are of many different kinds. In many places a small boat, or *salmon coble*, is used to carry out a seine net from the shore, setting (*shooting*) it with a circular sweep, the concavity of which is towards the stream or tide, and men stationed on shore pull ropes so as to bring it in by both ends at once with whatever it may have enclosed. Coracles (small boats of basket-work or a light wooden frame covered with canvas and tar, or other waterproof material) are used in S. fishing in the Severn and other Welsh rivers. Nets which a single man can carry and work are also used in many rivers and estuaries, as those called *halves* on the Solway, which may be described as a bag attached to a pole. Dogs have sometimes been trained to drive S. into nets, and some dogs have attained great expertness in catching S. without any assistance.

The SALMON TROUT (*S. trutta*, or *Fario argenteus*), also very commonly called the SEA TROUT, is rather thicker in proportion to its length than a S. of the same size, and has the hinder free margin of the gill-cover less rounded. The jaws are nearly equal; the teeth strong, sharp, and curved, a single row running down the vomer, and pointing alternately in opposite directions. The colors are very similar to those of the S.; the sides, chiefly above the lateral line, are marked with numerous X-shaped dusky spots and there are several round dusky spots on the gill-covers. The salmon trout does not attain so large a size as the S., but has been known to reach 24½ lbs. The flesh is pink, richly flavored, and much esteemed, although not equal to that of the salmon. Great quantities of salmon trout are brought to market in London and other British towns; this fish being found from the south of England to the north of Scotland, and plentiful in many rivers, particularly those of Scotland. Its habits are generally similar to those of the salmon. Large shoals sometimes congregate near the mouth of a river which they are about to enter, and sometimes afford excellent sport to the angler in a bay or estuary, rising readily to the fly. The young are not easily to be distinguished from parr. *Phinock*, *Hirling*, and *Whitling* are local names of the salmon trout on its first return from the sea to fresh water, when it has its most silvery appearance, in which state it has sometimes been described as a distinct species (*S. albus*).

The GRAY TROUT or BULL TROUT (S. *eriox*), the only other British species migrating like these, is already noticed in the article BULL TROUT. The gill-cover in this species is more elongated backwards at the lower angle than in the other two. On the banks of the Tweed and some other rivers, it is often called the sea trout, a name quite as appropriate to it as to the salmon trout. The seasons at which the gray trout ascends rivers are partly the same with those of the S. and salmon trout, and partly different. The laws relative to the fishing of S. apply equally to the bull trout.

Of other species of S. our notice must be very brief. Cuvier has described as a distinct species a S. with hooked lower jaw, known in France by the name of *Becard*. Agassiz and Bloch regard it as merely the old male of the Common Salmon. The hooked lower jaw of the male of the Common S. in the spawning season has been already noticed. But Valenciennes adheres to the opinion of Cuvier that the *Becard* is a distinct species, and insists on the greater length of the intermaxillary bones as a sure distinctive character; asserting also that the colors are always different from those of the common S.; a general reddish-gray, the belly dull white, the back never blue, nor the belly silvery. The subject seems to require further investigation.—The HUCHO of the Danube, called *Reo* in Galicia (*S. Hucho*), attains a weight of 30 lbs., and it is said even of 60 lbs. The body is longer and rounder, the head more elongated than in the Common Salmon. The color is grayish-black, tinged with violet on the back, the sides and belly silvery. The tail is forked. The hucho spawns in June, making holes for the purpose in gravelly bottoms; and these holes are so deep that the fish lying in them often escape the nets of the fishermen. The flesh is white, but very pleasant. The same, or a very similar species, is found in the Caspian Sea, and in rivers which flow into it.—The rivers of North America which flow into the Arctic Ocean, produce several species of S., of which perhaps that most nearly resembling the Common S., in the quality of its flesh is *S. Hearnii*. In these regions, ROSS'S *S.* (*S. Rossii* or *Fario Rossii*) is extremely abundant. It is of a more slender form than the S., with remarkably long lower jaw and truncated snout; the scales separated by naked skin; the back greenish-brown, the sides pearl gray, the belly orange or red. In the quality of its flesh it is very inferior to the salmon.—*S. Scouleri*, or *Salar Scouleri*, ascends the Columbia and other rivers of the north-west coast of North America in vast multitudes. In arms of the sea on that coast it is sometimes impossible for a stone to reach the bottom without touching several; and the channel of a river or a brook is often densely crowded with them. The flesh is excellent. The same species seems to ascend the rivers of Kamtchatka; but that country, the Kurile Isles, and Siberia have also species of their own. Concerning many of the species there is still great uncertainty. See SALMON, and PISCICULTURE.

ANGLING FOR SALMON.—The capture of the salmon by rod and line affords the most exciting sport of the kind. The pleasures of it have been descanted on by numerous writers, and whole treatises have been written on the minutiæ of the art. Among the more modern writers, on the subject we may name Davy, Stoddart, Colquhoun, Younger, Stewart, Francis, and Russel. The tackle used is sufficiently described in the article ANGLING; and the general principles of fly-fishing there laid down are applicable in this case. The chief specialty in salmon angling is to be able to maintain perfect coolness and vigilance when the fish is hooked. The rod must be kept at such an elevation as to bring its elasticity into play; and by allowing the line to run out as the fish dashes off, and winding it up as he returns, or by following his motions, if need be, in person, a constant and equal strain must be maintained; a sudden tug at an unyielding line, or a momentary slackening, being equally fatal. After struggling for from a quarter to half an hour (sometimes, though rarely, for two or three hours) against a steady pull, the fish generally yields to his fate and allows himself to be drawn into the shallow and landed. This is done either with the gaff; or the fisher, winding his line up within rod length and holding the top landwards, without slackening, seizes the fish with one hand by the root of the tail, and lifts, or rather slides him headforemost on to the gravel or grass.

Those rivers of Britain where the fishing is strictly preserved, still afford good sport; but of late many anglers betake themselves to Norway or even Canada for their favorite sport. In 1877 it was estimated that the salmon fishings of England were worth £30,000, of Ireland £400,000, and of Scotland, £200,000. Recently the salmon and other fish of the rivers of Britain have suffered terribly from a disease of which a cause or consequence is the growth on the fish of a fungus, *Saprolegnia ferax*. See an article by Prof. Huxley in *Nature*, vol. xxv.

SALMON-FISHERY LAWS.—The salmon is protected by peculiar laws in the United Kingdom. I. As to England.—The right to fish salmon in the sea and navigable rivers belongs to the public as a general rule; and the right to fish salmon in rivers not navigable belongs to the riparian owner on each bank, the right of each extending up to the center line of the stream. But though the public have, as a rule, the right to fish in the sea and navigable rivers, there are various exceptions, which arose in this way. Previous to Magna Charta, the crown, whether rightly or wrongly, assumed power to make grants to individuals—generally the large proprietors of lands adjacent—whereby an exclusive right was given to such individuals to fish for the salmon as well as all other fish within certain limits. This right, when conferred, often applied to the shores of the sea, but generally prevailed in navigable rivers and the mouths of such rivers. The frequency of such grants was one of the grievances redressed by Magna Charta, which prohibited the crown thenceforth from making like grants. But the then existing grants were saved, and hence every person who at the present day claims a several or exclusive fishery in navigable rivers, must show that his grant is from the crown, and is as old as Magna Charta. It is not, however, in any way necessary that he be able to produce a grant or chain of grants of such antiquity; for if he has been in undisturbed possession for a long time—say sixty years and upwards—it is presumed that such title is as old as Magna Charta, and had a legal origin. When a person is entitled to a salmon fishery (and if he is entitled to a salmon fishery he is entitled also to the trout and other fish frequenting the same place), he is nevertheless subjected to certain restrictions as to the mode of fishing salmon. These restrictions are imposed by the Salmon Fishery Acts of 1861, 1865, and 1873, which repealed prior acts of parliament.

No person is now entitled to use lights, spears, gaffs, strokehalls, snatches, or other like instruments for catching salmon; nor can fish roe be used for the purpose of fishing. All nets used for fishing salmon must have a mesh not less than two inches in extension from knot to knot, or eight inches measured round each mesh when wet. No new fixed engine of any description is to be used. A penalty is incurred for violating these enactments, and also for taking unseasonable salmon, or for taking, destroying, or obstructing the passage of young salmon, or disturbing spawning salmon. The close time, during which no salmon shall be

fished, extends from 1st September to the first February following, except that for rod fishing the close season shall not commence till 1st November. These periods may by bye-laws be slightly varied for each district. During close time no salmon can be legally sold or be in the possession of any person for sale; and such fixed engines as are still legal shall be removed or put of out gear during close time. Moreover, throughout the year, there is a weekly close time—that is to say, no person can, except with rod and line, lawfully fish salmon between 12 A.M. (noon) of Saturday to 6 A.M. of Monday following. Though owners of dams need not make fish-passes, there must be free gaps made in fishing weirs of a certain width. For the purpose of supervising the enforcement of the acts, fishery inspectors are appointed for England. Fishery Boards were established in 1866, and by bye-laws can change close seasons, license duties for fishing instruments, mesh of nets, and other matters, within limits. See also POACHING.

II. In Scotland, there are various important differences from the law of England as regards salmon fisheries. In Scotland, the general rule is that all salmon fisheries in the rivers and surrounding seas are vested in the crown, and hence no person is entitled to fish with nets or engines except he can show a grant or charter from the crown. If he can only show a general grant of fishings without specifying salmon, then it is necessary not only to produce such grant, but to show that he has been in exclusive possession for forty years and upwards of the salmon fishings. Moreover, while this right to catch salmon by nets is vested in the crown, or in some grantee of the crown, the right to angle for salmon is now held to be included, and does not belong to the riparian owner. The public, *qua* public, have no right anywhere in Scotland to fish for salmon either with net or rod. By virtue of many old statutes, all fixed engines for catching salmon are illegal, and it is settled that everything is in the nature of a fixed engine which is not held in the hand of the fishermen while they are fishing; but a mechanical contrivance, which enables the fisherman to go a little further into the river with his coble or boat, which is to drag the net, is not illegal. Stake nets, however, are not illegal if they are not in a river or the mouth of a river. In 1862 and 1868, statutes were passed for regulating the Scotch salmon fisheries. By these acts fishery districts are authorized to be managed by boards. These boards consist of the large proprietors of fisheries. The boards appoint constables, water-bailiffs, and watchers, forming a kind of river police. The board has power to assess the various proprietors in sums so as to raise funds for paying the expenses of working the act—like funds being raised in England only by license duties. The annual close time for salmon fishing is fixed by the commissioners, and varies in each district, but it generally extends from 27th August to 10th February following; the angler's close time commencing about 16th October. The commissioners are appointed by the Home Secretary, their duties being to fix the limits of fishery districts and of rivers, to make general regulations as to close time, cruives, nets, &c. The Scotch acts imitate the English acts in prohibiting fishing with lights or salmon roe, with nets having small meshes, &c. And there is a weekly close time from 6 P.M. on Saturday to 6 A.M. on Monday following.

III. Ireland.—The Irish salmon fishery laws are regulated chiefly by statutes distinct from those of England. Fishery districts are there established, and the fisheries are subject to rates and license duties for the purpose of raising funds. There is an annual and weekly close time, and fixed engines are prohibited, and free gaps enforced in all fishing weirs.

SALMON OF NORTH-WESTERN AMERICA. The rivers of North-western America abound in salmon and trout to a degree not exceeded, and perhaps not equalled, in any other part of the world. Since the article SALMON was written, a very interesting account of the most important species has been given by Mr. J. K. Lord, in his work entitled *The Naturalist in Vancouver Island and British Columbia* (2 vols., Lond. 1866), to which we are indebted also for accounts of the Candle-fish, Vancouver Island Herring, and viviparous Fish. The first place must be given to *Salmo Quinnat*, of which Quinnat is one of the Indian names, a fish similar in quality to our European salmon, and sometimes 70 lbs. in weight. It is very thick in proportion to its length, the dorsal outline slightly arched, almost forming a notch with the tail. The back is light steel blue, shading to a lighter tint on the sides, and imperceptibly changing to gray or silvery white, blushed over with pink, on the belly. The upper parts, and often also the lower, are thickly spotted with black stars. Salmon of this species ascend the Columbia, the Fraser, and other rivers in prodigious numbers, at the spawning season, and proceed hundreds of miles, and even in the Columbia 1000 miles, from the sea into every rivulet, 'filling even pools left on the prairies and flats by the receding floods.' In what multitudes they crowd up the rivers will be even better understood from the following statements of Mr. Lord, relating to a tributary of the Fraser. 'About a mile from my camp was a large patch of pebbly ground, through which a shallow stream found its way into the larger river. Though barely of sufficient depth to cover an ordinary-sized salmon, yet I have seen that stream so filled, that fish pushed one another out of the water high and dry upon the pebbles. . . . . With one's hands only, or, more easily, by employing a gaff or crook-stick, tons of salmon could have been procured by the simple process of hooking them out.'

Mr. Lord goes on to express his opinion that thousands of the salmon ascending the small mountain-streams never can spawn from sheer want of room. He describes them as dying by scores at the base of a waterfall which they could not leap, where, however, they persisted in remaining till they died from inanition, fresh fish coming up as the dead ones floated down. A prodigious stench arises from the multitude of dead salmon floated down the rivers. The Indians say that all the salmon of this species that come up to spawn die in the rivers; and Mr. Lord believes that few, if any, ever reach the sea again. They seem not to eat when in the fresh water, and cannot be tempted either by fly or bait, nor is any food to be found in their stomachs, although, in the stomachs of those taken in the tideway or salt water, the remains of small fish and marine animals are to be found. This kind of salmon ascends the rivers in June and July, for, unlike the salmon of Britain, it spawns in summer.—At the same time with *Salmo Quinnat*, a smaller species, called by the Indians, at the Kettle Falls, the Cha-la-lool (*Salmo Gairdneri*), ascends the rivers. Its average weight is only from eight to eleven pounds, but when it first arrives in the fresh water, its flesh is fat, pink, firm, and most delicious.—A little later in the season, comes the WEAK-TOOTHED SALMON (*Salmo paucidens*).—The autumn, also, has its supply of salmon, quite equal to that of spring in point of numbers, but inferior in quality. They ascend the rivers in September and October. The autumnal salmon (*Salmo lycaodon* of Pallas), a species known also in Northern Asia, is a dingy hook-nosed fish, called *Hooked Snout* by the fur-traders. The hooked snout, however, is peculiar to the males. Salmon of this species are to be found 'in every stream and rill where they can by any possibility work a passage,' and they often remain in fresh water, far from the sea, for four or six months, all of them becoming emaciated, and many of them dying, whilst the snout of the male becomes prodigiously elongated, and the teeth also increase into tusks. As to the multitudes of the full-grown fish of this species to be found at the proper season in the rivers of North-western America, the following extract from Mr. Lord's book is conclusive

'At Fort Hope, on the Fraser River, in the month of September, I was going trout-fishing in a beautiful stream, the Quaquealla, that comes thundering and dancing down the Cascade Mountains, cold and clear as crystal; these salmon were then toiling up in thousands, and were so thick in the ford that I had great trouble to ride my horse through: the salmon were in such numbers about his legs as to impede his progress, and frightened him so that he plunged viciously, and very nearly had me off.'—The RED-SPOTTED SALMON TROUT (*Salmo spectabilis*) is another valuable fish of the same regions. It seldom exceeds three pounds in weight. It ascends the rivers in October, when a great Indian fish-harvest takes place. This fish is readily taken by hooks baited with dried salmon-roe, or by a small shining strip fom the belly of a trout.—The OREGON BROOK TROUT (*Salmo* or *Fario stellatus*) abounds in the rivers and streams of North-western America, even to a height of 7000 feet in the Rocky Mountains. It attains a weight of three pounds, and is a delicious fish. This trout is readily taken with fly or bait.

The Indians of these regions take the salmon, as they ascend the rivers, by various contrivances. They construct weirs reaching from one side of a stream to the other, with openings, through which the fish pass into large lateral prisons of closely woven wicker. They use nets in the bays and harbors, when the salmon, pursuing anchovies and herrings, run into the net, and are caught, and thus immense numbers are taken. They construct rude scaffolds or stages of wood among the boulders on the sides of large rivers, on each of which many Indian fishers await the salmon, with small nets fastened to handles, forty or fifty feet in length. Thirty salmon an hour is not an unusual take for two Indians to land on a stage. Another and more curious method, practised at falls, is by means of great wicker hampers, about 30 feet in circumference, and 12 feet in depth, which are fastened to the smaller ends of huge trees placed so as to overhang the foaming water, and where the salmon generally leap. In each basket two naked Indians are stationed to catch and kill the fish that fall into the baskets. The Columbia River produces more salmon in one year than the whole of the rivers of the United Kingdom taken together. In an average year, the rivers of the United Kingdom have been calculated to yield about 1,000,000 salmon, while the yield of this river in 1881 was 1,500,000. The value of the British Columbia fisheries in 1881 was £300,000; 177,000 cases of tinned salmon were put up in the same year; and the number of vessels employed was 666; of persons, 2893.

SALMO'NIDÆ, a very large and important family of malacopterous fishes, of the suborder *Abdominales* (having the ventral fins on the abdomen, and behind the pectorals), nearly allied to *Clupeidæ* (the Herring family), but at once distinguished by the second dorsal fin, which they all have, and which is merely a fold of the skin, enclosing fat, whence it is called the *adipose fin*, and destitute of rays. They were all included by Linnæus in the genus *Salmo*, although now divided not only into numerous genera, but by many naturalists into several families, of which one retains the name of S., and the other principal ones are *Characinidæ* and *Scopelidæ*. The S. are generally very muscular, and possess great strength, swimming with great rapidity, even against strong currents, and some of them are capable of leaping up falls of considerable height, when there is sufficient depth of water beneath. Some of them are sea-fishes, never entering rivers, although, like the herring, pilchard, &c., they approach the shore to spawn; others are generally inhabitants of the sea, but ascend rivers to spawn, and some of them also on other occasions not yet well understood; others, again, are constant inhabitants of fresh-water lakes, or of rivers and streams. Most of them are esteemed for the table, and some are among the most esteemed of fishes.

The restricted S. of those naturalists who divide the family, are all scaly fishes, but with the head destitute of scales, and the cheeks fleshy; the upper part of the mouth is formed by the premaxillary and maxillary bones together; the branchiostegal rays are numerous; the air-bladder is large and simple; the teeth are usually small, sometimes very numerous, the tongue being furnished with them, as well as the other parts of the mouth, although others have the teeth few and small, or even wanting. They are generally voracious fishes, feeding chiefly on other fishes, crustaceans, worms, &c. The Salmon, Salmon Trout, Bull Trout or Gray Trout, Trout, Charr, Grayling, and Smelt, are familiar British examples.

The White Fish of North America is one of the most important species, and to the same genus (*Coregonus*) belong many others, inhabiting the lakes and rivers of the northern parts of the world, some of them, from their herring-like appearance, known as *Herring-Salmon* and *Freshwater Herring*. The Capelin (q. v.) is a sea-fish, never entering fresh waters. The restricted or true S. are found only in the northern parts of the world, and chiefly in the colder regions.

The *Characinidæ* also have the body scaly, and the head destitute of scales; the upper part of the mouth is formed by the premaxillaries and maxillaries together; there are only four or five branchiostegal rays; the air-bladder is divided by a constriction in the middle; the teeth are very various, wholly wanting in a few, numerous in most of the genera, present on the tongue in some, and not in others; small and feeble in some, in others large and strong; in many conical and sharp, in some flat. Most of the species feed on animal food, but a few on vegetable food alone; whilst some are omnivorous, eating with equal readiness worms or other soft animals and fruits which fall into the water. One of those feeding exclusively on vegetable substances is the Pacu (*Myletes Pacu*), a fish scarcely excelled by any as an article of food, which has teeth very like the molar teeth of sheep, and employs them in browsing on the plants that grow on rocks covered with water, near the cataracts of the rivers of Guiana, and in some of the tributaries of the Amazon. In form, it is very unlike the trout or salmon, being short, thick, and clumsy. This, however, is not unfrequent in the *Characinidæ*, which exhibit much greater variety of form than the S. proper. Thus, in some of the genus *Serrasalmo* (see PIRAYA), of which there are many species, voracious carnivorous fishes with sharp trenchant teeth, the depth of the body is almost as great as its length. The species of *Serrasalmo* are sometimes called *Saw-bellied Salmon*, from their keeled and serrated belly. The *Characinidæ* are all inhabitants of fresh waters; some of them African, but the greater number South American. Their flesh is generally much esteemed.

The *Scopelidæ* differ from both the previous sections of S. in the structure of the mouth, which is formed entirely of the premaxillary bone, the maxillary lying behind. Few of them have an air-bladder. Some are scaly, and some destitute of scales. The form of the body is salmon-like in some, but deep and compressed in others. They are generally marine, as the Argentine (q. v.), the only British species. They abound chiefly in the warmer seas; the Mediterranean produces some; but the greater number belong to the Chinese and East Indian seas. Some are in high repute for their fine flavor.

Australia produces none of the Salmonidæ. The rivers and streams of that region, however, as well as those of New Zealand, Patagonia, and the Falkland Islands, produce a number of species of *Galaxias*, a genus of very trout-like form, but with no scales and no adipose fin. They are called *trouts* by the colonists in Australia and New Zealand, but are of very inferior quality for the table.

SALOMON, JOHANN PETER, an eminent musician, violin-player, and composer, born at Bonn in 1745. When young, he was attached to the service of Prince Henry of Prussia, for whom he composed several operas. In 1781, he visited Paris, and afterwards London, where he met with so warm a reception, that he was induced to settle there. His series of subscription concerts in London, in 1790, form an era in the history of music, in so far as they led to the production of Haydn's twelve grandest symphonies, known as the Salomon set. In 1800, S. retired from public life, but continued to compose songs, glees, and violin solos and concertos. He died in 1815, and was interred in Westminster Abbey.

SALONI'KI (anc. *Thessalonica*, Turk. *Selanik*), a town of European Turkey, in the vilayet of the same name, and, next to Constantinople, the greatest emporium of commerce in the empire, is situated on the Gulf of Saloniki, and rises from the shore along the face of a hill. The city is enclosed by white walls, partly ancient and partly medieval, about five miles in circuit, and is surrounded by cypresses and other evergreens. As seen from the sea, it presents a bright and beautiful appearance; but its internal aspect is miserable in the extreme. The principal buildings are mosques, most of which were previously Christian churches. The *Citadel*, called by the Turks Vedi-Kuleh, or 'the seven towers,' is the ancient Acropolis; within it are to be seen the ruins of a triumphal arch belonging to the time of Marcus Aurelius. Other relics of antiquity are the Propylæum of the Hippodrome, a magnificent Corinthian colonnade of five pillars; the triumphal arch of Augustus, erected after the battle of Philippi (now forming the gate of Vardar or Vardari); the arch of Constantine, &c. S. exports the corn, cotton, wool, tobacco, beeswax, and silk of Macedonia. S. is connected by railway with Uskub, nearly 100 miles inland. In 1874, 1634 vessels, of 584,825 tons, entered and cleared the port. Pop. 70,000, of whom 30,000 are Turks, 20,000 Greeks, and 20,000 Jews.

S. was at first called Therma, under which designation it is mentioned in connection with the march of Xerxes through Greece. It was rebuilt by Cassander about 315 B.C., who probably named it Thessalonica in honor of his wife; and during the Roman-Macedonian Wars, it figures as the principal station of the Macedonian fleet. After the close of the civil wars, its prosperity rapidly increased, and for three centuries it was the first city in Greece. It was early the seat of a Christian church. During the barbarian invasions, it proved the great bulwark of the Eastern empire. It was thrice taken in the middle ages—first, by the Saracens in 904; secondly, by the Sicilian Normans in 1185; and thirdly, by the Turks under Amurath II. in 1430.

SALOO'P. See SASSAFRAS.

SA'LOP. See SHROPSHIRE.

SA'LPA, a genus of Molluscoids, of the division *Tunicata*, in which there is no shell, but a leathery tunic with two apertures; the type of the family *Salpidæ*, which float in the sea, and have the tunic transparent and elongated. They are allied to *Ascidia* (q. v.), although not fixed like them, and have two openings, through the hinder of which the water enters, and is expelled through the anterior by a regular contraction of the mantle, so that the animal is impelled through the water in a backward direction, without any apparent voluntary action. The *Salpæ* are sometimes solitary, and sometimes united in long chains, those in chains having the contractions of the individuals simultaneous; but the solitary *Salpæ* appear to be the parents of those which are in chains, and they in turn give birth to solitary individuals very different from themselves. The whole texture is very delicate, so that the animal is sometimes scarcely to be discerned, except from its iridescent hues in the sunshine, which make chains of *Salpæ*, when very numerous, a conspicuous feature in the surface of the great deep in tropical regions. The orifices of the alimentary canal are not near together, as in *Ascidia*, but at opposite extremities of the body.

The branchial chamber of *Ascidia* is represented by a wide membranous canal, traversed by a long vascular ribbon, which is continually exposed to the water that passes through the canal. The *Salpæ* united in chains have no organic connection, but apparently adhere together by little suckers.

SAL PRUNELLE. See NITRE.

SA'LSAFY, or SALSIFY (*Tragopogon porrifolius*), a biennial plant growing in meadows throughout Europe, not common, and perhaps not truly indigenous in Britain; cultivated in gardens for the sake of its root, which is used in the same manner as the carrot, and is very delicate and pleasant, with a flavor resembling asparagus or scorzonera. The root is long and tapering, and in cultivation white and fleshy, with much white milky juice; the stem 3—4 feet high, with smooth and glaucous leaves, which resemble those of leek; the flowers are of a dull purple color. The seed of S. is sown in spring, and the root is ready for use in winter. In the following spring, when the flower-stalks are thrown up, they are used like asparagus. Owing to a peculiar mode in which the roots are sometimes dressed, so as to have a flavor

somewhat like that of oysters, S. is sometimes popularly called the *Oyster Plant.*—The genus *Tragopogon* belongs to the natural order *Compositæ*, suborder *Cichoraceæ*, and is distinguished by one row of 8—10 bracts united at the base, a punctured receptacle, feathery pappus, and striated achenia with long beak.—The PURPLE GOAT'S BEARD (*T. pratensis*), a native of Britain was formerly cultivated in England for its roots, which are similar in quality to salsafy.

SALSE'TTÉ (native name *Sáshti*), an island on the west coast of British India, in the presidency of Bombay, lies immediately north of Bombay, with which it is connected by a long peninsula, and by an artificial embankment called Zion's Causeway. It is 18 miles long, and 11 miles in extreme breadth. Pop. about 50,000. It is beautiful, picturesque, and densely wooded, is diversified by mountain and hill, and contains many fertile tracts. Sugar, indigo, cotton, flax, and hemp are grown. Thanah, the chief town, stands on the east coast, 20 miles north-north-west of Bombay by the Great Indian Peninsular Railway, which, after traversing the islands of Bombay and S., crosses to the continent half a mile to the south of this town. Pop. about 12,000. A number of remarkable caves, called the Caves of Kánhari or Kenery, are found in the middle of the island, five miles west of Thanah. They are nearly a hundred in number, are all excavated in the face of a single hill, and contain elaborate carving. The caves are in six stories, on the ledges of the mountain, and the stories are connected by stairs cut in the rock. The cave first approached consists of three chambers, one unfinished, and dates from the 9th or 10th c. A.D.; it contains no figures or carvings. The other caves contain numerous carved representations of Buddha, many of them of colossal size. Relics and inscriptions are also found. There are caves in several localities of the island, besides those of Kánhari—e. g., those of Montpezir, Magatani, and Jageshwar. The caves are frequently the haunts of serpents and tigers. On the north, on the coast, is the small watering-place of Ghorá Bandar, which has been designated the Montpelier of Bombay. The fort of Thanah and the island of S. were taken by the English in 1774.

SALT, MANUFACTURE OF. See SODIUM. Common salt is either procured in the solid crystalline state, called *Rock-salt* (q. v.), as a natural brine from wells or springs, or by the evaporation of sea-water. In the first case it is obtained by mining, often at great depths, as at Northwich in Cheshire; at Salzburg, Magdeburg, Berchtesgaden, and Wimpfen in Germany; Cracow in Poland; in the Punjab and other parts of the world.

Rock-salt almost always contains impurities, and therefore is dissolved in water, and the insoluble matters mixed with it are deposited at the bottom. The brine is then drawn off, and evaporated by artificial heat in large iron pans.

Natural brine is obtained at Droitwich and Stoke in Worcestershire, and Nantwich in Cheshire. At Droitwich the shaft is only sunk 175 feet, and the brine rises to the surface, and overflows if not pumped. There are, however, reservoirs made for it, into which it is pumped, and from which it is distributed to the various works, which are little more than large sheds, with numerous openings in their roofs, to allow the steam free egress. Flues run from end to end of the floors, and on these rest the iron evaporating pans which are about 65 feet long by 25 broad, and about 18 inches in depth. In other places, very deep shafts have been sunk, and the brine requires to be pumped from a great depth. The flues heat the brine nearly to boiling-point, and as a large surface is exposed, the evaporation is very rapid, and the crystals are small, as in the fine table-salt. If, however, the heat is more gentle, the salt is coarser, and is fit for curing meat, fish, &c.; and when very slow, a much coarser kind, called *bay-salt*, is produced.

Salt is obtained from sea-water in many parts of the world, and this is effected by simply evaporating it in brine-pits or shallow square pools, dug on the shore for the purpose. When the evaporation has proceeded to a certain extent, the liquid assumes a reddish color; a pellicle of salt forms on its surface, which soon breaks, and sinks down, to be followed by another; and the crystallization then proceeds rapidly. When complete, the salt is removed to sheds open at the sides, and then piled in heaps, in order that the chloride of magnesium may be removed. This is very easy, for as it is extremely deliquescent, it liquefies by exposure to the atmosphere, and runs out. The salt is then redissolved and crystallized, if great fineness is required.

SALT, SIR TITUS, a public-spirited English manufacturer, born at Morley, 20th September 1803. He began business as a wool-spinner at Bradford in 1834, and was the first to introduce into England the manufacture of alpaca fabrics. He cherished a strong interest in the welfare of his work-people, and about 1850 established his factory in the healthy valley of the Aire, between Leeds and Bradford. Beside it he built the model village of SALTAIRE, containing a church, schools, a working-man's club (costing £30,000), baths, &c. The factory covers 12 acres. S. was returned to parliament in 1859, and was made a baronet in 1869 He died 29th Dec. 1876. See his life by Balgarnie (1877).

SA'LTA, a town in the north-west of the Argentine Confederation, capital of a state. It is 3900 feet above sea-level, but is unhealthy. Pop. 11,000.

SALT-CAKE is a term used for the crude sulphate of soda made from oil of vitriol and common salt, and used in preparing carbonate of soda.

SA'LTCOATS, a seaport on the Firth of Clyde, county of Ayr, 30 miles S.S.W of Glasgow. S. is a great resort of sea-bathers. Pop. (1881) 5096.

SALTI'LLO, a city of Mexico, capital of the northern state of Coahuila. Pop. 12,000. Seven miles south is Buena Vista, where in 1847 the Mexicans were defeated by the U. S. army.

SALTING, the process by which animal and vegetable substances are preserved for food by the aid of common salt. This is either done by rubbing dry salt into the flesh to be preserved, and repeating the process from time to time, until it has absorbed sufficient to arrest decomposition; or the salt is liquified with a little water, and made into brine, in which articles are placed until required for use, when a little soaking and washing removes the superfluous salt. Vegetables are only salted in the latter way; and continental nations use it extensively for the preservation of various kinds of vegetable food for winter consumption. A little saltpetre is often added, and very much increases the efficiency of the common salt. See ANTISEPTICS, FOOD.

SA'LTIRE, one of the ordinaries in Heraldry, its name of uncertain etymology, representing a bend sinister conjoined with a bend dexter, or a cross placed transversely like the letter X. Like the other ordinaries, it probably originated, as Mr. Planché suggests, in the clamps and braces of the shield. The form of the saltire has been assigned to the cross on which St. Andrew is said to have been crucified; hence the frequency of this ordinary in Scotch heraldry. A saltire is subject to the variations of being engrailed, invected, &c., and may be *couped*. When two or more saltires are borne in a shield, they are couped, not at right angles, but horizontally; and as they are always so treated, it is considered superfluous to blazon them as couped. Charges disposed in the form of a saltire are described as placed *saltireways*, or *in saltire*. The former term is more properly applied to two long charges, as swords or keys, placed across one another (in which case the rule is, that the sword in bend sinister should be uppermost, unless otherwise blazoned); and the latter to five charges placed two, one, and two.

SALT LAKE CITY, the chief town and ecclesiastical capital of the Mormon territory of Utah, U. S., is on the east bank of the river Jordan, between Lake Utah and Great Salt Lake, 20 miles south of the latter, and 4350 feet above the level of the sea, 650 miles east-north-east of San Francisco, and 1100 west of the Mississippi. It was settled by the Mormons (q. v.) in 1847, and contains 260 lots of ten acres each; 4 public squares; shaded streets 128 feet wide, through each of which flows a stream of pure water from the neighboring mountains, 10,000 feet high, from which the gardens are irrigated. The houses are chiefly built of adobes, or sundried bricks, each wife in the polygamic families having a separate entrance. The principal edifices are the Mormon Temple, the Tithing-house or Treasury, and the Social Hall, which serves for ball-room and theater. Pop. (1870) 12,854; (1880) 20,561, of whom a third are 'Gentiles.'

SALT OF SATURN, a name for acetate of lead.

SALT OF SORREL, the common name for binoxalate of potash. See OXALIC ACID.

SALT OF TARTAR, a commercial name for carbonate of potash in a very crude form.

SALT OF TIN is the term employed by the dyer and calico-printer for protochloride of tin, which is extensively used as a mordant, and for the purpose of deoxidizing indigo and the peroxides of iron and manganese.

SALT RANGE, or KALABAGH MOUNTAINS, a mountain range in the Punjab, India, lies in an east and west direction, in lat. 32° 30'—33° 20'. The range rises on the west bank of the Jhelum, runs west to the Indus, and after affording a passage to the river, reappears on its west side, and pursues the same direction till it meets with the Suleiman Mountains. The S. R. is about 200 miles in length, and varies from 2000 to 5000 feet in height. Its appearance is exceedingly bleak and barren; vegetation is seldom met with; there are no trees; and the bold and bare precipices which frequently occur, give to the range a forbidding aspect. Rock-salt is found in inexhaustible quantities, and so pure, that after being pounded, it is ready for use. Alum, iron ore, coal, gypsum, and limestone abound; gold-dust is washed down in the sands of the rivers, and graphite is also found.

SALT, SPIRITS OF, the old name for muriatic or hydrochloric acid.

SALTS, SMELLING, a preparation of carbonate of ammonia with some of the sweet-scented volatile oils, used as a restorative by persons suffering from faintness. The pungency of the ammonia is all that is useful, and the oils are added to make it more agreeable. Oils of lavender, lemon, cloves, and bergamot are those chiefly used. The celebrated Preston smelling-salts are scented with oils of cloves and pimento. The manufacture of ornamental bottles to contain this preparation is an important branch of the glass and silversmith's trades.

SALTS, THEORY OF. Any substance which is produced by the combination of a base with an acid, is commonly termed a *salt*. The base is in most cases a metallic oxide, which is capable of uniting with an acid, and of more or less completely neutralizing the distinctive properties of the latter; in some cases, however, the base is non-metallic and organic in its nature, as in the case of ammonia, morphia, quinia, strychnia, creatinine, &c.

The salts derive their generic name from common salt, now known as chloride of sodium, but till the time of Davy regarded as a compound resulting from the union of hydrochloric (or as it was then termed, *muriatic*) acid and soda. See SODIUM. Davy, however, showed that during their action upon each other, both the acid and the alkali undergo decomposition, and that while water is formed by the union of the oxygen of the alkali (NaO) and the hydrogen of the acid (HCl), the sodium of the former combines with the chlorine of the latter to form chloride of sodium (NaCl). Hence, strangely enough, the very substance from which the salts derive their name as a class, was the means of overthrowing the old idea that a salt, as a matter of necessity, must result from the union of a base with an acid. It was then proposed to divide salts into two classes—those formed by the union of a base with an oxyacid, such as nitrate of potash (KO,NO_5), formed by the union of oxide of potassium with nitric acid, sulphate of soda ($NaOSO_3$), carbonate of lime (CaO,CO_2), &c., which were termed *oxysalts;* while the other class consisted, like chloride of sodium, of a metal combined with the characteristic element (chlorine, iodine, bromine; fluorine) in a hydrogen acid or hydracid (as, for example, hydrochloric, hydriodic, hydrobromic, or hydrofluoric acid). The salts of this second class, of which chloride of potassium (KCl) and fluoride of calcium (CaF) may be quoted as examples, being constructed on the same plan or type as sea-salt, were termed *Haloid Salts* (q. v.), from the Greek word *hals*, the sea. The chlorine, iodine, bromine, or fluorine, which, in combination with a metal, forms a haloid salt, is by some writers termed a *salt-radical*.

'The great resemblance in properties between the two classes of saline compounds, the haloid and oxysalts, has very naturally led to the supposition, that both might possibly be alike constituted; and that the latter, instead of being considered compounds of an oxide and an acid, might with greater propriety be considered to contain a metal in union with a compound salt-radical, having the chemical relations of chlorine and iodine. On this supposition, sulphate and nitrate of potash will be constituted in the same manner as chloride of potassium, the compound radical replacing the simple one.

Old View.	New View.
$KO + SO_3$	$K + SO_4$
$KO + NO_5$	$K + NO_6$

Hydrated sulphuric acid will be, like hydrochloric acid, a hydride of a salt-radical, $H + SO_4$. When the latter acts upon metallic zinc, the hydrogen is simply displaced, and the metal substituted. No decomposition of water is supposed to occur, and consequently the difficulty of the old hypothesis is at an end. When the acid is poured upon a metallic oxide, the same reaction occurs as in the case of hydrochloric acid; water and a haloid salt are produced. All acids must be, in fact, hydrogen acids; and all salts haloid salts, with either simple or compound radicals.'—Fownes's *Manual of Elementary Chemistry*, 9th ed. (and compare other standard works).

This view, which is frequently termed *the binary theory* of salts, was originally suggested by Davy, but it remained for many years nothing more than (to use the words of Professor Miller) 'an elegant hypothesis,' till it was further illustrated by certain of Liebig's researches in organic chemistry, and till, in certain special cases, it received direct confirmation from the voltaic researches of Daniell and Miller, who found that when a current from two or three of Grove's cells was transmitted through fused nitrate of silver (AgO,NO_5), the latter was resolved into crystals of silver (Ag) at one pole, and NO_6 (which at once broke up into red fumes of peroxide of nitrogen and free oxygen) at the other.

But although the binary theory serves to explain in the most satisfactory way many chemical changes, as, for example, the modifications of phosphoric acid and phosphate of soda (see Miller's *Inorganic Chemistry*, 2d ed. 1860, p. 333; or Galloway's *Second Step in Chemistry*, 1864, pp. 128—130), there are many objections to it, and it will probably give place to other views regarding the constitution of salts. For a notice of these objections, we must refer to the above-mentioned works of Miller and Galloway. Some of our most eminent chemists, as, for example, the editors of Fownes's *Manual*, take a more hopeful view. According to Drs. Bence Jones and Hoffmann, 'the general application of the binary theory still presents a few difficulties. But it is very probable that the progress of discovery will ultimately lead to its universal adoption, which would greatly simplify many parts of the science.'

The salts may be arranged according to their mode of composition into:

1. *Neutral* or *Normal Salts;* 2. *Acid Salts;* and 3. *Basic Salts.* A salt is *neutral* which is composed of as many atoms or equivalents of the acid as there are of oxygen in the metallic base. If the base is a protoxide, or contains 1 atom of oxygen, 1 atom of the acid is combined with it. Sulphate of potash (KO,SO_3), nitrate of copper (CuO,NO_5), and carbonate of potash (KO,CO_2) are all neutral in their composition, each consisting of one atom of the acid in combination with one atom of a metallic protoxide. But all these salts are not neutral, if we judge of their neutrality by their exerting no action on litmus or turmeric paper, for while the first is neutral to test-paper, the second exhibits an acid, and the third an alkaline reaction; and hence the use of the term *normal*, in preference to that of *neutral*, as applied to this class, has been judiciously advocated by Miller and other chemists. If the base is a sesquioxide, three atoms of the acid combine with one atom of the base to form a neutral or normal salt: thus, the sulphates of alumina and of sesquioxide of iron are represented by the formulæ $Al_2O_3,3SO_3$ and $Fe_2O_3,3SO_3$; and as these salts not only redden litmus, but have an acid taste, they afford an additional reason for our preference to the term *normal* over *neutral* salts.

Acid Salts are generally formed by dissolving normal salts in the same kind of acid which they contain, by which means a new salt is often, but by no means always formed. Thus, if normal sulphate of potash (KO,SO_3) be dissolved in hot sulphuric acid, tablets of a new and strongly acid salt will appear as the solution cools. These crystals consist of bisulphate or acid sulphate of potash and their composition is represented by the formula $KO,HO,2SO_3$, or KO,SO_3+HO,SO_3, in which the atom of water may be regarded as acting in the character of a weak base. If a similar experiment is made of dissolving nitrate of potash in hot nitric acid, no new salt will be formed, the nitre crystallizing out unchanged. Why some acids should have the power of forming acid salts, and others should not possess the property is unknown.

In *Basic salts*, or *Sub-salts*, as they are often termed, the proportion of base predominates over that of the acid, there being two or three or more atoms of the basic oxide combined with one atom of the acid. Thus, nitric acid forms with oxide of lead not only the normal salt, PbO,NO_5, but three basic salts—viz., $2PbO,NO_5$, $3PbO,NO_5$, and $6PbO,NO_5$. Sulphuric acid forms with oxide of mercury not only the normal salt, HgO,SO_3, but the basic salt commonly known as *turpeth mineral*, and represented by the formula $3HgO,SO_3$.

There is one other class of salts requiring a brief notice—viz., the *Double Salts*. Many neutral salts containing the same acid, but different bases, may be made to combine so as to form salts of the class now under consideration. Thus, sulphate of potash and sulphate of alumina (both of which are neutral sulphates) by combining, give rise to the double salt popularly known as alum, and represented by the formula $KO,SO_3+Al_2O_3,3SO_3+24$ Aq. Similarly, double salts of silicic acid are of common occurrence. Thus, the varieties of felspar are double silicates of alumina with potash, soda, lithia, or lime, but most commonly with potash, and they may be represented by the general formula $MO,SiO_2+Al_2O_3,3SiO_2$, where MO stands for potash, soda, &c.

The salts at ordinary temperatures are solid bodies, with a strong tendency to crystallization, although a considerable number are amorphous. They may be either colorless or colored. When a colorless acid combines with a colorless base, the resulting salt does not exhibit color. A colored base combining with a colorless acid transmits its color to the resulting salts, and if a colored acid combine with the colorless base, a similar but less marked result ensues. The salts usually have a decided taste which is usually dependent on the base; the sulphites are, however, an exception to this rule, as their taste resembles that of the acid. They are variously influenced by high temperatures: some remain unchanged; while others votatilize, fuse, and either simply lose their water of crystallization, or become decomposed. Most salts are soluble in water, and some, as for example, carbonate of potash and chloride of calcium, have so strong a tendency to dissolve in that fluid, that they abstract the moisture of the atmosphere. Such salts are termed *deliquescent*. As a general rule, hot water exerts a far more powerful solvent action than cold. There are, however, some remarkable excep-

tions to this law. Thus, the solubility of common salt (chloride of sodium) is very nearly the same, whatever be the temperature of the water, and certain salts of lime are more soluble in cold than in hot water.

It has been already shown that an atom of water enters into the composition of certain salts in precisely the same way as an atom of potash or any other base. Such water is termed *basic water*, and is an integral constituent of the salt, from which it cannot be expelled by an ordinary heat. This water is quite distinct from the *water of crystallization*, which is taken up by many salts in a definite quantity, when crystallizing from water, and which is readily expelled by a gentle heat without altering the chemical properties of the salt. The crystalline form of salts which contain water of crystallization is much influenced by the proportion in which the latter occurs. Thus, green vitriol (sulphate of iron) crystallizes in two different forms and with two different proportions of water according to the temperature at which the salt separates from its solution. The number of equivalents of water of crystallization may vary from 1 to 24, which is the highest number yet observed. In order to distinguish the water of crystallization from water acting as a base, we characterize it by the symbol Aq. (from the Latin *aqua*, water). The ordinary phosphate of soda is represented by the formula $2NaO,HO,PO_5 + 24$ Aq. Many salts which contain water of crystallization (for example, sulphate or carbonate of soda) give off the whole or a part of their water of crystallization in a dry atmosphere, and crumble to powder; such salts are said to *effloresce*. Salts which contain no water of crystallization are termed *anhydrous;* of which nitre (KO,NO_5) is an example. All salts, when dissolved in water, are readily decomposed by the electric current, the base going to the negative, and the acid to the positive pole. In consequence of this result, the acid is termed the electro-negative, and the base the electro-positive constituent of the salts. When a haloid salt is similarly treated, the halogen (chlorine, &c) is separated at the positive pole, while the metal is liberated at the negative pole.

SAL'TWORT (*Salsola*), a genus of plants of the natural order *Chenopodiaceæ*, having hermaphrodite flowers, with 5-parted perianth, and a transverse appendage at the base of each of its segments, five stamens and two styles, the seed with a simple integument. The species are numerous, mostly natives of salt-marshes and sea-shores, widely diffused. One only PRICKLY S. (*S. kali*), is found in Britain. It has herbaceous prostrate, much-branched stems, awl-shaped spine-pointed leaves, and axillary solitary greenish flowers. It was formerly collected in considerable quantities on the western shores of Britain, to be burned for the sake of the soda which it thus yields. *S. sativa* is the chief Barilla (q. v.) plant of the south of Spain.

SALU'TE is a compliment paid in the Navy and Army, when a royal or other distinguished personage presents himself, when squadrons or armed bodies meet, when officers are buried, and on many other ceremonial occasions. There are several modes of saluting: firing great guns and small-arms, dipping colors, flags, and topsails, presenting arms, manning the yards, cheering, &c. A royal salute consists in the firing of 21 great guns; in the lowering by officers of their sword-points, and the dipping of the colors. A form of salute of more frequent occurrence is when a soldier 'presents arms;' or touches his cap to an officer.

SALUZZO, an episcopal city of Northern Italy, in the province of Cuneo, at the foot of the Alps. It contains a semi-Gothic cathedral built in 1480, with pillars of rare marbles, and colossal statues. Noteworthy are also the ancient civic palace, the old castle of the marquises of S. (now a prison), and a ruined abbey. Silvio Pellico was born here. Its products are grain, hemp, and wine; and its manufactures are silk fabrics and hats. Pop. of commune (1881) 15,641; of town, about 10,000.

SA'LVAGE (from Lat. *salvare*, to save) is the payment due by the owner of a ship or cargo to persons who may have been instrumental in saving it from extraordinary danger—from the sea, fire, or an enemy.

Salvage was recognized in the earliest maritime codes—as in the laws of Rhodes, Oleron, and Wisby. The law of England divides it into two classes, civil and hostile salvage. *Civil Salvage* is saving a vessel or her cargo, or part thereof, from the perils of the deep; hostile salvage recovers it from an enemy or pirate after capture. No proportion is laid down in civil salvage, as generally applicable. Each case must be decided on its own merits, the ingredients for decision being—1st, the degree of danger incurred by the salvors; 2d, the degree of peril in which the property rescued stood; 3d, the degree of skill, labor, and time evinced in the salvage; 4th, the value and nature of the property. Except where the assistance rendered has been trifling, the salvage usually ranges from a third to a half of the property saved. A royal ship is bound to aid a merchantman in distress; but it can still claim salvage. *Hostile Salvage* was fixed in 1803 at one-eighth the value of the property saved for royal ships, and one sixth for private vessels.

SALVATION ARMY is the name of a Christian organization, whose aim is to bring under the influence of the gospel the classes not reached by the ordinary home-mission agencies of the churches—the inhabitants of the lowest slums of cities, profligates, thieves, confirmed drunkards, and vagabonds. It was founded in 1865 by Mr. Booth, now called 'General' Booth, formerly a minister of the Methodist New Connection. The organization steadily grew, and in 1878 the name Salvation Army was adopted. Its members not merely fight figuratively under the Captain of Salvation, but delight in applying pseudo-military names to all their offices and actions. Thus the various local associations are called corps, and all the missionaries, male and female, are 'officers' (majors, captains, &c., as the case may be); preliminary prayer is called 'knee drill,' and devotional services are 'skirmishes,' 'engagements,' or 'field-days.' The services are highly unconventional; much use is made of processions in the streets, of banners, and of brass bands in worship. Ejaculations of applause and wavings of handkerchiefs and flags accompany the services. The doctrines are, however, those of the orthodox evangelical churches, great stress being laid on purity of heart or sanctification. The army has excited singularly keen antipathy amongst the roughest part of the population, and its members have very frequently been assaulted and maltreated, especially on occasion of processions. But they are said to have been very successful in reclaiming drunkards and criminals. In 1883, the S. A. had nearly 1000 'officers' in Britain, and had missions in the United States, in Canada, Australia, New Zealand, the Cape, and France. A biweekly paper, abounding in the military jargon of the S. A., has a circulation of 400,000. Members of the association are expected to wear a badge; and if they can, to procure a complete uniform.

SA'LVÉ REGI'NA, the first words of one of the most popular prayers in the Roman Catholic Church, addressed to the Blessed Virgin Mary. It forms part of the daily office of the Roman Breviary, and is recited at the end of 'Lauds' and of 'Complin.' But it is still more in use as a prayer of private devotion, and concludes with an earnest and tender appeal for the intercession of the Blessed Virgin with her Son, 'that we may be made worthy of the promises of Christ.'

SA'LVO is a concentrated fire from a greater or less number of pieces of artillery. Against a body of men, a salvo is generally useless, as the moral effect is greater in proportion to the area over which devastation is spread; but with fortifications, the case is otherwise. For the purpose of breaching, the simultaneous concussion of a number of cannon-balls on masonry, or even earthwork, produces a very destructive result. At Almeida, after the French had fired a few salvos of 65 guns, the castle sunk in a shapeless mass. The effect of a salvo of modern artillery, with its enormous steel shot, against iron-plated ramparts, has never yet been tried in actual war.

SAL VOLATILE, a well-known remedy for faintness, is a solution of the carbonate of ammonia, or common smelling-salts. See SALTS, SMELLING.

SA'LZBRUNN, the name of three villages, NEU, NIEDER, and OBER S., in Prussian Silesia, 37 miles south-west of Breslau; they have eight mineral springs, and much-frequented baths. Alkalo-saline water is exported. Pop. in all, 3050.

SA'LZBURG, a crown-land in the west of Austria, bounded on the west partly by Bavaria, and partly by the Tyrol. Area, 2765 sq. m.; pop. (1880) 163,566. The principal mountain-ranges are the Noric Alps, which traverse the south of S. from west to east, and rise in the Grossglockner to the height of 12,360 feet; and branches of the Rhætian Alps, which separate the Tyrol from S., and ramify throughout the middle districts of the latter, rising in the Ewiger Schneeberg to 9580 feet. Snow-fields and glaciers occur in the more elevated regions. The chief river, the Salza, drains the greater part of the crown-land, flows first east, then north, and is 147 miles in length. The climate is cold and variable, but healthy, and although, of the whole area, 2000 sq. m. are capable of bearing crops, this crown-land is inferior to most of the provinces of the monarchy in quantity and value of products. The rearing of cattle and horses is an important branch of industry. Salt is obtained in large quantities, especially at Halle (q. v.). Salzburg is the capital.

SALZBURG (anc. *Juvavia*), perhaps the most charmingly situated town in Germany, is the capital of the Austrian crown-land of the same name, and stands on both banks, but chiefly on the left bank of the Salza, 190 miles west-south-west of Vienna by railway. Here the river, banked on both sides by precipitous crags, rushes through what seems to be a natural gateway, and flows northward to its junction with the Inn.

The picturesque situation of the city is thus described by Wilkie: 'It is Edinburgh Castle and the Old Town brought within the cliffs of the Trosachs, and watered by a river like the Tay.' The heights on either bank of the Salza are crowned with edifices. That on the left, called the Mönchsberg, is surmounted

by the castle, called Hohen-Salzburg, an irregular feudal citadel of the 11th c., and, during the middle ages, the residence of the archbishops of S., who combined the dignity of princes of the German empire with their ecclesiastical rank. The castle itself is now dismantled, but still serves as a barrack. A statue of Mozart (q. v.) adorns one of the squares. Opposite Mönchsberg is the Capuzinerberg, with a convent. The cathedral, a large and beautiful Italian edifice, was built in the early part of the 17th century. The architectural taste of the archbishops has adorned the city with many beautiful edifices, chiefly in the Italian style. The city is surrounded by walls, here and there dismantled, and the bastions are for the most part in a state of decay. The city is the seat of an archbishop, and contains numerous libraries, museums, and educational and other institutions, among which is an upper gymnasium, and the *Mozarteum*. It carries on manufactures to some extent, is in communication with Vienna, Munich, and Innspruck by railway, and has a considerable transit-trade. Pop. (1880) 24,952.

SALZKA'MMERGUT, called also the *Austrian Switzerland*, one of the most picturesque districts of Europe, forms the south-west angle of the crown-land of Austria ob der Enns, between the crown-lands of Salzburg on the west, and Styria on the east. Area 249 sq. m.; population, 18,000, of whom 6500 are Protestants. The scenery combines in rare beauty the usual features of valley, mountain, and lake. The vales are clothed with a rich verdure, and are studded with clumps of fruit and forest trees; the mountains are covered with beeches and oaks; higher up with pines and larches, and in some instances are topped with everlasting snow. The highest peak, Grosse Priel, reaches an altitude of 7931 feet. But the district derives its reputation for beauty chiefly from its lakes, the largest and most famous of which are the Hallstadt and the Traun, or Gmunden lakes. They are bordered with lofty mountains, which rise sheer from the surface of the water; and their pit-like character, and the strong light and shade thrown on them from the mountains, combine to render the scenery, of which they form the center, unusually sublime. The Hallstadt and Traun lakes are connected, and indeed formed by the river Traun. The district of S. derives its name from the salt which is obtained in enormous quantities from its springs and mines. Salt being a government monopoly in Austria, the works are under the management of the *Kammer*, or exchequer. From 6000 to 7000 of the inhabitants are employed in the salt-works, and the amount annually obtained is near 50,000 tons. The chief seats of the salt-works are Ischl (q. v.) and Hallstadt. Little or no agriculture is carried on in the S., and the inhabitants not engaged in the main industry of the district are engaged in cattle-breeding and in the timber trade.

SA'LZWEDEL, a small manufacturing town of Prussian Saxony, 54 miles north-north-west of Magdeburg, on the Jeetze. It carries on sugar-refining, and manufactures of linen, woollen, and cotton fabrics. Pop. (1880) 8780.

SAMANI AND DILEMI were two dynasties which divided between them the kingdom of Persia towards the beginning of the 10th century. They both rose to power through the favor of the califs, but they speedily threw off the yoke. The Dilemi, divided into two branches, exercised sovereign authority in Kerman, Irak, Fars, Khuzistan, and Laristan, always acknowledging their nominal dependence on the calif; and during the whole period of their rule, one of the southern branch of this family was vested with the dignity of *emir-ulomra*, or vizier, and managed the affairs of the califate. Several of the Dilemi were able and wise rulers, as the remains of their works of irrigation and other structures amply testify; but Mahmud of Ghizni put an end to the rule of the northern branch in 1029, and the Seljuks subjugated the southern one in 1056, by the capture of Bagdad, their last stronghold. Their more powerful rivals, the *Samani*, had obtained from the calif the government of Transoxiana in 874 A.D.; and to this, Ismail, the most celebrated prince of the family, speedily added Khaurezm, Balkh, Khorassan, Seistan, and many portions of Northern Turkestan. Rebellions of provincial governors distracted the Samanide monarchy towards the end of the 10th c., and in 999 A.D. their dominions north of Persia were taken possession of by the khan of Kashgar, the Persian provinces being added by Mahmud of Ghizni to his dominions.

SAMAR, one of the Philippine Islands (q. v.).

SAMARA', a frontier government of Russia, bounded on the E. by the Kirghiz Steppes, and on the W. by the governments of Saratov, Simbirsk, and Kazan. Area, 64,953 sq. m.; pop. (1880) 2,143,490. It was erected into a government by ukase of Dec. 1850, and was formed out of portions of the governments of Simbirsk, Orenburg, and Saratov. The Volga, which forms the western boundary, and its affluent, the Samara, are the chief rivers. The country is very fertile, and agriculture and fishing are among the chief employments of the inhabitants. Only a comparatively small portion of the country is colonized. Chief town Samara (q. v.).

SAMARA, capital of the Russian government of the same name, on the left bank of the Volga, at the junction of that river with the Samara. It is the chief grain-market on the Volga, and it contains numerous store-houses, especially for grain. A good trade in salt, fish, caviare, and tallow is also carried on. From S. comes a great number of lambs' skins, which are famous for their fineness. Pop. (1880) 51,947.

SAMARA'NG, an important seaport on the north of Java, 385 miles (by steamboat course), east of Batavia, in 6° 57′ 20″ S. lat., and 110° 26′ 30″ E. long., is the capital of the Residency, and the point to which the produce of Middle Java is brought for exportation to Europe. Pop. 50,000. The city lies on the right bank of the river Samarang. A railway to the Vorstenlanden (Princes' Lands), 126 miles long, was completed in 1874. The Chinese, Malays, and Arabians have their own captains, and quarters of small, dark, dirty houses. The Europeans dwell partly along the sea-shore, but chiefly on the left of the river, by the shady road to Bodjong, the resident's house, which is two miles from the city. The Protestants and Roman Catholics have each a church, orphan-house, and school. There are 3 public and 12 private schools, an excellent hospital for 550 patients, and other charitable institutions.

Only small vessels can enter the river. The roadstead is exposed to the west wind, and is dangerous during the rainy season. Besides the usual trades, the natives work in gold, silver, copper, and tin. Coffee, rice, sugar, tobacco, and indigo are the chief exports, an agent of the Netherlands Trading Company (q. v.) being established at S. to attend to the government trade. In 1874, the pop. of the residency of S. amounted to 1,319,978 souls, 3050 being European, and 15,185 Chinese.

SAMA'RIA (Heb. *Shomerôn*, Chald. *Shamrayin*, Septuagint, *Samareia, Semeron*, &c.), anciently a city of Palestine, the chief seat of the Ephraimitic Baal-worship, and, from the seventh year of Omri's reign, the capital of the kingdom of Israel. It was beautifully situated on a hill about six miles north-west of Shechem, and probably derived its name (which may be interpreted 'pertaining to a watch' or a 'watch-mountain') from the position of the hill, which rises from the center of a wide valley, and commands an extensive prospec ; but an eponymous etymology is adopted by the writer of 1st Kings, who says (chap. xvi. verse 24): 'And he [Omri] bought the hill Samaria of Shemer for two talents of silver, and built on the hill, and called the name of the city which he built, after the name of Shemer, owner of the hill, Samaria.' The date assigned to Omri's purchase is 925 B.C., from which time S. became the seat of government, which had been formerly at Thirsa. It was twice besieged by the Syrians (901 B.C., and 892 B.C), under Ahab and Joram, on both occasions unsuccessfully; but in 721 (720) B.C., it was stormed by Shalmaneser, king of Assyria, after a three years' siege.

Its inhabitants, together with those of all the other 'cities of Samaria' (which had become the general name for the country itself in which the city stood), i. e., the kingdom of Israel—or the 'ten tribes'—were then carried off into a captivity from which they never returned. Their place was supplied, after a time, by colonists, planted there by Shalmaneser and Esarhaddon, from Babylon, Cuthah, Ava, Hamath, and Sepharvaim (according to 2d Kings, chap. xvii. verse 24; Media and Persia, Josephus's *Antiquities*, x. 9, 7), who constituted the original body of the people subsequently known as Samaritans, but whose bulk was gradually increased by accessions of renegade Jews and others. The question has been much, and on the whole unprofitably, discussed, whether these so-called 'Samaritans' were a mixed race of remanent Israelites and heathen Assyrians, or whether they were exclusively the latter. The mere language of Scripture, strictly construed, seems to favor the second of these views, unless the term 'cities' of 2d Kings, xvii. 24, is intended to imply that the ancient inhabitants dwelt in the open country. On the other hand, we find, apart from the other reasons against so unparalleled a wholesale deportation, Israelitish inhabitants under Hezekiah and Josiah, both in Ephraim and Manasseh. Modern authorities therefore assume that they were, to a certain extent, what they always insisted on being, Israelites—(not Jews), i. e., a people largely intermixed with Israelitish elements, that, during the exile, had adopted the worship of Jehovah. The returning Jews, however, would not recognize their claims to the participation in the national *cultus* and temple, and a bitter antagonism sprang up between the two nationalities.

In 409 B.C., a rival temple was erected on Mount Gerizim, and a rival priesthood and ritual organized, and henceforth the breach, for some periods at least, became apparently irreparable—'the Jews had no dealings with the Samaritans,' and *vice versâ*. At other periods, however, a more friendly intercourse seems to have taken place between them. The rabbinical laws respecting the 'Kushites' (Cuthim), as they were called by the later Jews, are

therefore strangely contradictory, and their discrepancies can only be explained partly by the ever-shifting phases of their mutual relations, and partly by the modifications brought about in the Samaritan creed itself. The later history of the city of S. is somewhat checkered. It was captured by Alexander the Great, when the 'Samaritan' inhabitants were driven out, and their place supplied by Syro-Macedonians. It was again taken (109 B.C.) by John Hyrcanus, who completely destroyed it. Soon rebuilt, it remained for the next 50 years in possession of the Jews; but Pompey, in his victorious march, restored it to the descendants of the expelled Samaritans, who had settled in the neighborhood, and it was refortified by Gabinius. Herod the Great rebuilt it with considerable splendor, and called it Sebaste, in honor of the Emperor Augustus, from whom he had received it as a present. In the 3d c., it became a Roman colony and an episcopal see. Its prosperity perished with the Mohammedan conquest of Palestine; and at present, it is only a small village called Sebustieh, an Arab corruption of Sebaste, but contains a few relics of its former greatness. 'Samaritans,' as a religious sect, still exist at Nablus (anc. Shechem), as they have existed in the district uninterruptedly through all the vicissitudes of war and conquest from the time of Christ. Their present creed and form of worship agree in many particulars with that of the so-called 'rabbinical' Jews, although the Samaritans pretend utterly to reject the 'Traditions.' They alone, however, have retained the paschal sacrifice of a lamb.

The language of the ancient Samaritans is a Hebræo-Aramaic dialect, but contains a number of non-Semitic (Cuthæan) words. It only survives in a few fragments of ancient literature, a translation of the Pentateuch, and some liturgical pieces. The present inhabitants speak Arabic.—See Dr. Robinson's *Biblical Researches*, Raumer's *Palästina*, and Dean Stanley's *Sinai and Palestine*, &c.

SAMA'RITAN PENTATEUCH, a recension of the commonly received Hebrew text of the Mosaic law, in use with the Samaritans, and their only canonical book of the Old Testament. Some vague allusions in some of the Church Fathers (Origen, Jerome, Eusebius), and one or two more distinct, but less generally known Talmudical utterances respecting this recension, were all the information available up to the early part of the 17th c. (1616), when Pietro della Valle acquired a complete codex from the Samaritans in Damascus. Since then, the number of manuscripts of the Samaritan Pentateuch, with and without translations (in Arabic, has considerably increased in European libraries; and fragments, consisting of special books or chapters, are of the most frequent occurrence. In fact, writing portions of Samaritan Pentateuch on the oldest of skins, would, in the face of the great demand for the article on the part of ignorant European, especially English, travelers, appear to be a favorite and lucrative pastime, if not an established trade and business, among the modern Samaritans.

These MSS. are written in the Samaritan character, a kind of ancient Hebrew writing, probably in use before, and partly after the Babylonish exile, and vary in size from octavo to folio, the writing being proportionately smaller or larger. Their material is vellum, or cotton paper, and the ink used is black, with the exception of the Nablûs MS., which is written in gold. There are neither vowels, accents, nor diacritical points, the single words are divided from each other by dots. None of the MSS. that have reached Europe are older than the 10th century. The Samaritan Pentateuch was first edited by J. Morinus in the Paris *Polyglott* (pt. iv. 1632) from *one* codex (whence it found its way into Walton), and was last re-edited, written in the square Hebrew characters, by B. Blayney, Oxford, 1790. The first publication of this strange document, and principally the *Exercitationes Ecclesiasticæ*, with which J. Morinus accompanied it, mark a certain epoch in modern biblical investigation; for, incredible as it now appears, it was placed by Morinus and his followers far above the received Hebrew text, which was said to have been corrupted from it. As reasons for this, were adduced its supposed superior 'lucidity and harmony,' and its agreement with the Septuagint in many places. This opinion, which could only have been entertained by men devoid of knowledge, was zealously cherished, and fiercely combated for exactly 200 years, when the first proper and scientific investigation (by Gesenius) set it at rest, once for all, among the learned world at least. This absurd notion chiefly owed its popularity to the anti-Jewish as well as anti-Protestant tendency of its supporters, to whom every attack against the received form of the text—that text upon which alone the Reformers professed to take their stand, was an argument in favor of the Roman Catholic dogma as to the 'Rule of Faith' (q. v.). This boasted superiority *en bloc*, gradually dwindled down to two or three passages, in which the Samaritan reading seemed preferable, and even these have now been disposed of in favor of the authorized Masoretic text.

The variants, which Gesenius was the first to arrange systematically, present simply the ordinary aspect of partly conscious, partly unconscious corruptions. They arose, for the greatest part, from an imperfect knowledge of the first elements of grammar and exegesis. Others owe their existence to a studied design of conforming certain passages to the Samaritan mode of thought, speech, and faith, more especially to show that Mount Gerizim was the spot chosen by Jehovah for his temple. There are, however, only two essential alterations respecting the Mosaic ordinances themselves to be found, one, Exod. xiii. 7, where the Samaritan Pentateuch has 'six days shalt thou eat unleavened bread,' instead of 'seven;' and Deut. xxiii. 17, where our 'shall be no' is altered into 'shall not live.' A chronological peculiarity deserves special mention—viz., that no one in the antediluvian times begets his first son in the Samaritan Pentateuch after the age of 150, either the father's or the son's age being altered in proportion; after the Deluge, however, the opposite method is followed of adding 50 or 100 years to the father's years before the begetting of a son. We will only further add that anthropomorphisms, as well as anthropopathisms, are most carefully expunged, and that in Deut. xxvii. 4, Gerizim is wilfully substituted for Ebal.

It is, in the absence of a critical edition, exceedingly difficult to do more than speculate on the age and origin of the Samaritan Pentateuch, and opinions remain indeed widely divergent. The principal opinions on the subject are, briefly, either that it came into the hands of the Samaritans as a natural inheritance from the Jewish people, whom they succeeded at the time of the Babylonish exile; or that it was brought to them by Manasse (Jos. *Ant.* xi. 8, s. 2, 4), when the Samaritan sanctuary on Mount Gerizim was founded; or, again, that the Israelitish priest sent by the king of Assyria to instruct the new settlers in the religion of the country, brought it with him. Of other more or less isolated opinions, only that one deserves further notice, that it was a late and faulty recension, into which glosses from the LXX. (Septuagint) were received. This agreement between the LXX. and the Samaritan Pentateuch, to which we have already alluded, has likewise given rise to many speculations and suggestions. The foremost of these are, that the LXX. have translated from the Samaritan Pentateuch; that mutual interpolations have taken place; that both versions were formed from Hebrew codices, differing among themselves, as well as from the authorized recension; and that many wilful corruptions have been superadded at a later time; finally, that the Samaritan has been altered from the LXX. There is also a translation of the Samaritan Pentateuch (which is Hebrew) into the Samaritan idiom; it is ascribed by the Samaritans to their high-priest, Nathaniel, who died 20 years before Christ. It was probably a kind of popular version, like the Targums (q. v.), and was composed, very likely, shortly before the destruction of the second temple. The translation is done in the most slavish and incompetent manner. Another Arabic version is due to Abu Said, in Egypt (1070), based on Saadiah's translation; and to this Samaritan-Arabic translation, a Syrian, Abu Barachat, wrote, in 1208, a commentary, which is sometimes erroneously taken to be an independent Syriac version of the Samaritan Pentateuch. Among the principal modern writers on the Samaritan Pentateuch are Gesenius, Kirchheim, and Deutsch.

SAMARKA'ND was in the 14th c. the capital of the great Tartar empire of Timur. It has since remained the center of Mohammedan learning in Central Asia. It was till 1868 the second city of the khanate of Bokhara, and since that period annexed to the dominions of the Czar, it has become one of the chief towns of Russian Turkestan. It is in lat. 40° 2′ N., and long 67° 3′ E., 4 English miles south of the Zer-Afshan (a river which 'loses itself in the sands'), and 145 miles nearly east-by-north from Bokhara. It is situated at the foot of Mount Chobanata, in a plain of exuberant fertility; and when seen from a distance, its glittering minarets, lofty domes, and prominent edifices and ruins, relieved by the brilliant green of the closely-planted gardens interspersed within the walls, present an imposing effect. The river for centuries has been changing its course, and S. has followed it—so that it consists of a 'new city,' and the ruins of those which preceded it. The 'new city' is surrounded with walls, pierced with six gates, and is filled with narrow streets and lanes, which have, however, undergone many improvements since the Russian occupation. The population, which in the 14th c. exceeded 100,000, has dwindled to 20,000. The inhabitants consist chiefly of Tajiks and Usbeks. They are chiefly employed in the manufacture of silk, wool, and leather. The old or 'ruined city' is the portion most interesting to Europeans, as the capital of that mighty conqueror who wielded the scepter of Asia from China to the Hellespont. Many of the ruins belong to this epoch, among which are the Hazreti Shah Zinde, at one time supposed to have been a summer palace of Timur, but now shown to have consisted of tombs and chapels only.

In the center of the city, separated from each other by a wide open space, stand three medresses, or sacred colleges. Each consists of a large quadrangular court, surrounded by a range of two-

storied buildings, with chambers occupied by teachers and pupils. One of the objects of interest in S. is the palace of the Emirs of Bokhara, built within the citadel, where, before the Russian conquest, they were in the habit of spending the summer months with their harem suite. In one of the courts is the famous Kuktash, or green-stone, which served as Timur's throne. The palace has now been converted by the Russians into an hospital. S. was the ancient *Maracanda*, the capital of Sogdiana. It was seized by the Arabs, 707 A.D., and from this time belonged either to the calif ate or to some of the dynasties which were offshoots from it, till 1219, when it was taken by Genghiz Khan. In 1359 it was captured by Timur, and ten years afterwards became the capital of his empire. It remained the chief town of Turkestan till 1468, when it declined in importance with the rise of the Usbeks. It retained, however, its position as the chief seat of Mohammedan learning in Asia. Until recently it had been visited by only four Europeans—in 1404 by the Spaniard Clavijo, in 1841 by Lehmann and Chanykow, and in 1863 by Vambery. But in May 1868, the gates of S. were opened to the Russians (see BOKHARA), and they have since retained possession of the city. The inhabitants have manifested less antipathy to the rule of the infidel than might have been expected, from the reputation of S. as a seat of Mohammedan fanaticism. The Jews have prospered by the encouragement given to trade; and the Tajik population have shown, as in the other cities of Turkestan annexed by Russia, goodwill towards their conquerors, and a desire to adopt European ideas.—See Vambery's *Travels in Central Asia* (Lond. 1864), and paper on 'Ruins of Samarkand,' by Professor Fedchenko, in *Proceedings of Royal Geographical Society*, December 1871.

S'AMAVEDA is the name of one of the four Vedas. See VEDA.

SAMBAS. See PONTIANAK.

SAMBOO, or SAMBUR. See RUSA.

SA'MBOR, NEW, a town of the Austrian empire, in the province of East Galicia. It is a thriving and well-built town, with manufactures of linens and extensive salt-works. Pop. 12,000.

SAMMATIYA is one of the four divisions of the *Vaidhâshika* system of Buddhism; its reputed founder was *Upâli*, a disciple of *the* Buddha, S'âkyamuni.—See C. F. Koeppen, *Die Religion des Buddha* (Berlin, 1857); and W. Wassiljew, *Der Buddhismus, seine Dogmen, Geschichte und Literatur* (St. Petersburg, 1860)

SA'MNITES, an ancient Italian people of Sabine origin, who occupied an extensive and mountainous region in the interior of Southern Italy. They were surrounded on the north by the Peligni, Marsi, and Marrucini; on the west and south-west by the Latins, Volscians, Sidicini, and Campanians; on the south by the Lucanians; and on the east by the Apulians and Frentani. The S. were divided into four nations: 1. The *Caraceni* in the north, whose capital was Aufidena. 2. The *Pentri* in the center, whose capital was Bovianum, and who constituted the most powerful nation of the Samnite stock. 3. The *Caudini*, in the south-west. 4. The Hirpini in the south, whose capital was Beneventum. For an account of their origin, ethnological affinities, and history, see ROME, HISTORY OF.

SAMO'AN ISLANDS. See NAVIGATORS' ISLANDS.

SA'MOS (Mod. Gr. *Samo;* Turk. *Susam Adassi*), an island in the Ægean Sea, is situated about a mile off the coast of Asia Minor, in the Bay of Scalanova, about 45 miles south-south-west of Smyrna. Its length is 30 miles; its mean breadth about 8 miles. A range of mountains, which may be regarded as an insular continuation of Mount Mycale, on the mainland, runs through the whole island, whence its name—Samos, being an old Greek word for any height in the neighborhood of the sea. The highest peak, Mount Kerkis (anc. *Cerceteus*), reaches an elevation of 4725 feet. S. is still, as in ancient times, well wooded. Between its eastern extremity and the mainland lies the narrow channel of Mycale (called by the Turks the *Little Boghaz*), where, in 479 B.C., the Persians were totally defeated by the Greeks under the Spartan Leotychides. Between the island and Nicaria (anc. *Icaria*), on the west is the *Great Boghaz*, from 3 to 8 miles broad, and much frequented by vessels sailing from the Dardanelles to Syria and Egypt. S. is well watered and very fertile, exporting considerable quantities of corn, grapes, wine, oil, valonia, &c.; its mountains furnish quarries of marble. The present capital, called Khora ('the town'), is situated on the south side of the island, at the base of a hill (about 2 miles from the sea), on which ruins of the ancient acropolis (*Astypalaia*) are still visible. On the north coast lies Vathy or Bathy, which derives its name from its deep (Gr. *bathys*) harbor. The pop. of the island was 35,878 in 1877.

Anciently, S. was one of the most famous isles of the Ægean. At a very remote period, it was a powerful member of the Ionic Confederacy, and (according to Thucydides) its inhabitants were the first, after the Corinthians, who turned their attention to naval affairs. Their energy and resources were soon seen in the numerous colonies which they established in Thrace, Cilicia, Crete, Italy, and Sicily. But the celebrity of the island reached its acme under Polycrates (q. v.) 532 B.C., in whose time it was mistress of the archipelago. Subsequently, it passed under the power of the Persians, became free again after the battle of Mycale, stood by Athens during the Peloponnesian War, and after several vicissitudes, became a portion of the Roman province of Asia, 84 B.C. Its later history is but the melancholy record of continuous decay, nor till the rise of the modern Greeks against the Turks did it ever again acquire distinction. When the war of independence broke out none were more ardent and devoted patriots than the Samians; and deep was their disappointment when, at the close of the sharp and brilliant struggle, European policy assigned them to their former masters. They are not, however, incorporated, so to speak, with the Turkish empire, but are semi-independent, being governed by a Fanariot Greek, who bears the title of Prince of Samos, and pays tribute to the Porte.

SAMOTHRA'CE, or THRACIAN SAMOS (Mod. Gr. *Samothraki*), an island in the north of the Ægean, north-east of Lemnos (*Stalimene*). It is a rugged and mountainous mass, about 8 miles long by 6 miles broad, towering to the height of 5240 feet, and forming the loftiest land in the whole Greek archipelago. The traveler on the plains of Troy can see its white summit shining afar in the north-west over the intervening hills of Imbros—a proof that Homer drew from personal observation when he made Poseidon watch from his Samothracian throne the events of the war. The island has not a single good port, whence Pliny calls it 'the most harborless of all isles' (*importuosissima omnium*), but there are some good anchorages. Its history is quite unimportant, and all the interest attaching to it is derived from its connection with the mysterious and gloomy worship of the Cabeiri (q. v). Pop. 5000, almost all Greeks.

SAMOYE'DES, the name of a race widely spread over the extreme north of Europe and Asia, and forming one of the four families of the great Altaian stock. Originally, the S. inhabited the whole of the vast Siberian plain from the Altai to the Arctic Sea, but for many hundred years Mongolian peoples have forced themselves in among them. Their chief seat at present is the region lying between the Obi and the Yenisei. They have been very little influenced by Russian civilization or Christianity, retain in great measure their old manners and customs, and live by fishing, or the rearing of reindeer. The most important researches concerning their ethnographic and linguistic relations have been made by Castren (q. v.).

SA'MPHIRE (*Crithmum*), a genus of plants of the natural order *Umbelliferæ;* having compound umbels, and an oblong fruit, rather flattened at the back, with five winged ridges, and many *vittae* spread all over the seed. COMMON S. (*C. maritimum*) is a perennial, native of Europe, growing chiefly on rocky cliffs near the sea. It is common in the south of England, but is rare in Scotland. Its radical leaves are triternate; those of the stem have lanceolate and fleshy leaflets. The stem is about 1½ feet high, the flowers yellow. S. makes one of the best of pickles, and is also used in salads. It has a piquant, aromatic taste. It is generally gathered where it grows wild, but is sometimes very successfully cultivated in beds of sand, rich earth, and rubbish, occasionally supplied with a little salt.—*Inula Crithmoides*, a perennial plant, allied to Elecampane (q. v.), and of the natural order *Compositæ*, a native of the sea-coasts of England, is used in the same way as S., and is often called GOLDEN SAMPHIRE.—The young shoots of *Salicornia herbacea* (see GLASSWORT) are also substituted for it as a pickle, and sold under the name of MARSH SAMPHIRE.

SA'MSOE, a small island belonging to the kingdom of Denmark, is situated in the northern entrance to the Great Belt, between Zealand and Jutland. Area, 42 sq. m.; pop. 5875. There are no towns, and the inhabitants owe the considerable comforts they enjoy entirely to the unusual fertility of their island.

SAMSON (Heb. *Shimshon*, compare *Shemesh*, sun), the son of Manoah, of the tribe of Dan, for 20 years 'Judge' over the south-western tribes of Israel—perhaps only of Dan. It would appear, however, as if this title had only been bestowed upon him as a kind of reward for his daring and extraordinary exploits against the neighboring Philistines, who at his birth held a great part of Palestine tributary. There is in the whole account of his deeds no sign of any superior authority vested in him. His history bears altogether more the general character of a popular tale, or saga, than that of a real historical account. His whole life is surrounded by a marvelous halo from his birth to his death. To his mother, long barren (cf. Gen. xviii. 10, 1 Sam. i. 2, &c., Luke i. 7, &c.), there appeared an angel, who promised her a son on the condition that he should become a Nazarite. He is born: his mother abstaining from all strong drink and unclean food before his birth. His hair, left to grow to its full length, in accordance with the Nazarite rules, endows him with a supernatural strength, which

apparently increases with each manifestation. His first feat is his tearing a lion, when on his way to ask a Philistine woman in marriage. Returning the same road, to celebrate his wedding, he finds a swarm of bees in the lion's carcass, and forthwith propounds a riddle, which, through his wife's treachery, costs 30 Philistines their lives. We need not here recapitulate the many similar exploits composing his well-known career, which he ended by pulling down the house upon himself and his enemies the Philistines, so that 'the dead which he slew at his death were more than they which he slew in his life.'

It has been matter of most contradictory speculations, how far his existence is to be taken as a reality, or, in other words, what substratum of historical truth there may be in this supposed circle of popular legends, artistically rounded off, in the four chapters of Judges (xiii.—xvi.) which treat of him. To begin with, difficulties are raised respecting the time in which he is said to have lived. While some hold him to be a contemporary of Eli and Samuel, others see in Eli his successor; others again suppose an interregnum between him and Eli. Next comes the question how he, a Nazarite, could eat honey out of the lion's carcass—a fact, by the way, entirely ignored by Josephus. The miraculous deeds he performed have taxed the ingenuity of many commentators, and the text has been twisted and turned in all directions, to explain 'rationally' his slaying those prodigious numbers single-handed; his carrying the gates of Gaza, in one night, a distance of about 50 miles, the probable distance from Hebron to Gaza, and some have indeed assumed that he did not carry them there all at once, but piecemeal. But the principal difficulty seemed to lie in the well that sprung out of the jaw-bone, and the early Jewish interpreters (Targum, Josephus) take the word Lehi to be the name of a place; a notion countenanced, so far, by Gesenius, as he allows that it might have been 'derived etymologically from this myth.'

The close parallel between the deeds of S. and those of Hercules has caused some to identify the two heroes; yet whose might be the priority, is matter of contest between the different schools of biblical criticism. It is not necessary to enlarge upon this point. It is well known how Hercules slays the Nemean lion; another formidable lion at the Mount of Cithæron; how he catches the stag of Diana and the Cretan bull; how he is kept prisoner in Egypt; how he comes to his death by the agency of a woman; not to mention the extraordinary circumstances of his birth, and the like. See HERCULES. This once popular notion, however, of seeing nothing more in S. than the Tyrian sun-god Hercules (Baal-Shemesh, 'Lord of the Sun;' Baal-Chamon, 'Lord of the Heat,' &c.), and the attempt to explain the various 'myths' accordingly, is not countenanced by most modern critics. However embellished and overladen with legends, they say, the account in the Book of Judges may be, there is hardly any doubt as to the real existence of a man S., of extraordinary prowess, who turned his whole might and strength against the hereditary enemies of his people, whose land bordered on that of the tribe to which he belonged; who, with all his blemishes, was possessed by a noble, self-sacrificing patriotism, and never for one moment forgot the chief end and aim of his life, viz., to free his people from foreign yoke. Altogether, he is too human ever to have been an allegory or a parable, the moral of which would, indeed, hardly be perceptible, or to have, as some have conjectured, 'been intended through his whole career to be a living mockery of the Philistine Hercules.'

SAMUEL (Heb. *Shemuel*, heard by or asked from God), the last *Shofet* or Judge of Israel, the 'first of prophets,' the founder of the schools of prophets and of the monarchy in Israel. He was the son of Elkanah and Hannah, a woman of no ordinary gifts, and almost a Nazarite herself, who dedicated the long yearned-for child to the Lord even before his birth. Elkanah was of Levitic descent, living, however, not among his own tribe, but in Ephraim. S., brought up in the sanctuary at Shiloh, under the eyes of Eli, there received his first prophetic call, and from that time forth, his prophetic mission was decided. For about twenty years from the death of Eli and his sons, we hear nothing of Samuel. The first public manifestation of his assumption of the office of judge, is his convoking an assembly at Mizpeh, and routing, at the head of the people, the Philistines—his first and probably his only military achievement. His occupations generally were of a more peaceful character. Dwelling in his own native city of Ramah, where he had erected an altar, he annually went 'on circuit' to the three principal sanctuaries west of the Jordan —Bethel, Gilgal, and Mizpeh, there to instruct and judge the people, and break them from their idolatrous habits, to which they were wont to yield, in imitation of the peoples around them. For the better carrying out of this purpose, he organized special schools of teachers and prophets. These seemed to have formed special colonies (Naboth, Bethel, Gilgal, Jericho), and to have moved about in large numbers. These fraternities were destined to take an important place in the commonwealth, and to exercise the greatest possible influence upon the internal as well as the external affairs of the state, while at the same time they were the teachers of the people, expounding and developing the Mosaic law, and keeping the sacred traditions alive within the houses and hearts of Israel.

The peace S. had restored—for during his lifetime those harassing raids from the neighboring tribes had entirely ceased—and the happy use he made of it by consolidating the religious institutions and the internal power and union of the people, must have impressed the latter with the advantage of being ruled by a firm and capable head and hand. It would have been easy enough for S. to have got himself elected king, of Israel, but the establishment of a dynasty appeared to him utterly contrary to the theocratic character of the law. When, however, his two sons, Joel and Abiah, whom he had installed provisional or supplementary judges, 'turned aside after lucre, and perverted judgment,' and the complaints of the people were loud about them, S., was pressed by its representatives, who foresaw a time of terrible anarchy and lawlessness at his approaching demise, and he was obliged to yield to the general wish of installing a king to judge them 'like all the nations.' See JEWS and SAUL. The further events of S.'s life, as connected with Saul, and subsequently with David, are well known, and will be found indicated briefly under those two heads. As to his character, notwithstanding the reproaches that have been heaped upon him, we cannot but see in him one of the wisest, most sagacious, unselfish, patriotic heroes. He was, doubtless, severe and energetic in the extreme, following the path that seemed to him indicated by Jehovah as the only one leading to the common welfare. Gifted with both the spiritual and worldly supreme power over the people, at a time when they had neither political unity, nor laws, nor a *cultus*, he succeeded in rousing the public spirit, in uniting all the tribes under one banner, and in shaking off the Philistine yoke.

He routed idolatry, and raised by the institution of prophetic schools, the Mosaic religion to the highest eminence, while they at the same time formed a healthy counterpoise to priestcraft. That on finding Saul negligent to certain dicta of the law, for the protection of which alone he had been elected, he casts aside all personal love and fear, and for the sake of saving the country, and keeping its constitutions intact, chooses another more worthy head for the commonwealth, is not more than could be expected from this most zealous champion for Jehovah's commands. The people themselves gave him the most honorable testimony for his uprightness and justice, and later ages placed him side by side with Moses.

S. seems, after having anointed David, to have retired from public action, and to have lived in comparative seclusion at Ramah—there is, at least, no further mention of him until his death. The time of his life and the period of his judgeship are not given. It may be presumed that he died not long before Saul. If the latter ruled for twenty years, it may well be that they governed together, as Josephus has it (*Ant.* vi. 14. 9), for eighteen years; his age, however, is not easily calculated, and the opinions about it vary between sixty and ninety years. He was buried at Ramah, and his tomb is still shown at Nebi Samwil, although according to Jerome, his remains were removed under the Emperor Arcadius, to Thrace. All Israel mourned him as they had mourned none since Moses. For his apparition at En-Dor, &c., see NECROMANCY.

SAMUEL (SHEMUEL), BOOKS OF, originally formed one work, but were by the LXX. and Vulg. (followed by the recent Hebrew editions since Bomberg) and the Authorized Version, divided into two books, the first closing with the death of Saul. The name they bear is derived from Samuel, as the principal figure in them. He not only stood at the head of the commonwealth at the period they treat of in a spiritual and worldly capacity, but also anointed Saul and David, and exercised an important influence upon their rule. Their contents beginning with the high-priesthood of Eli, the narrative concludes with the death of David, and thus three principal periods are noticeable—1. The restoration of the theocracy, of which Samuel assumes the leadership (I. i.—xii.); 2. The history of Saul's kingship till his death (I. xiii.—xxxi.); and 3. David's reign (II.).

The plan of the whole work is not, as has been stated, to represent one king as he ought not to be—viz., Saul, contrasted by a king after the heart of God, David; but simply to draw the development of the theocracy from the end of the period of Judges to the end of David's reign, its humiliation and its glory under Samuel and David, whose history is, to a certain extent, told with biographical minuteness, on account of their being the divinely-chosen vessels for this great work of the restoration. As to the composition and unity of the books, it has been the prevailing opinion of scholars to see in them not a loose compilation from a number of stray sources, but a consecutive narrative drawn upon ancient and authentic documents. The character of the narrative itself, occasionally dwelling at large upon biographical episodes,

occasionally assuming the brevity of a mere chronicle, and at times repeating itself at length, is quite in accordance with ancient Semitic historiography.

It has been supposed by some that the books of Samuel were composed by the same hand that wrote the books of Kings, but they belong to a much earlier period. The author appears to have lived after the separation of the kingdoms, but long before the Exile, the language being remarkably pure, and quite free from late forms and Chaldaisms. In all probability, the author was a prophet of the time of Solomon. The Talmudical notion of Samuel's authorship has been rejected by the critics, as inconsistent with the contents and circumstances of the book. There are glosses in the book due to later hands. Of sources, we only find the 'Book of Jashar' mentioned in the work. The author, if he did not use real annals of the empire, which were only first commenced under Solomon, had, at all events, a certain number of prophetical narratives of Samuel's, Saul's, and David's lives and doings before him. As regards the occasional verbal agreement between S. and Chronicles, which has often been commented upon, we may either assume that the latter drew upon the former, or that they both—which is more probable from internal evidence—drew upon the same source, and modified their accounts according to their special tendencies. Altogether, the work before us bears the character of a truly authentic record. Of modern commentators, we mention principally Hensler, Königsfeldt, Thenius, and Ewald.

SAMYDA'CEÆ, a natural order of exogenous plants, which are all trees or shrubs and all tropical, mostly American. The order contains about 80 known species, generally characterized by astringency in the bark and leaves. Some are used in medicine, to make poultices for wounds, lotions for ulcers, &c. The foliage of *Casearia esculenta* is eatable.

SANÄA', the principal district in Yemen or Arabia Felix, corresponding to the ancient Sába, or Sheba, the land of the Sabeans (q. v.). Its extent is very undefined, but it may be taken to include the country round the capital bearing the same name, to a distance of half a day's journey on the west, north, and east, and on the south it is bounded by the Teháma and the districts of Láhej and Yáffa.

While the dynasty of the Imáms existed, their sway extended over a much greater space, sometimes, indeed, over the whole of Yemen. Gradually it was encroached upon by the Sheikhs, who had been subject or tributary to them, and by the Turks. A bad system of government prepared the way for intestine strife; on the death of each sovereign, the succession was disputed, until at length the very shadow of regular government has passed away. In July 1872, S. was again occupied by the Turks, who afterwards overran the greater part of Yemen.

The city of Sanäa, once capital of the Imáms of Yemen, is situated in a deep and beautiful valley, about twenty or thirty miles in length, and six or seven in breadth, and 4000 feet above the level of the sea. The population of the city has been estimated at 40,000, and of the valley at about 70,000. This valley is bounded on the east by a high range of mountains called Jebel Nikkum, and is studded throughout its length with large villages.

The city and its suburbs are both surrounded by high walls, and, including the gardens, the circumference is about five and a half miles. The houses are of brick, well and strongly built, and most of them furnished with fountains, while the palaces of the Imáms, almost approached magnificence. The Jews, of whom even now there are about 20,000, have a quarter to themselves, distant about half an hour's walk from the Mohammedan town: it contains many buildings, once the abode of affluence and ease, but now bearing unmistakable signs of the devastation committed by the savage and fanatical Mohammedans of the city. The city walls are of unburned brick, and mounted with cannon, but they are in a very bad condition. There are four gates, and at both east and west end a castle containing a palace built in the Saracenic style with extensive gardens round them, and constructed with a view to defence, but now utterly neglected. See YEMEN.

SAN ANTO'NIO, called also San Antonio de Bexar, a city of Texas, U.S., is built near the sources of the San Antonio River, 110 miles south-west of Austin. It is one of the oldest Spanish towns on the continent, and in the Texan revolution of 1836 was the scene of the massacre of the Alamo, when a garrison of 150 men, led by Colonel Travis, and including David Crockett, was surrounded by several thousand Mexicans, and after a heroic resistance killed to the last man. It contains an arsenal and ten churches. Pop. (1870) 12,256; (1880) 20,561.

SAN CASCIA'NO, a city of Central Italy, province of Florence, and ten miles south-west of the city of that name. Pop. 6860. It is well built. The lands belonging to it produce a very strong wine, highly prized in Italy, also grain, oil, fruit, and mulberries.

SANCHUNIA'THON (SANCHONIATHON, SOUNIAITHON), the supposed author of a Phœnician history of Phœnicia and Egypt, called *Phoinikika*. He is supposed to have been a native of Berytus; and the accounts which speak of him as born at Sidon or Tyre, probably take these cities in their wider sense for Phœnicia itself. Our principal information about him is derived from Philo of Byblus, a Greek writer of the beginning of the 2d c. A.D., who translated S.'s history into his own tongue; but both the original and the translation are lost, save a few small portions of the latter, preserved by Eusebius, who uses them as arguments in a theological dispute against Porphyry. According to Philo, S. lived during the reign of Semiramis, Queen of Assyria, and dedicated his book to Abibalus, king of Berytus. Athenæus, Porphyry, and Suidas, on the other hand, speak of him as of an ancient Phœnician, who lived 'before the Trojan war.' There is also a discrepancy between the various ancient writers respecting the number of books contained in the *Phoinikika*. Orelli (1826), and after him, C. Müller (1849), published the remaining fragments of S., and the hot discussion raised on their genuineness and value is far from being settled yet. Several critics went so far as to deny the fact of the existence of a S. point blank. According to some (Lobeck, &c.), it was Eusebius; according to others (Movers, &c.), Philo, who fathered his own speculations upon an ancient authority. The latter was actuated, Movers thinks, partly by the desire of proving that the whole Hellenistic worship and religion was simply a faint imitation of the Phœnician; partly by the desire of lowering the value of the Old Testament, by showing the higher authority of the Phœnician writer; and partly, as was the fashion among the unbelieving philosophers of his age, to bring the popular creed into a bad reputation, by proclaiming his own views under the guise of an ancient sage.

Yet even those who deny the authenticity of S., agree in allowing the fragments current under his name a certain intrinsic value, they being founded on real ancient myths. This, in fact, is now, with more or less modification on the part of the different investigators, Ewald, Bunsen, Renan, &c., the prevalent opinion. Ewald contends for the real existence of a S., in which he is supported by Renan. Even if there never was a S., it was not Philo who forged him. There seems no doubt that we have but a very dim and confused reproduction of what, after many modifications, misunderstandings, and corruptions, finally passed the hands of Philo and Eusebius, and was by the Church Father, as we said, quoted in a theological disputation. Yet, even assuming the person of a S., his age—and he insists upon a very remote one indeed—must be placed much lower: into the last centuries before Christ, at the earliest. He would then, it seems, have endeavored to stem the tide of Greek superiority in all things, by collecting, grouping, and remodelling the ancient and important traditions of his own country, and thus proving to both his countrymen and to the Greeks their high importance, in comparison with the Greek productions, on the field of religion and philosophy.

The *Phoinikika* was not only a cosmogony, it would appear, but a history of his and the surrounding nations; and like similar ancient histories, it probably began with the creation of the world, and contained an account of the Jews. All the historical parts, however, are lost, and nothing remains but a fragmentary cosmogony, or rather two or three different systems of cosmogony, or, according to Movers, merely an Egyptian and Phœnician patchwork, for a brief account of which we refer the reader to the article PHŒNICIA. One of the chief difficulties for us consists in the Phœnician words of S., which Philo either translated too freely, or merely transcribed so faultily in Greek characters as to render them an everlasting puzzle.

Eusebius further contains a fragment of a treatise by S., *Peri Judaión*, but it is doubtful whether this is the work of Philo of Byblus or of S.; and if it be that of the latter, whether it is a separate work, or merely a separate chapter out of his larger work. A forgery, said to contain the whole nine books of S., and to have been found by a Portuguese, Colonel Pereira, at the convent of St. Maria de Merinhão, and to have been by him intrusted to a German corporal in Portuguese service, named Christoph Meyer, was published by Wagenfeld (Bremen, 1837), and translated into German (Lübeck, 1837), but was very soon consigned to disgrace and oblivion by Movers, K. O. Müller, and Grotefend, the last of whom had at first not only believed in its genuineness, but even written a preface to the *editio princeps*. There never was such a convent or such a colonel; but the facsimile taken by 'Pereira' in the convent in Portugal was found to have been written on paper showing the water-marks of an Osnabrück paper-mill.

SANCROFT, DR. WILLIAM, an English archbishop, historically notable as the most distinguished dignitary among the *Nonjurors* (q. v.), was born at Fresingfield in Suffolk, January 30, 1616, educated at the grammar-school of Bury St. Edmunds, and at Emanuel College, Cambridge. S. was reckoned a first-rate

scholar by his contemporaries; and in 1642, S. was elected Fellow of his college, but in the following year he was deprived of his fellowship by the Puritans for refusing the famous 'Engagement,' after which he went abroad. On the restoration of Charles II., in 1660, he was appointed chaplain to Cosin, Bishop of Durham; and after several preferments, was in 1668 made Archdeacon of Canterbury, and in 1677 was raised, against his inclination, to the first dignity in the church—the archbishopric of Canterbury.

The manner in which S. discharged his ecclesiastical duties deserves the highest commendation. He attended King Charles II. on his death-bed, and is said to have spoken very freely to the once 'merry monarch' on the nature of his past life. In 1688, along with several of his brother-bishops, he was committed to the Tower by King James II., for sending him a petition in which they explained why they could not conscientiously order his declaration in favor of liberty of conscience to be read in the churches; but in the events which immediately preceded and accompanied the great Revolution, he played a somewhat ambiguous and perplexing part. At first he refused when James asked him to sign a declaration expressing abhorrence of the Prince of Orange's invasion. Later (December 1683), he even went the length of concurring in an address to William, yet he seems from this point to have drawn back, and to have fallen under the dominion of his theory of the Divine Right of Kings. He was not present at the convention of the lords spiritual and temporal to meet the new monarch, and after the settlement, he refused, along with seven other bishops, to take the oath of allegiance to the government, in consequence of which he was suspended by act of parliament, August 1, 1689, but his actual departure from Lambeth did not take place till June 23, 1691. He then retired to his native village, where he died, November 24, 1693. See Macaulay's *History of England*, vols. ii. iii. and iv.

SANCTIFICA'TION, in distinction from justification, in the nomenclature of Protestant theology, is the process by which the Holy Spirit renews man in the divine image, destroying within him the power of evil, and quickening, educating, and strengthening in him the life of goodness and holiness. Whereas justification is considered as a judicial act on the part of God's free grace, liberating the sinner from condemnation, absolving and pardoning him once for all, sanctification is reckoned a work or process, advancing in various stages of weakness or strength, and only completed in the future life of the believer, when removed beyond the influences of sin that now surround him. In Roman Catholic theology, this distinction between the initiative of the divine life in man (justification) and its progressive development (sanctification), is not maintained, at least in the same precise and logical manner that it has been advocated by Protestants. By the latter, the distinction has been held of first-rate importance in their theological systems, and no less so in their practical conception of the Christian life.

SA'NCTUARY, a consecrated place which gives protection to a criminal taking refuge there; or the privilege of taking refuge in such a consecrated place. Among the Jews, there were cities of refuge to which the slayer might flee who killed a man unawares, and something analogous to a right of sanctuary may also be traced in pagan communities. In the ancient Greek states the temples, or at least some of them, afforded protection to criminals, whom it was unlawful to drag from them, although the food which was being supplied might be intercepted. As early as the 7th c., the protection of sanctuary was afforded to persons fleeing to a church or certain boundaries surrounding it. The canon and more ancient ecclesiastical law recognizes this protection to criminals as continuing for a limited period, sufficient to admit of a composition for the offence; or, at all events, to give time for the first heat of resentment to pass, before the injured party could seek redress. In several English churches there was a stone seat beside the altar where those fleeing to the peace of the church were held to be guarded by all its sanctity. One of these still remains at Beverley, and another at Hexham. To violate the protection of this seat, or of the shrine of relics, was an offence too grave to be compensated by a pecuniary penalty. Connected, in England, with the privilege of sanctuary was the practice of *abjuration of the realm*. By the ancient common law, if a person guilty of felony took the benefit of sanctuary, he might, within forty days afterwards, go clothed in sackcloth before the coroner, confess his guilt, and take an oath to quit the realm, and not return without the king's license. On confessing and taking the oath, he became attainted of the felony, but had forty days allowed him to prepare for his departure, and a port assigned him for embarkation, to which he must immediately repair with a cross in his hand, and embark with all convenient speed. If he failed to depart, or afterwards returned without license, he was condemned to be hanged, unless he happened to be a clerk, in which case he was allowed the *benefit of clergy*.

By the ancient canons of the Scottish councils, excommunication was incurred by the offence of open taking of theives out of the protection of the church. Some churches, however, by their superior sanctity, were held practically to afford a much surer asylum than others, and it was not uncommon for the Scottish kings, with the view of strengthening the hands of the church, to give a formal sanction to particular ecclesiastical asylums. One of the most celebrated sanctuaries in Scotland was the church of Wedale, now called Stow, where was an image of the Virgin believed to be brought by King Arthur from Jerusalem. David I. granted the 'King's Peace,' in addition to the protection of the church, to all fugitives from peril of life or limb who betook themselves to the church of Lesmahagow. The Scotch law of sanctuary or *gryth* was, however, guarded from affording too easy an immunity.

A very remarkable right of sanctuary existed in Scotland under the name of the *privilege of Clan Macduff*, which was alleged to have been granted by Malcolm Canmore on recovering the throne of his ancestors. Any person related within the ninth degree to the chief of Clan Macduff, who should have committed homicide without premeditation, was entitled, on fleeing to Macduff's Cross in Fife, to have his punishment remitted for a fine, or at least to be repledged from any other jurisdiction by the Earl of Fife. There is evidence of this privilege having saved Hugh de Arbuthnot and his accomplices from being proceeded against for the murder of John de Melvil of Glenbervie in 1421.

While the institution of sanctuary often enabled criminals to bid defiance to the civil power, it no doubt was not unfrequently a protection to the innocent, who thus escaped oppression or private enmity pursuing them under the name of law. In rude and unsettled times it seems, on the whole, to have operated beneficially by throwing the control of society into the hands of the clergy, who were less tempted than any other class to misuse that power. But as the civil power and authority of the law were strengthened, the right of sanctuary became useless and mischievous; the civil power endeavored to narrow the privilege as far as possible, while the church sought hard to preserve it. The English Reformation, though it greatly restricted, did not abolish the right of sanctuary. It was not till 1534 that persons accused of treason were debarred the privilege, and the right of sanctuary for crime was finally abolished by 21 Jac. I. c. 28. Various precincts, however, in and about London, known as sanctuaries, continued to afford shelter to debtors, all which were done away with in 1697, by Act 8 and 9 Will. IV. c. 26.

In Scotland there still exists a sanctuary for debtors in the Abbey and Palace of Holyrood, with its precincts, including the hill of Arthur Seat and the Queen's Park. The sanctuary is placed under the control of a bailie appointed by the Duke of Hamilton as heritable keeper of Holyroodhouse. When a debtor retires to the sanctuary, he has a 24 hours' protection against personal diligence; but in order to extend the privilege longer, he must be enrolled in the books of the abbey. The sanctuary affords no protection to a criminal, a fraudulent debtor, or a crown debtor; nor is it available for protection from personal execution for debts contracted within its precincts, for which the debtor may be imprisoned in the abbey jail.

SAND, GEORGE. See DUDEVANT, MADAME.

SANDALS, a covering for the feet, consisting of soles so attached as to leave the upper part of the feet bare. See SHOES.

SA'NDAL-WOOD (a name corrupted from *Santal* wood), the wood of several species of the genus *Santalum*, of the natural order *Santalaceæ* (q. v.), natives of the East Indies and tropical islands of the Pacific Ocean. S.-W. is compact and fine grained, very suitable for making work-boxes and small ornamental articles, and is remarkable for its fragrance, which however, is fatal to insects, so that cabinets of S.-W. are extremely suitable for the preservation of specimens in natural history; but it is much too expensive for general use. The odor is due to an essential oil, heavier than water. WHITE S.-W., the most common kind, is the produce of a small tree (*Santalum album*), a native of mountains in the South of India and the Indian Archipelago, much branched, resembling myrtle in its foliage and privet in its flowers. The trunk is seldom more than a foot in diameter. YELLOW S.-W. is probably produced by another species, perhaps *S. Freycinetianum* of the Indian Archipelago and Sandwich Islands, and from these regions the Chinese import it, chiefly for the purpose of burning it both in their temples and in their houses. They reduce it to sawdust, and mix it with paste before burning. Dr. Seemann has, however, recently found another and previously-unknown, species of *Santalum* (*S. Yasi*) to yield the much-valued S.-W. of the Fiji Islands, where the tree has been almost extirpated in consequence of the demand for its wood in commerce.

RED S.-W., or SANDERS, is the produce of a very different tree, *Pterocarpus santalinus*, of the natural order *Leguminosæ*, suborder *Papilionaceæ*, a native of the tropical parts of Asia, particularly of the mountains of the south of India and of Ceylon. The tree is about sixty feet high, with pinnated leaves, having gener-

ally three leaflets, and axillary racemes of flowers. The heart-wood is dark red, with black veins, and so heavy as to sink in water. It is used as a dye-stuff, and also by apothecaries to color certain preparations. The Arabs use it as an astringent, and it is the basis of some of our tooth-powders.—A deep red dye is also yielded by the chips of *Adenanthera pavonina*, a tree allied to the *Acacias* (q. v.), a native of the East Indies. The wood of this tree is sometimes called RED SANDAL-WOOD.

SANDALWOOD ISLAND called by the natives Tjindana, Sumba and Tanah Tjumba, lies in the Indian Ocean, between 9° 18′—10° 20′ S. lat. and 118° 58′—120° 43′ E. long., has an area of 4966 sq. m., and a pop. of 1,000,000. The coast is steep and rocky, so that, except at the west, south, and east corners, ships can approach quite near. The produce consists chiefly in dye-woods, ebony, timber, cotton, rice, pepper, cocoa, maize, coffee, sugar, wild cinnamon, cocoa-nuts, and various fruits. Little sandal-wood is exported, though abounding in the forests, the natives refusing to cut the trees, which they believe to be the dwellings of their ancestors' souls. Exports are: horses, timber, cotton, pepper, wax, tortoise-shell, tow made from bark, maize, and edible nests. The cliffs swarm with the *Collocalia esculenta*, and collecting the nests is a leading occupation of the men. The Sandalwood islanders belong to the Malay race, are well made, wiry, and of a brownish complexion. The most trifling causes lead them to commit suicide, a vice of rare occurrence in other parts of the archipelago.

The S. I. is nominally subject to the Netherlands, but the rajahs and regents are almost independent of foreign influence. The principal havens are at Nangamessi on the north, and Tida about the middle of the south coast, good anchorage being found in many other parts. Notwithstanding the repressive measures taken by the Netherlands government, and the destruction, in 1860, of ten vessels engaged in the slave-trade, it is still extensively carried on by the Sandalwood islanders.

SA'NDARACH, or SANDARACH RESIN, is a friable, dry, almost transparent, tasteless, yellowish-white resin, which is imported from the north of Africa. It is completely soluble in oil of turpentine, but not completely soluble in alcohol. When heated, or sprinkled on burning coals, it emits an agreeable balsamic smell. It exudes from the bark of the S. tree (*Callitris quadrivalvis*), a native of the north of Africa, of the natural order *Coniferæ*.—The quantity of S. used is not great; it is employed mostly for the same purposes as Mastic (q. v.). The finely-powdered resin is rubbed, as *Pounce*, on the erasures of writing-paper, after which they may be written upon again without the ink spreading.—The wood of the S. tree is highly balsamic and odoriferous, extremely durable and valuable.

SA'NDAY or SANDA ISLAND, one of the most northern of the Orkney (q. v.) group, contained, in 1881, 413 inhabited houses and 2082 inhabitants.

SA'NDBACH, a small market-town of Cheshire, 25 miles east-south-east of Chester by railway, on an eminence on the right bank of the Wheelock. Pop. (1881) 5493, mostly employed in silk-throwing, and in making salt and shoes.

SANDBAGS, in Military works, are canvas bags about 28 or 30 inches in length by from 14 to 16 broad. They are filled with sand or earth, and form a ready means of extemporizing a parapet or traverse against the enemy's fire; they are likewise used for protecting the head of a trench, or tamping the charge in a mine. See MINES, MILITARY. If employed as lining for embrasures or barbettes, sandbags should be covered with raw hides to prevent them from taking fire.

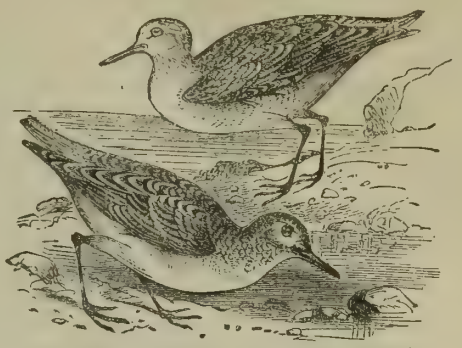
SAND BLAST, a method of engraving figures on glass or metal, or cutting away or boring holes in hard substances, by means of a stream of fine sand, driven by a blast of air or steam.

SA'NDCRACK is a splitting or fracture of the horny fibres of the horse's hoof, extending usually from above downwards; when reaching to the quick it causes lameness, and in all cases it constitutes unsoundness. Horses, with thin, weak, brittle feet, spoilt by much rasping, and rattled on the hard roads, furnish the majority of cases. The horn must be thinned for an eighth of an inch on either side of the crack; across the upper and lower ends of the crack, to prevent its extension, the firing-iron should be drawn, making a line nearly through the horny crust. The opening may further be held together by winding round the foot several yards of waxed string, or fine iron wire. Except in very bad cases, slow work on soft land may be permitted, but road work is injurious. The growth of healthy horn is promoted by applying round the coronet, at intervals of ten days, some mild blistering liniment.

SAND EEL. See LAUNCE.

SANDEMA'NIANS. See GLASSITES.

SA'NDERLING (*Calidris*), a genus of birds of the plover family (*Charadriadæ*), or which perhaps ought rather to be referred to the snipe family (*Scolopacidæ*). The Common S. (*C. arenaria*) is a very widely diffused bird, breeding in the Arctic regions, and migrating southwards on the approach of winter as far as the coasts of Africa, of India, and of Brazil. It is pretty common on the British coasts, in small flocks, in winter. It is



Sanderling, Male and Female (*Calidris arenaria*).

only about eight inches long; its winter plumage very light ash-gray, under parts white. In spring the plumage acquires a reddish tinge with black markings. The S. feeds on marine worms, small crustaceans, &c. It is esteemed for the table, and appears in the London market.

SAND GROUSE. See GANGA.

SAND-HOPPER (*Talitrus locusta*), a small crustacean, of the section *Edriophthalma* (q. v.) and order *Amphipoda*, which so abounds on the sandy sea-shores of Britain, that the whole surface of the sand often seems to be alive with the multitudes which leaping up for a few inches into the air, fill it like a swarm of dancing flies. This activity is not, however, displayed at all times; but if a mass of sea-weed left by the retiring tide be turned over, countless sand-hoppers may be seen to leap away, or they may be found by digging in the sand, in which they burrow. The S. leaps by bending the body together, and throwing it open with a sudden jerk. It feeds on almost any vegetable or animal substance, particularly on what is already dead and beginning to decay. It is itself the food of crabs, and of many kinds of birds.

SANDHURST, ROYAL MILITARY COLLEGE. In 1802 it was determined to institute a college for the training of military officers, in which professional education should be grafted on the groundwork of general instruction. The college was opened at Great Marlow; but, in 1812, it was transferred to a handsome stone building at Sandhurst. Up to 1862, this was devoted to the education of boys from the age of 13 upwards; a description of the college as then existing is given under CADETS' COLLEGE. In that year, however, the system was changed; the course limited to one year immediately before entering the army, and the subjects of instruction confined to the higher mathematics, modern languages, and military science. Entrance was on the nomination of the commander-in-chief; and the payment by the cadet's parent or guardian varies from £100 to *nil*, according to the circumstances and rank of the parent. Those for whom no payment is made must be orphans, and are styled 'Queen's Cadets.' Under the purchase system, all first commissions in the cavalry and infantry of the line, which were granted without purchase, and not to men from the ranks, were given to cadets from the Royal Military College, who competed for these prizes, and obtained them in order of merit.

The abolition of purchase in 1871 brought about a radical change. The students are no longer boys intending to become officers: but sub-lieutenants, who, having passed by competition for the army, spend a year at Sandhurst in acquiring the theoretical part of the war science. To be confirmed in the army as lieutenant, the officer must pass creditably out of Sandhurst, and then serve a year on probation with a regiment. It cannot be doubted that this change of system must tend, as years go on, to secure for the army a great body of scientific officers.

The Staff College (q. v,) is a separate institution, about two miles distant.

The estimated charge for the Royal Military College for 1881—1882 was £40.642, of which about £5000 is covered by the payments for the students.

SA'NDHURST, a town of Victoria, 82 miles north-north-west from Melbourne, on the railway between Melbourne and Ebuca. It is the center of an important mining district of the Bendigo gold-fields. Pop. (1881) 28,128. The mines in the S. district, which comprehend nearly 800 auriferous quartz reefs, give employment to about 7000 men, of whom above 800 are Chinese.

SA'NDIVER, a product of the glass furnaces. When the materials used in the manufacture of glass are melted, a scum arises which has to be removed, this is called sandiver, and is,

when powdered, used as a polishing material, and formerly had a considerable reputation as a tooth-powder.

SAND-MARTIN. See SWALLOW.

SAN DOMI'NGO. See DOMINGO, SAN; DOMINICAN REPUBLIC.

SAND-PAPER is made in the same way as emery-paper (see EMERY), but with sand in place of emery.

SA'NDPIPER, the common English name of a numerous group of birds, generally referred to the family *Scolopacidæ*, all formerly included in the genus *Tringa*, but some now constituting the genera *Totanus*, *Pelidna*, *Actitis*, &c., of ornithologists. In characters and habits they are all very similar. They are not of large size; they are very active and graceful in all their movements; their plumage not gay, but of pleasing and finely-diversified colors; their legs are rather long, the lower part of the tibia naked, the tail very short, the wings moderately long; the bill rather long and slender, grooved throughout the whole or a considerable part of its length, straight in some, and a little arched in others. The feet have three long toes before, and one short toe behind; the toes in the genus *Tringa*, as now restricted, are partially webbed at the base, in *Totanus* they are completely separate. They are good swimmers, but are not, however, often seen swimming; they frequent sandy sea-shores, some of them congregating in numerous flocks in autumn and winter; and seek their food by probing the sand with their bills, and by catching small crustaceans in pools or within the margin of the sea itself. Many are birds of passage, visiting high northern latitudes in summer, and spending the winter on the coasts of more southern regions. The flesh of all the species is good, and some of them are in much request for the table.—The British species are numerous. The DUNLIN or PURRE (*Tringa variabilis*) is noticed in the article DUNLIN. The KNOT (*Tringa canutus*), also known, in different states of plumage, as the RED S. and the ASH-COLORED S., is a bird of about ten inches in length, appearing in great flocks on the British coasts in winter, and equally common in North America.—The LITTLE S. or LITTLE STINT (*Tringa minuta*), occasionally seen in Britain, occurs in India and in South Africa.

The name STINT is given to a number of species of *Tringa*.—The PURPLE S. (*Tringa maritima*), not unfrequent on the British

Redshank (*Totanus calidris*).

coasts, is reckoned among the birds of Iceland, Greenland, Melville Island, Nova Zembla, and Spitzbergen. Of the genus *Totanus*, to all the species of which the popular name GAMBET is

Common Sandpiper (*Totanus hypoleucos*).

sometimes given, one of the best known species is the REDSHANK (*Totanus calidris*), a bird which resides in Britain all the year, but known also as a summer bird of passage in the most northern parts of Europe and Asia, and occurring in winter as far south as Smyrna, and even in India. It is about eleven inches long It receives its popular name from its red legs.—The GREEN S. (*Totanus ochropus*) is also a pretty common British species, for the most part migrating to the north for the summer.—The COMMON S. or SUMMER SNIPE (*Totanus hypoleucos*) is in Britain a summer bird of passage.—The GREENSHANK (*Totanus glottis*) is chiefly seen in Britain in spring and autumn, and has its name from the olive-green color of its legs.—Sandpipers of various species—some of them the same as the British, and others different—are numerous in North America, and in winter in the West Indies.

SANDPIPES are cylindrical hollows existing in chalk deposits. They descend perpendicularly into the chalk at right angles to the surface, tapering downwards, and ending in a point; they reach occasionally a depth of 60 feet, and have a diameter varying from 1 to 12 feet. They are most probably produced by the chemical action of water, charged with carbonic acid, which exists more or less in all rain-water, and is especially abundant in water that has been in contact with decaying organic matter. The pipes are filled with sand, clay, or gravel from the overlying deposit.

SANDROCO'TTUS or SANDROKYPTOS, is the Greek spelling of the name of the Hindu king Chandragupta, of Pât'aliputra or Palibothra, to whom Megasthenes was sent as ambassador from Seleucus Nicator, and who lived about the beginning of the 4th c. B.C.

SANDSTONE is a rock formed of compacted, and more or less indurated sand. The grains generally consist of quartz, though other mineral substances are often mixed with this; they are colorless, or of a dull white, yellow, brown, red, or green color. The grains vary in size, forming, as the case may be, a fine or coarse grained stone. The loose sand becomes solidified by pressure simply, but more generally from being cemented together by calcareous, silicious, or ferruginous infiltrations, and the dark color of the mass is produced by the cement. Sandstones that have undergone great or continuous metamorphic action, pass into Quartzite; and between this and friable sand, all intermediate stages are found.

SANDU'SKY, a city and port of Ohio, U. S., on the south shore of Sandusky Bay, an arm of Lake Erie, 110 miles north of Columbus. The bay, 20 miles long and 5 wide, forms an excellent harbor. The city is built upon a bed of limestone, of which its edifices are constructed, among which are a custom-house, 14 churches, 3 banks, large public halls, hotels, schools, &e. There are several newspapers, manufactures of lumber and bent woodwork for carriages, &c., with extensive fisheries. Pop. in 1860, 8408; in 1870, 13,000; in 1880, 15,838.

SA'NDWICH (i. e., village on the sands), a Cinque Port, market-town, and municipal borough of Kent, on the right bank of the Stour, 98 miles east-south-east of London by the South-Eastern Railway. Within the last 800 years the sea has here considerably receded, for S., which is now two miles from the shore, is described at the commencement of the 11th c., as the most famous of all the English harbors—*omnium Anglorum portuum famosissimus*. The town is rectangular, and was surrounded by walls along which a broad path now leads. The streets are confined; and the houses, which seem crushed together, and the architecture of which recalls the times of the Plantagenets, are peculiarly and strikingly antique in appearance. The church of St. Clement's with a low Norman tower, is probably the most interesting edifice. Small vessels importing timber, iron, and coal, and expoting corn, flour, malt, seeds, and hops, come up to the town. Tanning, shipbuilding, and seed-crushing are carried on. With Deal and Walmer, the town used to send two members to parliament; but S. is one of the boroughs which has been disfranchised for corrupt practices during seven years, from the first meeting of parliament, 1883. Pop. (1871) of mun. borough, 3060; (1881) 2846; of the parl. borough of S. and Deal, 14,885; (1881) 15,566.

S., the most ancient of the Cinque Ports, probably occupies the site of the Roman *Rutupiæ*, and many interesting antiquities have been found in the vicinity. In the reign of Edward IV. its customs yielded £17,000 yearly, and 95 ships and 1500 sailors belonged to it.

SANDWICH, said to have been named after the Earl of Sandwich, consists of two thin slices of bread, with some savory food placed between.

SANDWICH ISLANDS, the name given by Captain Cook to the islands forming the kingdom of Hawaii (so called from the chief island), Lord Sandwich being then first Lord of the Admiralty. They are a rich, beautiful, and interesting chain, eight in number, exclusive of one or two small islets. The chain runs from south-east to north-west, and lies in the middle of the Pacific Ocean, in lat. 19°—22° N., long. 155°—160° W. Area, 7600 sq. m.; pop. (1878) 57,985, of whom 4561 were Europeans. The names, with the areas of the respective islands, are: Hawaii (formerly Owhyhee), 4850 sq. m.; Maui, 750; Oahu, 700; Kaui, 780; Molo-

kai, 170; Lanai, 170; Niihau, about 110; and Kahoolaui, about 40 sq. miles.

Surface, &c.—Situated near the middle of the Pacific Ocean, about half the distance from San Francisco in North America that they are from Melbourne in Australia, and Canton in China, the S. I. form an oasis in the middle of a wide ocean waste, and offer convenient stations for the refreshment and repair of the merchantmen and whalers that traverse the Pacific. They are of volcanic origin, and contain the largest volcanoes, both active and quiescent, in the world. The most prominent physical features of the group are the two lofty mountain peaks of Hawaii, Mauna Kea and Mauna Loa, each of which is 14,000 feet in height, or within 1800 feet of the loftiest of the Alps. Besides these two chief peaks, which stand apart from each other, and one of which is covered with perpetual snow, the island is traversed by other mountains, which give it a rugged and picturesque outline, and in some cases front the sea in bold, perpendicular precipices, from 1000 to 3000 feet in height. In general, the islands are lofty—the small islet of Lehua is 1000 feet high, and the upland regions of Kaui are, on an average, 4000 feet above sea-level.

Within the coral reefs, which, in single, and more rarely in double ridges, skirt portions of the coast, sandy shores, leading up to rich pasture-lands, and occasionally to productive valleys, are frequently seen. Everywhere, however, the configuration of the surface betrays the volcanic origin of the islands. Extinct and partially active volcanoes occur in most of the islands. Kilauea, on the Mauna Loa mountain in Hawaii, the largest active volcano in the world, has an oval-shaped crater 9 miles in circumference, and is 6000 feet above sea-level. In the center of this immense caldron is a red sea of lava, always in a state of fusion. At intervals, the lava is thrown to a great height, and rolls in rivers down the mountain sides. From 1856 to 1859, this volcano was in an incessant state of eruption, forming at night a sublime spectacle, and occasionally casting forth burning streams, by one of which a small fishing-village was destroyed, a bay on the shore filled up, and a promontory formed in its place. On Maui, the crater of Mauna Haleakala (House of the Sun), by far the largest known, is from 25 to 30 miles in circumference, from 2000 to 3000 feet deep, and stands 10,000 feet above sea-level. Within this huge pit, about 16 basins of old volcanoes, whose ridges formed concentric circles, have been counted. Good harbors are few. The chief is that of Honolulu (q. v.), in Oahu, with 22½ feet of water in its shallowest parts. On the same island is Ewa, an immense basin, with 12 feet water at low-tides. During the prevalence of the trade-wind, which blows south-west for about nine months of the year, the south shores of the islands affords safe anchorage almost everywhere.

Climate, Soil, Rivers, &c.—Though situated within the tropics, the S. I. boast a climate that is temperate rather than tropical. In the native language, there is no word to express the idea of *weather*, and this fact may be considered as evidence that extremes of heat or cold do not occur. At Honolulu, the extremes of temperature in the shade during 12 years were 90° and 53°, and the diurnal range is 12°. Rains brought by the north-east trade-wind are frequent on the mountains; but on the leeward side of the islands, little rain falls, and the sun is rarely obscured by clouds. The soil, the constituent parts of which are mainly scoriæ, decomposed lava and sand, is generally thin and poor. This, however, is not universally the case. At the bases of the mountains and in the valleys, where abraison, disintegration, and the accumulation of vegetable mould, have gone on for ages, there are extensive tracts as fertile as they are beautiful. The islands produce fine pasturage in abundance, and large herds are bred and fattened, to supply meat to the whalers and merchant-ships. On the Waimea Plains, in Hawaii alone, 30,000 sheep of the merino breed are grazed. The upland slopes of the mountains are clothed with dense forests; and lower down, are grassy plains and sugar and coffee-plantations. Basalt, compact lava, coral-rock, and sand-stone, are used for building purposes. No metals occur. Several of the islands, especially Hawaii and Kaui, are well supplied with rivers, which, from the size and conformation of the group, are necessarily small, but afford great facilities for irrigation. Vast numbers of semi-wild horses roam the islands, and while they consume the pasturage, and break down the fences, are of little use.

The indigenous fauna is small, and consists mainly of swine, dogs, rats, a bat that flies by day, birds of beautiful plumage, but for the most part songless. Among the indigenous trees and plants are the sugar-cane, banana, plantain, cocoa-nut, candle-nut, various palms, the taro, a succulent root which formed the staple of the food of the natives, and is still generally used; the cloth-plant; and the *ti*, the roots of which were baked and eaten, while the leaves were used for thatching huts. Cattle and other useful foreign animals and plants were introduced by Vancouver and other navigators. There are about 30,000 mules and semi-wild horses in the kingdom.

Commerce, Products, &c.—The commerce of this young kingdom is still in its infancy, but is gradually on the increase. Until recently, the most important branch of it was maintained by vessels engaged in the whale-fisheries of the North Pacific. This branch of commerce has greatly declined within recent years. In 1878, 27 whaling-vessels, showing a decrease of 20 as compared with the number in 1872, entered the ports. Trusting no longer to the whaling business, the producers and merchants of the S. I. have found out other outlets for their goods, and, without doubt, the trade of the islands will in the future be almost wholly confined to the coasts that bound the Pacific. The islands are within 16 days (by sailing-vessels) of San Francisco, 27 days from Vancouver's Island, 26 days from Kanagawa in Japan, and 67 days from Hongkong. Sugar, coffee, and rice have been proved to produce well, and all these find ready markets at hand in California, British Columbia, and Vancouver's Island, which, together, can consume more than the S. I. can supply. Of sugar, the 3,000,000 lbs. produced in 1862 were increased to nearly 40,000,000 in 1878, and from the number of new plantations recently organized, the amount of produce may be expected to continue increasing. The exports, consisting mostly of sugar, coffee, rice, pulu (q. v.), hides, and corn, amounted in 1882 to £1,371,087; the imports, mostly manufactured goods, amounted in the same year to £909,595.

History, Constitution, and Finances.—Of the origin and character of the inhabitants of this kingdom, of its interesting internal history, or of the much-canvassed question as to whether the native race will flourish along with or wither before the Saxon race, it is not within our limits to speak. We can only notice a few of the leading events which have occurred in these islands since their shores were first visited by what the natives called the 'floating islands' of the civilized nations. Although one member of the group was seen by Gaetano in 1542, the islands cannot be said to have been discovered till Cook visited them in 1778. The great navigator treated the simple and confiding natives with a cruelty and a hypocrisy which consort ill with his fame, and which were the direct causes of the brawl in which he met the death he had provoked in Kealakeakua Bay, Hawaii, in 1779. In early times, each island had a king; but under Kamehameha I., a man of shrewd sense, and of great bravery and resource, the islands were formed into one kingdom. This king, writing to George III., August 6, 1810, desired formally to acknowledge the king of England as his sovereign, and to place the islands under British protection—an offer which was accepted. After inaugurating the era of advancement, this king died in 1819, and was succeeded by Liholiho, who adopted, on his accession, the name of Kamehameha II., and in whose reign idolatry was abolished simultaneously throughout all the islands. The first Christians who visited the S. I. were Cook and his followers, of whom the simple natives retained no favorable impression.

Vancouver, who arrived with Cook in 1778 and returned in 1792, and again in 1794, made sincere attempts to enlighten the natives, and the king and his chiefs requested Vancouver to send out religious teachers to them from England; but the first missionaries that visited the islands came from America in 1820. On their arrival, the missionaries witnessed the singular phenomenon of a nation without a religion. The instructions of Vancouver had not been forgotten, and no doubt enabled the idol-worshiping islanders to see more readily the absurdities of their system. But the spontaneous movement of 1819—1820, when the whole nation rose up to destroy idols, temples, and the furniture of idolatry, 'was no triumph of Christianity—for Christianity had not yet claimed or even approached the Hawaian Islands.' The nation had voluntarily cast off the religion of their ancestors, and had not yet adopted—were not even acquainted with—any other system. The American missionaries who arrived in 1820 were well received, and the work of instruction was at once begun. Besides instructing them in Christianity, in less than 40 years they taught the whole Hawaian people to read and write, to cipher and to sew.

Kamehameha II. and his queen visited England, and after a short residence in this country, both died in London, July 1824. Prior to the year 1838, the government was a despotism; but in 1840, the king, Kamehameha III., granted a constitution, consisting of king, assembly of nobles, and representative council. This constitution, based on that of Great Britain, has in more recent times been much matured and improved. In 1843, the independence of the Hawaian kingdom was formally declared by the French and English governments. Kamehameha IV. acceded to the throne in 1854, and after a useful reign, died in 1863, and was succeeded by his brother, Kamehameha V. Lunalilo followed in 1873, and in 1874 Kalakaua, who visited Europe in 1881. The revenue for 1882 was £445,070; expenditure, £549,157.—See Miss Bird's *Six Months in the Sandwich Islands* (1875); Miss Gordon Cumming's *Fire Fountains* (1883).

SANDWORT. See ARENARIA.

SAN FE'LÉ, a town of South Italy, in the province of Potenza, 17 m. N.W. of Potenza. Pop. 10,500.

SAN FELI'PÉ DE ACONCA'GUA, a town of Chili, capital of the dep. of Aconcagua, 60 miles east-north-east of Valparaiso. It is regularly built, and has a handsome appearance. In the vicinty are copper-mines. Pop. stated at from 12,000 to 13,000.

SAN FELIPE DE JATIVA. See JATIVA.

SAN FRANCI'SCO, the principal seaport on the western coasts of North America, and the chief city of California, U.S., stands on the west shore of San Francisco Bay, 6 miles south of the Golden Gate, the outlet leading west, and connecting the bay with the Pacific Ocean. Lat. 37° 46′ N., long. 122° 23′ W. It has a fine deep harbor, well-built streets, handsome shops, gas and water works, and elegant public buildings, among which are the custom-house, mint, city hall, marine hospital, city hospital, theaters, orphan asylums, a convent, &c. There are about 75 churches, 11 daily and 46 other newspapers, numerous schools and charitable institutions, and several fire insurance companies. Of the population attracted by the discovery of gold to S. F., a great number are Irish, German, British, French, and Chinese. There are newspapers in English, French, German, Spanish, Italian, and Chinese. The Chinese have a church, Roman Catholic, with a Chinese priest educated at Rome; and a school. Among the manufacturing establishments are flour-mills, saw-mills, woollen factories, and iron foundries. In recent years, the receipts of precious metals have sometimes amounted to above £12,000,000 in a year; but this sum does not nearly represent all the receipts, as much treasure comes by private hands, and passes through no channel by means of which the amounts can be noted by the authorities. The treasure exported in the last five years of the decade 1870—1880, varied from £5,250,000 to £11,550,000. The other exports were chiefly wheat, barley, wool, quicksilver, hides, furs, flour gunpowder, copper ore, wine, and tinned fruits. In 1875—1880, the value of wheat exported varied from £5,000,000 to £10,520,000 a year; the whole imports of foreign merchandise varied from £8,200,000 to £5,400,000, including sugar, coal, rice, coffee, tea, wines and spirits, iron, cotton, silk, and various manufactured goods. Numerous ocean-steamers run to the chief ports of the world. The Union Pacific Railroad, completed in 1870, makes S. F. an important point as the commercial highway from Europe and the Eastern United States to Asia. In 1776, the mission of St. Francis was commenced here by two Spanish monks. In 1825, the mission had under its care 1800 Indians, and possessed 76,000 cattle and 79,000 sheep. In 1834, the property of the mission was secularized, and it rapidly decayed. In 1846, it was taken by the United States, and in 1847 had a population of 450. The discovery of gold in 1848 caused it to be at first nearly deserted; but soon commenced a rapid growth, which, in spite of several destructive fires, has continued to increase. The Chinese, of whom there are about 20,000 in the city, occupy 'Chinese Quarter,' and have two theaters. Pop. of S. F. (1860) 55,626; (1870) 149,473; (1880) 233,956.

SAN FRATE'LLO, a town of Sicily, in the province of Messina, 53 miles west-south-west from Messina. At the base of the hill on which the town stands is a remarkable cave, discovered in 1859, and containing prodigious quantities of bones of mammals, with which flint implements are mixed. Pop. 7200.

SANGAREE', a West Indian beverage, consisting of Madeira wine, syrup, water, and nutmeg.

SANGERHAUSEN, a town of Prussian Saxony, 37 miles west of Halle. It carries on weaving, tanning, shoemaking, and copper-smelting, and manufactures saltpeter. Pop. (1880) 9136.

SANGI'R ISLANDS lie to the north of Celebes, in 2°—4° N. lat., are upwards of 50 in number, of various sizes, and nearly all inhabited. Pop. 80,000. The three largest islands, Great S., Sjiauw, and Tagolandang, with those which surround each, form as it were separate groups. In the S. I. are many mountains, which, except the volcanoes, are clothed to their summits with a rich vegetation. Great S. has an area of 273 sq. m., and is divided into four kingdoms. The usual anchorage is on the west side, in 3° 28′ N. lat., and 125° 44′ E. long. Pop. 13,000. In the north-west is a volcano, called Abu, or the 'Ash Mountain,' which has frequently caused great devastation. In March 1856, the streams of lava and boiling water carried away the rich plantations, and 2806 lives were lost.

Sjiauw lies in 2° 43′ N. lat., and 125° 28′ E. long., is also mountainous; a volcano, on the north-east coast, being 6200 feet high. Pop. 3000. The chief town is Uluw.

Tagolandang, in 2° 20′ N. lat., and 125° 30′ E. long., is populous, and the center of the missionary work which has been carried on successfully in the S. islands. A small ship belongs to the station, in which to visit the scattered converts and schools.

In all the islands, the areng (*Saguerus* or *Borassus gomutus*), the sago, cocoa-nut, and the finest sorts of timber-trees abound. Maize, rice, katjang (a species of bean), tobacco, cocoa, and the sugar-cane are cultivated.

The Sangirese belong to the Malay race, are well made and brave, but cunning, lazy, and dirty in their habits. This, and scarcity of pure drinking-water, make them liable to a loathsome skin disease. There are four rajahs in Great S., one in Tagolandang, and one in Sjiauw. The government is monarchical, somewhat limited by a council.

Towards the end of the 15th c., the Sangirese became Mohammedan; a century later, under the Portuguese, they were brought over to Christianity. These islands, forming now a Netherlands dependency, have several Dutch missionaries, and 24 churches, which are also used as schools. Government supports 8 teachers, the villages 16.

SANG-KOI. See TONQUIN.

SANGRAAL. See GRAAL.

SANGUINA'RIA, a genus of plants of the natural order *Papaveraceæ*, having 8—12 petals, 2 stigmas, an oblong swollen capsule with two deciduous valves, and a persistent, many-seeded frame. *S. Canadensis*, the BLOOD-ROOT or PUCCOON of North America, has a fleshy root-stalk abounding in a red juice, which abounds also in the leaf-stalks; and solitary radical leaves, which are roundish, deeply heart-shaped, and with about seven toothed angles. The flowers are solitary and spring from the root, on short stalks. The whole plant is acrid and narcotic, emetic and purgative in large doses; and in small doses stimulant, diophoretic, and expectorant. It is much used as a medicine in the United States.—It is supposed to owe its properties to a peculiar alkaloid called *Sanguinarine*, which is obtained from it as a white pearly substance. The large white flowers appear early in spring, and are a frequent ornament of flower-borders.

SANGUINE, or MURREY, one of the tinctures of less frequent occurrence in Heraldry, denoting blood color, and represented in engraving by lines crossing each other saltireways.

SANGUISORBA'CEÆ, or SANGUISO'RBEÆ, according to some botanists a natural order of plants, but more generally regarded as a sub-order of ROSACEÆ (q. v.). As a sub-order, its distinctive characters are apetalous flowers—the tube of the calyx thickened, indurated, and lined with a disc, generally few stamens, and a solitary carpel, which ripens into a nut enclosed in the calycine tube. About 150 species are known, all of which are herbaceous or half shrubby, some of them spiny.—The leaves of *Acaena sanguisorba*, a native of Van Diemen's Land, are said to be an excellent substitute for tea. Of British species, Burnet (q. v.) and Lady's Mantle (q. v.) are among the best known.

SA'NHEDRIM (Gr. *Synedrion*), the supreme national tribunal of the Jews, established at the time of the Maccabees, probably under John Hyrcan. It consisted of 71 members, and was presided over by the Nasi (Prince), at whose side stood the Ab-Beth-Din (Father of the Tribunal). Its members belonged to the different classes of society: there were priests (*Archiereis*); elders, that is, heads of families, men of age and experience (*Presbyterοi*); scribes, or doctors of the law (*Grammateis*); and others, exalted by eminent learning—the sole condition for admission into this assembly. The presidentship was conferred on the high-priest in preference, if he happened to possess the requisite qualities of eminence; otherwise, 'he who excels all others in wisdom,' was appointed, irrespective of his station. The limits of its jurisdiction are not known with certainty; but there is no doubt that the supreme decision over life and death, the ordeal of a suspected wife, and the like criminal matters, were exclusively in its hands.

Besides this, however, the regulation of the sacred times and seasons, and many matters connected with the *cultus* in general, except the sacerdotal part, which was regulated by a special court of priests, were vested in it. It fixed the beginnings of the new moons; intercalated the years, when necessary; watched over the purity of the priestly families, by carefully examining the pedigrees of those priests born out of Palestine, so that none born from a suspicious or ill-famed mother should be admitted to the sacred service; and the like. By degrees, the whole internal administration of the commonwealth was vested in this body, and it became necessary to establish minor courts, similarly composed, all over the country, and Jerusalem itself. Thus, we hear of two inferior tribunals at Jerusalem, each consisting of 23 men, and others consisting of three men only. These courts of 23 men (lesser Synedrion), however, as well as those of the three men, about both of which Josephus is silent, probably represent only smaller or larger committees chosen from the general body. Excluded from the office of judge were those born in adultery; men born of non-Israelitish parents, gamblers; usurers; those who sold fruit grown in the Sabbatical year; and, in single cases, near relatives. All these were also not admitted as witnesses. Two scribes were always present, one registering the condemnatory, the other the exculpatory votes. The mode of procedure was exceedingly complicated; and such was the caution of the court, especially in matters of life and death, that capital punishment was pronounced in the rarest instances only. The Nasi had the su-

preme direction of the court, and convoked it when necessary. He sat at the head, and to his right hand was the seat of the Ab-Beth-Din; the rest of the 71 took their places according to their dignity, in front of them, in form of a semicircle, so that they could be seen by both the chief officers.

The lictors, or 'sheriffs,' were always present at the session. The court met on extraordinary occasions in the house of the high-priest; its general place of assembly, however, was a certain hall (*Lishcat Hagaziz*), probably situated at the south-east corner of one of the courts of the temple. With exception of Sabbath and feast days, it met daily. The political troubles forced the Sanhedrim (70 B.C.) to change its abode, which was first transferred to certain bazaars (*Hannyoth*) at the foot of the temple mount. After the destruction of the temple and Jerusalem, it finally established itself, after many further emigrations, in Babylon.

We cannot here enter into that most difficult question as to the origin and development of the Sanhedrim, and how far it was intended primarily to be a faithful reproduction of the Mosaic assembly of the 70 (Moses himself making 71), supposed to have been re-established by Ezra after the Exile; any more than we can examine in this place into the widely different opinions respecting the jurisdiction and competence of the Sanhedrim at the time of Christ and the apostles; how far, in fact, it may be said to have existed at all—save for a few matters of smallest importance—curtailed and circumscribed as it was by the Romans, who seem to have recognized only the 'high-priest;' and that collateral but most vital question, whether it was the Sanhedrim at all from whom emanated those well-known acts recorded in the New Testament. There can be no question as to its utter incompetence to arraign Christ for a 'crimen læsæ majestatis,' i. e., for high treason against the Roman emperor. No less difficult is the explanation of many of the proceedings against the apostles ascribed to this body. The suggestion, that the word Synedrion, as used in the New Testament, stands only for an arbitrarily convoked 'lynch-tribunal,' deserves more consideration than it has hitherto received.

SANHITA is the name of that portion of the Vedas which contains the Mantras or hymns. See VEDA.

SA'NITARY SCIENCE, known also under the names of PREVENTIVE MEDICINE, STATE MEDICINE, HYGIENE, and PUBLIC HEALTH, has been variously defined by different writers.* Dr. Mapother's is perhaps as good a definition as any. In the first of his *Lectures on Public Health*, he describes this science as 'an application of the laws of physiology and general pathology to the maintenance of the health and life of communities, by means of those agencies which are in common and constant use.' This department of science received so strong an impulse, about a quarter of a century ago, from the labors of Southwood Smith, Edwin Chadwick, Lyon Playfair, and others, that many persons regard it as of modern origin; and doubtless to a great extent they are right; but on turning back to the records of early history, we almost invariably find evidence that the health of the general population was a subject of legislation. The Mosaic code of laws—the most ancient on record—contains minute directions for the cleanliness of the person, the purification of the dwelling and the camp, the selection of healthy and the avoidance of unwholesome food (pork, for example, which in hot countries is more commonly found to harbor parasites than in temperate climates, and blood, which is the most putrescible part of the animal), the seclusion of persons with contagious disorders, the regulation of sexual intercourse at certain periods, and various other points bearing on the physical well-being of the Jewish nation. The Greeks and Romans, although not, like the Jews, making hygiene a part of their religious duties, were far from neglecting it.

'The Laws of Lycurgus,' says Dr. Gairdner, 'are not wanting in very pointed enactments on sanitary matters; and the importance attached by all the Greek republics, and in the Platonic ideal polity, to physical culture, is too well known to require remark. The Roman people, poor and apparently rude as it was in its origin, yet found time, amidst its military occupations, to construct the *Cloaca Maxima*, as an indestructible and stupendous memorial of its attention to the drainage and sewerage of the city at a very early period of its history. At a later period, aqueducts were made to cover miles upon miles of the surrounding plain; and their splendid ruins, still partly used for their original purpose, attest the munificence and the abundance with which the first of sanitary requisites was supplied to the imperial city.'—*Public Health in Relation to Air and Water*, 1862, p. 6. Moreover we know enough of the construction of the private houses and public buildings of the Romans to see that they recognized the necessity for free ventilation and good drainage. When the *Archiatri populares*, or state-physicians, were first appointed in the Roman Empire, is not certainly known. Their mode of election is described in the Theodosian and Justinian codes. There were ten of them in the largest towns; one to each district or subdivision; seven in towns of the second order; and five in the smaller ones. They collectively formed a college, whose duty it was to attend to the public health; and they may be regarded as the earliest type of our 'General Medical Council.' Gradually, however, as Christianity spread, an utter misconception of doctrine, led to the neglect of all care of the human body.

While the monks and friars devoted themselves to good works, feeding the hungry, clothing the naked, and instituting hospitals, they entertained no idea of the possible prevention of disease. They never attempted to impress upon their followers the importance of drainage, ventilation, pure and abundant water, &c.; but when an epidemic arose, it was supposed to be a manifestation of God's special anger; and it would have been impossible to make them understand that it was the natural result of a prolonged disregard of the laws of nature. Those who have read Dean Stanley's graphic *Memorials of Thomas A'Becket* will be inclined to wonder whether those who adopted such penances as his could ever be free from cutaneous disorders. The state of the towns in England in the 13th c. is so clearly described by Mr. Brewer in his Introduction to the *Monumenta Franciscana*, that we should have been glad to have extracted it, if our space had permitted. Those who have not access to the valuable series in which Mr. Brewer's work is included, will find a sufficient quotation from it in Dr. Gairdner's interesting volume on *Air and Water*, pp. 44—47. In another work in the same series—the *Liber Albus*, edited by Mr. Riley—much important information regarding the general sanitary state of London in the medieval times may also be found. In addition to the causes of disease indicated by these writers, such as the absence of drainage, the accumulation of filth, bad ventilation, insufficient and often unwholesome water, inattention to personal cleanliness, &c., must also be noticed the ordinary food in those times. The common vegetables of our own day, excepting the cabbage, were only slowly introduced from the time of Henry VIII. As turnips were not then used as a winter-food for oxen and sheep, these animals were with difficulty kept alive during the season when grass was scanty, and were therefore killed and salted in the beginning of the cold weather; and during several months, game and river-fish were the only kinds of fresh animal food.

Macaulay, in his celebrated third chapter on 'The State of England in 1685,' observes that, at that time, meat, although cheaper than in former times, was still so dear that hundreds of thousands of families scarcely knew the taste of it; that bread such as is now given to the inmates of work-houses was then seldom seen even on the trencher of a yeoman or of a shopkeeper; and that the great majority of the natives lived almost entirely on rye, barley, and oats. Many important facts of a similar nature are also recorded in Froude's *History of England*.

During the 18th c., many important steps were taken for the improvement of the public health. Under a proper system of drainage, ague became eradicated from extensive fenny districts; and with a knowledge of the therapeutic properties of cinchona bark and arsenic, we can cut short the disease when it appears. Scurvy* was all but blotted out of the list of diseases that proved most fatal to our sailors; and vaccination, incomparably the greatest discovery yet made in this department of science, was the crowning achievement of the century.†

The first outbreak of cholera in this country in 1832, lamentable as it was in itself, was productive of much benefit in directing the public mind to the all-important subject of the prevention or repression of disease. It was impossible to ignore the fact that, while the poor, dwelling in unventilated and undrained hovels, fell victims to this new and ill-understood disease in thousands, the middle and higher classes were comparatively safe. All investigations into the dwellings and domestic habits of the lowest class of the population revealed a condition of things of which the general public had no conception. A new poor-law was consequently passed in 1834, and a commission was appointed to investigate and report upon its working. The *Report on the Sanitary Condition of the Laboring Population of Great Britain*, published in 1842, and mainly treating of the sanitary state of the poor and of the character of their dwellings, may be regarded, as Professor Gairdner ‡ well observes, as 'the true starting-point of modern sanitary legislation.' A 'Health of Towns' Commission,' which was soon after appointed, gave in two valuable Reports in 1844 and 1845; and subsequently, a Metropolitan Sanitary Commission published Reports in the years 1847 and 1848. These Re-

* As the state of Sanitary Science, both in principles and practice, is substantially what it was when this exhaustive account of the subject was written by the late Dr. Day, the article has been allowed to stand without any material alteration.

* We regret to state that during the last few years scurvy is again becoming prevalent in the mercantile service, and occasionally amongst navvies engaged at places where good food was not easily attainable. In both cases, it may always be traced to neglect of due dietetic precautions.

† And yet, in consequence of vaccination being either neglected or imperfectly performed, no less than 51,034 persons died in Great Britain from small-pox in the ten years, 1856—1865. In the year 1864 alone, the deaths were 9425. On this subject, see Sir James Y. Simpson's 'Proposal to stamp out Small-pox, &c.,' in the *Medical Times and Gazette* for January 4, 1868.

‡ *Public Health in Relation to Air and Water*, p. 17.

ports will form a lasting memorial of the labors of Mr. Chadwick and his able co-operators. Nor, in this rapid glance at the history of sanitary science, can the name of Dr. William Farr be omitted, who—again to quote Dr. Gairdner's words—'found the facts of this science in a state of almost hopeless and aimless confusion, and has not only added immensely to their number and value, but has brought into them light, harmony, order, and, for the first time in the history of the science, a determinate method, and an approach to scientific exactness.' By his system of calculating death-rates, he has placed an easy and useful method at the service of his professional brethren, while, by the formation of life-tables, he has greatly facilitated the operations of life assurance.

We now pass on to the consideration of the most important sanitary agents, beginning with AIR. Under this head, we have to consider (1) the amount of air necessary for the full performance of the respiratory process; (2) the means of ascertaining when air is impure, or, if impure, what substances are mixed with it; (3) the means of purifying contaminated air; and (4) the diseases due to deficiency in the quantity, and alterations in the quality of the air.

(1) The *first* question can be answered both by calculation and experiment. By calculation, Dr. Parkes finds that 2082 cubic feet of air must be supplied per head per hour, so to dilute the products of respiration and transpiration from the sound body, as to keep the air always pure and fresh (see his *Manual of Practical Hygiene*, 1864, p. 65). From numerous experiments in which the outflow of air was measured, and the carbonic acid simultaneously determined, he found that at least 2000 cubic feet per hour must be given to keep the carbonic acid at its normal level of ·5 or ·6 in 1000 volumes, and to remove the *odor humanus* or fetid smell of animal matter. General Morin, in his *Rapport de la Commission sur le Chauffage et la Ventilation des Bâtimens du Palais de Justice*, 1860, gives results in close accordance with those of Parkes, assigning the following as the relative hourly amounts of fresh air (expressed in cubic feet) per head in temperate climates: in barracks, at 1059 by day, and 2118 by night; in workshops, prisons, and theaters, 2118; in schools, 1059; and in hospitals, 2825, increased to 4236 during the hours of dressing the surgical cases, and 5650 during epidemics.* In mines, if it is wished to keep up the greatest energies of the men, 6000 feet of air per hour must be allowed. It may be incidentally mentioned that a horse requires 2460 feet per hour at the least.

It is difficult to lay down any rules regarding the amount of fresh air required in sickness. The vitiation of the air by the products of combustion of gas, candles, lamps, &c., must not be overlooked. For every cubic foot of gas that is burned, 1800 cubic feet of air are required to keep the air pure, unless the gaseous products are carried off in a special channel, such as is now frequently attached to gas-fittings. A pound of oil burned in a lamp may be regarded as equivalent to 10 cubic feet of gas, so far as the deterioation of the air is concerned. (For these facts, we are indebted to Dr. Parkes.)

(2) The composition of pure air is sufficiently described in ATMOSPHERE. The impurities in air may be divided into: (*a*) suspended matters, (*b*) gaseous substances, and (*c*) special impurities. Amongst *suspended matters* are, according to Pasteur and others, numerous and universal germs of organic beings, both animal and vegetable, as of vibriones, bacteria, and monads; pollen, spores of fungi, mycoderms, mucedones, &c. Minute particles of finely comminuted inorganic matter are also often taken up by currents of air, and remain in suspension. These are probably altogether harmless. The works of man more seriously affect the air in a hygienic point of view. Particles of coal and of half-burned carbon (smuts), starch-cells (from bakeries and bread), and, when certain trades are carried on, cotton fibres, hairy particles of wool, of stone, of iron, &c., may, when constantly inhaled, give rise to the production of special diseases of the lungs and stomach. In the air of badly-kept hospital wards, pus-cells and epithelial cells are often to be detected.

Most physicians now believe that the specific poisons of small-pox, scarlet fever, and measles, which are derived from the skin and mucous membrane, consist of molecular organic matter, which, although as yet undetected, must pass into the air; and the same remark applies to the so-called germs of typhoid fever (see the article on TYPHUS AND TYPHOID FEVERS) and cholera, which are thrown off by the intestinal mucous membrane, and subsequently become dried and capable of aerial suspension. Amongst *gaseous matters*, which merely pass into the atmosphere either from natural causes or manufactories, are various compounds of carbon, sulphur, chlorine, nitrogen, and phosphorus, with oxygen and hydrogen, which it is unnecessary here to enumerate. Besides the gases formed by the union of the above-named elements, we must notice organic vapor from decomposing animal matters and sewers, which last has been found by Odling to be carbo-ammoniacal. Amongst *special impurities*, those caused by respiration are the most important. An adult man, under ordinary conditions, gives off, in 24 hours, from 12 to 16 cubic feet of carbonic acid by the lungs, and a certain additional quantity, not determined, by the skin. Watery vapor, ranging from 25 to 40 ounces, also passes off daily from the skin and lungs, together with an undetermined quantity of organic matter, which is partly suspended (as particles of epithelium, &c.), and partly made up of organic vapor. This vapor, when collected and condensed from a large volume of respired air, is found to be nitrogenous, and has a very fetid smell. Here there is a most powerful source of vitiation, regarding which numerous chemical analyses have been made; for details regarding which we may refer to Parkes, *op. cit.* pp. 70—77; Gairdner, *op. cit.* p. 69; and Mapother's *Lectures on Public Health*, 2d ed., pp. 40—61.

There is a condition of the atmosphere to which various observers, and especially Pasteur, have directed attention, which requires a passing remark. It is what may be termed the fermentative condition, and depends upon the universal presence in the air of countless germs of vegetables and infusoria. It is possible that this atmospheric condition may be concerned in some of the zymotic diseases. Dr. Salisbury, an American physician, endeavors to show that the poison of measles is due to a fungus which grows on rotten straw; another American physician, Dr. Flint, 'has almost fully demonstrated that the spores of palmella cause ague.'—Mapother, *op. cit.*, p. 431, &c. The presence of a *cholera-fungus*, which has been recently proved to exist in the evacuations of all cholera patients, gives as will be seen from Mr. Simons's Report of the Weimar Conference,* a hint as to the probable cause of that disease. Bearing on the same subject is the fact, lately noticed by Davaine, that the splenic apoplexy of sheep is owing to the presence of bacteria in the blood, and that sheep, rabbits, and horses can be inoculated by transferring into their circulation the bacteria, which are extremely thin rod-like organisms, varying in length from $\frac{1}{6000}$th to $\frac{1}{2000}$th of an inch. The same observer has just found (as we learn from the 'Parisian Medical Intelligence,' in the *Lancet* for January 4, 1868) that bacteria are to be found in all carbuncular diseases of any form whatever; that the supervention of these little beings in the spleen, the lungs, and the blood, precedes the occurrence of morbid phenomena; and that the carbuncular blood ceases to be contagious as soon as the bacteria have disappeared; and hence he feels justified in regarding them as the cause of carbuncle.

Another French observer, M. Poulet, has just detected myriads of infusoria (*monas termo* and others) in the breath exhaled in whooping-cough. If one contagious disease can be proved to be connected with the germs occurring in the air, it is almost a certainty that similar diseases must arise from corresponding causes.

(3) The natural means of purifying the atmosphere are diffusion, oxidation, the action of winds, and the fall of rain. In cases where the air is specially impure, as in sick-rooms where there are contagious cases, the agents commonly known as *Disinfectants* (q. v.), or *deodorants*, are employed. Amongst the *solids* of this class are charcoal (see WOOD-CHARCOAL), dried earth, and the carbolates of lime and magnesia. Amongst the *liquids*, those in highest reputation are *Condy's Fluid*† (consisting of an alkaline permanganate, which at once decomposes ammoniacal compounds, and destroys organic matter rapidly) and carbolic acid: whilst amongst the *gases* or *vapors*—which are the most powerful means of purifying the atmosphere, next to ventilation—may be especially mentioned chlorine, nitrous acid, and sulphurous acid; of these, says Dr. Parkes, the nitrous acid is probably the most powerful, but it is useful to employ all three alternatively, or even together. It must be recollected that all these agents are mere auxiliaries to ventilation, the primary importance of which must never be forgotten.

(4) Abundant experience confirms the view which might have been *a priori* inferred from the study of the physiology of Respiration (q. v.), that the breathing of impure air must be incompatible with perfect health. The special impurities which are worthy of notice as being causes of disease, or of an impaired state of health, are arranged by Dr. Parkes as follows: (*a*) Suspended matters; (*b*) Gaseous matters; (*c*) Impurities from several substances always co-existing.

(*a*) *The suspended matters* which are known to occasion disease in various trades, are very numerous. Thackrah, in his well-known work on *The Effects of Arts, Trades, and Professions on Health*, published in 1832, gives the following list of workmen who were injuriously affected by the dust of their trades: Corn-millers, maltsters, tea-men, coffee-roasters, snuff-makers, paper-makers, flock-dressers, feather-dressers, shoddy-grinders, weavers of coverlets, weavers of harding, dressers of hair, hatters employed in the bowing department, dressers of colored leather,

* The older observers fixed the necessary quantity of fresh air far too low: Peclet thought 212 feet sufficient; Arago, 353 feet; and Dr. Reid, 600 feet per hour.

* *Ninth Report of the Medical Officer of the Privy Council* (1866), pages 29 and 515.

† It may interest some of our readers to know that by washing the cavity of the mouth with a very weak solution of Condy's Fluid, the odor of tobacco is instantly removed.

workers in flax, dressers of hemp, some workers in wood, ware-grinders, masons, colliers, iron-miners, lead-miners, grinders of metals, file-cutters, machine-makers, makers of fire-arms, and button-makers. Colliers suffer from lung disease in ill-ventilated mines; and to the list above given must be added potters, especially the class called *flat-pressers*, in whom emphysema is so common that it is known as 'the potters' asthma;' the china-scourers, who all, sooner or later, become asthmatical from inhaling the light flint-dust in suspension; pearl button-makers and pin-pointers, who suffer from bronchitis and hæmoptysis; the makers of grinding-stones; the makers of Portland cement, &c. In some trades, irritant vapors are more or less associated with suspended particles in causing disease. Brass-founders suffer not only bronchitis and asthma from the inhaled dust, but also a special disease, described by Dr. Greenhow (in the *Proceedings of the Medico-Chirurg. Soc.* vol. 4) as Brassfounders' Ague, which is apparently produced by the inhalation of the fumes of oxide of zinc; the symptoms being oppression of the chest, with indefinite nervous sensations, followed by shivering, a hot stage, and profuse sweating. Coppersmiths and tin-plate workers are liable to somewhat similar attacks. Plumbers, house-painters, manufacturers of white-lead, &c., are, as is well-known, liable to lead-poisoning.

The peculiar affection to which workers in mercury and its amalgams, as silverers and water-gilders, are exposed, is described in the article PARALYSIS, under the name of *Mercurial Tremor*, or *The Trembles*. In the various trades in which arsenical compounds are employed, as in making artificial flowers, green paper for walls, &c., preparing arsenical pigments, &c., the well-known symptoms of chronic arsenical poisoning are likely to ensue. On the subject, Dr. Guy has, at the request of government, drawn up an elaborate Report.

Passing from inorganic or unorganized matter to organic substances floating in the atmosphere, and giving rise to a large class of important diseases, we may remark, that it still remains to be decided in what exact condition this organic matter exists—whether it is in the form of impalpable particles, or moist or dry epithelial or pus cells; 'and whether it is always contained in the substances discharged or thrown off from the body (as is certainly the case in small-pox), or is produced by putrefactive changes in these discharges, as is supposed to be the case in cholera and dysentery, is also a matter of doubt. But, from the way in which, in many cases, the organic substance is absorbed by hygroscopic substances, it appears that it is often combined, or at anyrate condensed, with the water of the atmosphere.'—Parkes, *op. cit.*, p. 86. This much is known with certainty regarding the specific poisons—viz., that they differ extremely in the readiness with which they are oxidized and rendered harmlesss. While typhus and oriental plague throw off a poison, which, if there is due ventilation, is readily destroyed, the poisons of small-pox and scarlatina spread in defiance of free ventilation, and retain their virulence for weeks or months.

(*b*) The most important *gaseous matters* in the air likely to produce disease are *carbonic acid* and *carbonic oxide*. The normal quantity of carbonic acid in the air being regarded as ·5 in 1000 volumes, 'it produces fatal results when the amount reaches 50 per 1000 volumes; and at an amount much below this, 15 or 20 per 1000, it produces in some persons, at anyrate, severe headache.' Dr. de Chaumont, assistant Professor of Hygiene at Netley, has published a valuable paper in the *Lancet* for September 1866, in which he shows how the amount of air necessary to reduce the carbonic acid of respiration to a given standard could be calculated; and in the *Edinburgh Medical Journal* for May 1867, he has given extended formulæ for calculating most of the problems connected with ventilation. Amongst the most important of his conclusions are the following: (1) We cannot safely accept a lower standard of purity than ·06 per cent. of carbonic acid. (2) Uniform diffusion being supposed, we cannot preserve this standard with a less delivery of fresh air than 3000 cubic feet per head per hour. (3) We must provide an air space which will admit of the delivery of 3000 cubic feet per head, and at the same time preclude the necessity of changing the whole air so often as six times per hour, for which condition a minimum of 1000 cubic feet is absolutely necessary.* *Carbonic oxide* (q. v.), which is often developed in association with carbonic acid, is far more actively poisonous than carbonic acid.

An atmosphere containing ½ per cent. killed small birds in three minutes; and when 1 per cent. was present, they died in half this time (Letheby). For the effect of other gaseous matters, as sulphuretted hydrogen, carburetted hydrogen, sulphurous acid gas, hydrochloric acid, &c. we must refer to any of the more elaborate works on this subject.

* A committee, of which Sir T. Watson was president, recently appointed by the Poor-law Board to consider the question of the amount of cubic space necessary for the sick in workhouse infirmaries, report that for ordinary patients 850, for offensive cases, 1200, and for fever patients 3000 cubic feet should be allowed. Although these spaces are greater than we find in most workhouses, it is obvious from the statements in the text that they are not sufficient.

(*c*) The *impurities from several co-existing agents* next claim attention. In point of fact, these are the impurities with which we have practically almost always to deal, and it is very probable that a knowledge of the action, of two or more isolated noxious agents might lead us to very incorrect conclusions regarding the composite effect that is actually produced. When air is vitiated by respiration, it is popularly believed that the carbonic acid gas is the chief poisonous agent; and that the fatality in such well-known cases as the Black Hole (q. v.) of Calcutta, the prison in which the Austrians were placed after the battle of Austerlitz, the steamer *Londonderry*, &c., is simply due to the action of this gas. The true poisonous agencies in these instances are the organic matter, which is always found in air rendered fetid by the prolonged respiration and cutaneous exhalation of a crowd of human beings, and the deficiency of the oxidation, and the consequent increase of putrescent matter in the body (see Carpenter's *Human Physiology*, 1864, p. 304). Putting aside these extreme cases, which are of rare occurrence, we have abundant evidence in the Reports of the Health of Towns Commission, and elsewhere, that the continuous inhalation of an atmosphere moderately vitiated from respiration has an injurious effect on the health. The aëration of the blood is imperfectly effected, and the nutrition generally is more or less interfered with.

Although impure air has long been vaguely regarded as a cause of phthisis, it is only during the present century that the fact has been placed on unquestionable authority. It may now be regarded as established, that not only phthisis but other lung-diseases may have their origin in breathing an atmosphere contaminated by respiration. The subject is one of such vital importance that we shall adduce the very strong evidence of Dr. Parkes, who most distinctly proves that the prevalence of phthisis amongst our troops is in a direct ratio to the impurity of the air in the barracks. 'A great amount of phthisis used to prevail,' he observes, 'in the most varied stations of the army, and in the most beautiful climates: in Gibraltar, Malta, Ionia, Jamaica, Trinidad, Bermuda, &c., in all which places the only common condition was the vitiated atmosphere which our barrack-system everywhere produced. And as if to clench the argument, there has been of late years a most decided decline in phthisical cases in these stations, while the only circumstance which has notably changed in the time has been the condition of the air. So also the extraordinary amount of consumption which prevails in the men of the royal and merchant navies, and which, in some men-of-war, has amounted to a veritable epidemic, is in all probability attributable to the faulty ventilation.'—*Op. cit.*, pp. 91, 92. A considerable amount of evidence in support of this view is afforded by comparative pathology. The extraordinary mortality of phthisis amongst the inhabitants of the old monkey-house in the Zoological Gardens, was found to be due to overcrowding and bad ventilation; and now, in their present airy residence, the inhabitants are no longer prematurely cut off. The overcrowding to which cows in large towns are subjected leads to the great amount of pulmonary disease amongst these animals; while horses, which in the worst stables have more free air than cows, rarely suffer. Not only are pulmonary affections induced by the prolonged respiration of air partially vitiated by organic exhalations, but such an atmosphere seems to favor the spread of several well-known specific diseases, as typhus, plague, small-pox, scarlatina, and measles.

Hitherto, we have simply considered the effect of breathing an atmosphere vitiated by the exhalations given by persons in ordinary health; if we now pass to the consideration of the air of a crowded hospital-ward, we shall find the organic matter not only more abundant, but at the same time far more noxious. The convalescence of patients is much retarded by their being kept in such an atmosphere (see CONVALESCENT HOSPITALS.) When the air has absorbed a certain amount of organic impurity, its respiration is very likely to give rise to erysipelas and hospital gangrene. *Sewers* and old *cesspools*, when opened, give off *sewage-gas* containing carbonic acid, sulphuretted hydrogen, sulphide of ammonium, and putrid organic vapor. A case is given in the first volume of the *Health of Towns Report*, which forcibly illustrates this fact. When a privy connected with a school at Clapham was cleaned out, 23 of the children were seized with violent vomiting and purging, headache, great prostration, and convulsive muscular twitchings; and 2 of them died within 24 hours. Sewer-men are more liable to typhoid and typhus fever than any other persons; but night-men and scavengers do not seem liable to any special disease. The effect of diluted sewer-gas from bad drainage, on the health of the population at large, is a distinct question, into which we have not space to enter, further than to remark that typhoid and diarrhœa are commonly induced by the escape of this gas through our drains and water-closets into our houses. The effects of the impurities arising from manufactories of various kinds, are of course extremely varied; and the subject is so extensive a one that it must be touched upon very briefly.

Sulphurous and sulphuric acid are given off from vitriol and copper-smelting works; hydrochloric acid from alkali-works;

arsenical fumes and sulphurous acid from copper and lead smelting furnaces; carbonic acid and carbonic oxide from cement-works, &c. Soap and candle manufactories, if not well superintended, yield various gases of a rancid smell, and even that powerful irritant, acroleine. Gas-works in which the wet-lime process of purification is adopted, often evolve sulphuretted hydrogen to such a degree as to become a nuisance injurious to health. Manure-works usually evolve more or less disgusting smells according to the basis operated on, and the mode of preparation. No bad effect on the health has, so fas as we know, been observed in this country, from the gases given off by such works, and the exhalations from the manufactories of *poudr tte*, which is dry fæcal matter, are positively declared, by several of the highest French authorities, to exercise no injurious action either on man or vegetation; but the eminent French hygienist, Parent Duchâtelet, relates two cases in which poudrette underwent fermentation on board ship; and in one of these cases, the vessel lost half her crew (number not stated); while in the other, all on board (five) suffered from intense headache, pain in the limbs, vomiting, prostration, and (in two cases) diarrhœa. The *air of old graveyards*, when they are disturbed, often gives rise to epidemics of fever; but the effect of the effluvia of comparatively recent putrefying human bodies is much more decided. Numerous cases are recorded of asphyxia and various forms of fever arising from the exhumation and disturbance of bodies. How far the effluvia arising from *slaughter-houses* and *knackeries* are injurious to health, is an open question.

There is very strong general evidence that the men employed at Montfaucon (where, however, the ventilation is excellent, and no putrid matters are allowed to remain) enjoy good health; and Tardieu, from a late re-examination of the point, confirms the old conclusion, except so far as glanders and malignant postule are concerned. The danger of breathing the *air of marshes* also requires notice. Malaria seems not only to occasion intermittent and remittent fevers, but diarrhœa and pure dysentery. Organic matter to the amount of eight grains has been obtained from 1000 cubic feet of air collected over marshes; and it is worthy of notice that it has just the same chemical characters as the organic matter exhaled from the lungs, turning red with nitrate of silver, yielding ammonia when treated with lime, and blackening sulphuric acid when drawn through it. See Mapother, *op. cit.*, p. 87.

The next point to be considered is the means to be adopted for continually changing the air, so as to keep it in its natural purity. We have already shown that this change must amount to at least 2000 cubic feet per head per hour for persons in health; and sometimes double that amount, or more, for sick persons. The general principles of ventilation having been treated in the article on WARMING AND VENTILATION, we shall confine ourselves here to a few supplementary observations. In whatever way the fresh air is supplied, there are several essential conditions to be observed, of which the following, as stated by Dr. Parkes, deserve special notice: (1) 'The *entering air* must itself be pure. It must be warmed if too cold, and cooled if too warm. (2) Its movements should be imperceptible, otherwise it will cause the sensation of draught, and will chill.

'The rate at which the movement becomes imperceptible is 1½ feet per second, or 1·36 miles per hour; 2 and 2½ feet per second, or 1·4 and 1·7 miles per hour, are imperceptible to some persons; 3 feet per second, or 2 miles per hour, is perceptible to most; 3½ feet is perceived by all persons. Any greater speed than this will give the sensation of draught, especially if the entering air be of a different temperature, or moist. (3) It must be well diffused all through the room, so that in every part a movement shall be going on—in other words, the distribution must be perfect. (4) The *outgoing air* must be removed so immediately that there shall be no risk of a person breathing again either his own expired air or that of any other person.'—*Op. cit.* p. 103. The *action of the wind* is a powerful ventilating agent. If it can pass freely through a room with open doors and windows, it changes the air to an extent that can be effected in no other way. The most serious objection to winds as ventilating agents by perflation is the uncertainty of their movement, and the difficulty of its regulation. When the velocity reaches 4 miles, it is found unpleasant by most people and is therefore either excluded, or only admitted through small openings, when it fails to become properly distributed. For the various ways in which the perflative power of the wind has been employed in systems of ventilation, we must refer to Ritchie's *Treatise on Ventilation*. 1862; Tomlinson's *Treatise on Warming and Ventilation;* and to the chapter on that subject by Dr. Parkes, who gives a diagram illustrating the mode in which Dr. Arnott has most successfully ventilated the Field Lane Ragged Schools. In the ventilation of ships, the wind is always used, the air being directed between decks and into the hold by means of wind-sails or tubes with cowls turning towards the wind.

A description of Dr. Edmond's plan of ventilation, which is now commonly used in emigrant ships, and as being adopted in the royal navy, is given in a recent article in *The Lancet*, on 'The Medical Aspects of the Abyssinian Expedition.' 'In all cases,' says Dr. Parkes, 'in which the air of a room—as in a basement story or in the hold of a ship, perhaps—is likely to be *colder* than the external air, and where artificial means of ventilation cannot be employed, the wind should be taken advantage of as motive agent.' In artificial ventilation by a fan or screw, it is a question which of the two methods should be employed—the method of *extraction*, in which the air is drawn out of a building or room; or the method of *propulsion*, in which air is driven in, so as to force out the air already in the room. Both plans have advocates of authority. The advantages of the method of propulsion are its certainty and the ease with which the amount may be altered. The stream of air can be taken from any direction, and can be washed, cooled, or warmed at pleasure. The fan or wheel commonly used in propulsion is essentially that proposed by Desaguliers in 1734; it is figured in article BLOWING-MACHINES (figs. 7, 8). The following is the way in which it is applied to one of the largest rooms in this country—St. George's Hall, at Liverpool. The air is taken from the basement; is washed, by being drawn through a thin film of water, thrown up by a fountain; is passed (in cold weather) into vessels for the purpose of warming it, in which it can be moistened by a steam-jet, if the difference of the dry and wet bulb be more than five degrees, and is then propelled along the channels which distribute it to the hall. In summer, it is cooled in the conduits by the evaporation of water. This system is employed with success in various hospitals, asylums, &c. in France and America; and during the Crimean war, Mr. Brunel introduced into the hospital of Renkioi a wheel of Desaguliers' at the entrance of each ward of 50 beds, which was worked by hand, and could throw 1000 cubic feet of air into the ward every minute.

For information regarding the best means of keeping the air of rooms at the most fitting temperature, we must refer to the article WARMING. The degree of artificial warmth that should be given to the air varies according to circumstances. Healthy adults, who are well fed and clothed, usually find any temperature from 50° to 60° comfortable; while children and aged persons require a temperature of 65° to 70°. In hospitals, the proper temperature is usually supposed to be about 60°; but in those diseases in which there is preternatural heat, except possibly in scarlatina, a lower temperature—as from 50° to 45°, or even 40°—is more expedient. In most febrile cases, in the acute stage, cold air moving over the body is very efficacious as a cooling agent.

The next sanitary element to be considered is WATER. The *daily quantity* of water for healthy and sick persons is the first point for consideration. Water is required by healthy persons (1) *For drinking.* A man weighing 10 stone will take on an average from 70 to 90 ounces of water in 24 hours, of which 30 or 40 ounces are taken imperceptiby in the solid food, while the remaining 50 or 60 ounces are taken in a liquid form. But the amount varies extremely. The usual allowance on board ship for both drinking and cooking is 8 pints per adult daily. (2) *For cleansing the person, clothes, and habitations.* Dr. Parkes estimates 4 gallons per head daily as the smallest amount; and if perfect cleanliness is to be secured, and baths* are taken, at least 16 gallons per head are required. (3) *For sewage*, an additional 9 gallons must be added. The amount for a water-closet varies with its construction. At Netley Hospital, to which Dr. Parkes is physician, Jenning's closets are used, which require 10 gallons per head daily.

It may be of importance to many of our readers to know that a horse drinks from 8 to 12 gallons daily, and ought to have 3 or 4 more for grooming purposes; a cow or small ox drinks from 6 to 8 gallons; and a sheep or pig, from 2 quarts to 1 gallon.

The different *sources* of water—rain-water, rivers, and springs; the chief impurities in these waters; the methods of detecting them; and the modes of purifying bad water, are so fully described in the article WATER-SUPPLY that we have scarcely anything to add on these points. The *organic matters* in different waters used for drinking purposes require, however, a few additional remarks, on account of their extreme importance in a hygienic point of view. To the remarks on this subject in another part of this volume, we may add that their amount varies from 0·3 per gallon to as much as 12 or even 30 grains per gallon, the purest waters in this respect being those from granitic, or clay-slate, or chalk districts. The most common organic matter is derived from the vegetable kingdom, and consists of humin and ulmin, and of acids derived from humus; all which substances are non-nitrogenous, although the acids combine readily with ammonia. This form of organic matter is far less dangerous than that which has an animal origin, and contains nitrogen. This organic matter is usually derived from the contents of cesspools or sewers percolating into springs. Its exact composition is not known. Fæcal and biliary matters doubtless contribute to the composition of this matter; and in addition, decomposed flesh, as the refuse of butch-

*A general bath requires about 50 gallons; a shower-bath at least 6 gallons; and a hip-bath from 12 to 18 gallons.

ers' shops and slaughter-houses—substances from tripe-manufactories and gut-spinners, from size, horn, and isinglass manufactories, &c., often contribute to the organic matter of well and spring water. See Parkes, *op. cit.*, p. 12. Most of these substances, in decomposing, produce both nitrous and nitric acid and ammonia; and the nitrites and nitrates thus formed unfortunately not only do not communicate any bad taste or smell to the water, but actually tend in many cases to render it especially palatable. The use of water of this kind is liable to produce diarrhœa and choleraic symptoms.

The characters of good drinking-water—as laid down after much discussion by various sanitary congresses—are summed up by Dr. Parkes as follows: 'It must be transparent, colorless, without odor, and tasteless; it should be well aërated (as it then appears to be more easily absorbed), cool, and pleasant to drink; it must have no deposit; vegetables should be readily cooked in it; the total dissolved constituents must be within a certain amount, which, with some limitation, may be represented by the following numbers: organic matter should not exceed 1·5 grains per gallon; carbonate of lime, 16 grains; sulphate of lime, 3 grains; carbonate and sulphate of magnesia, 3 grains; chloride of sodium, 10 grains; carbonate of soda, 20 grains; sulphate of soda, 6 grains; and iron, 0·5 of a grain.'

For details regarding the mode of examining water with the view of ascertaining its value for drinking purposes, we must refer to any of the leading works on Practical and Analytical Chemistry, and an especial reference may be made to Professor Miller's recent Memoir on Potable Water, and to Dr. Parkes's section on the examination of water. To the substances named in the article on WATER-SUPPLY, as purifying water from organic matter, we may add the following: (1) *Permanganate of potash*, commonly known as Condy's Fluid, which decomposes organic matter and ammoniacal compounds by rapid oxidation. A physician who has had long experience on board Australian emigrant-ships informs us that he has often added a small quantity to the water which, when drawn from the casks, was almost undrinkable, with the effect of at once rendering it totally inoffensive. (On this subject, Condy's *Air and Water, their Impurities and Purification*, may be read with advantage.) (2) *Strychnos potatorum*, which is used in India to purify water; the nut being rubbed on the inside of the casks. (3) Certain vegetables containing *tannin*, as tea,* kino, the Laurier rose (in Barbary), and bitter almonds (in Egypt).

The consequences of an *insufficient* and *impure* supply of water are deserving of the most serious consideration. The Reports of the Health of Towns Commission (1844 and 1845) contain much information on the first of the subjects; while the Reports of the Medical Officer of the Privy Council abound in facts relating to the second subject. We find that an insufficient supply leads to the person and clothes not being washed at all, or being repeatedly washed in the same water; to water for cooking being repeatedly used; to imperfect cleansing of houses and streets; to the sewers becoming clogged, and the air thus rendered impure. The natural result is—as in the case of a deficiency of pure air—a depressed condition of the general health, with a tendency to skin-diseases, ophthalmia, &c.; while the imperfect cleansing of the sewers favors the spread of typhoid fever and of choleraic diarrhœa. We are indebted more perhaps to Mr. Simon's valuable Reports than to any other source for the knowledge that a continually increasing class of cases is found to be connected with the use of impure water, the principal noxious ingredients being animal organic matter, especially when of fæcal origin; vegetable organic matters, when derived from marshes; and some salts, except when in very small quantities, as sulphates of lime and magnesia, chlorides of calcium and magnesium, nitrates and nitrites of ammonia, &c.

The *alimentary mucus membrane* is especially liable, he supposes, to be affected by impure water. Thus, dyspepsia, with such symptoms as partial loss of appetite, uneasiness or pain in the pit of the stomach, nausea and constipation, with occasional diarrhœa, may be caused by water containing certain quantities (probably about eight grains each per gallon) of sulphate of lime, chloride of calcium, and the magnesian salts. *Diarrhœa* may be caused by the use of many of the great North American rivers, the Ganges, &c., where much clay is held in suspension. Water contaminated with sewage, and containing suspended animal and especially fæcal matter, is a common cause of an outbreak of this affection, and even of choleraic symptoms. Dissolved animal organic matters doubtless have a similar effect, but it is difficult to distinguish between the actions of these and of suspended organic matters. Amongst other impurities known to occasion diarrhœa are fetid gasses (sulphuretted hydrogen), an excess of dissolved mineral matters and nitrate of lime; and on most persons, brackish water acts similarly. The effects which the selenitic well-waters of Paris exert on strangers are well known. There is abundant evidence to show that impure water is one of the principal causes of *Dysentery*. The records of our army surgeons abound in illustrative cases. The deleterious effect of the impure water of Calcutta in inducing dysentery has been forcibly pointed out by Dr. Chevers in the *Indian Annals* for 1864.

In addition to the diseases affecting the alimentary mucous membrane of the intestines, there are certain *specific diseases* which result from the use of impure water, as *Malarious Fevers* of various forms, from the use of the water of marshes; *Typhoid Fever*, from water contaminated with sewage matters, or the special typhoid poison; *Cholera*, from water into which cholera-evacuations have made their way; and possibly *Yellow Fever*. (The relation of impure water to typhoid fever and cholera will be more fully noticed in a later part of this article). To the use of water unfit for drinking purposes are also ascribed epidemic boils from the presence of sulphuretted hydrogen; disease of the bones, as exostosis, from an excess of carbonate and sulphate of lime; calculi (on, we think, insufficient evidence); goitre, from water derived from limestone and magnesian rocks; and entozoa of various kinds. Dr. Parkes sums up the department of his *Manual* which treats of water in a hygienic point of view with the following practical conclusion: '(1) An endemic of diarrhœa *in a community* is almost always owing either to impure air, impure water, or bad food. If it affects a number of persons suddenly, it is probably owing to one of the two last causes; and if it extends over many families, almost certainly to water. (2) Diarrhœa or dysentery constantly affecting a community, or returning periodically at certain times of the year, is far more likely to be produced by bad water than by any other cause. (3) A very sudden and localized outbreak of either typhoid fever or cholera is almost certainly owing to the introduction of the poison by water; and the same fact holds good in cases of malarious fever. (4) The presence of lumbrici, guinea-worm, or *Bothriocephalus latus*, should always excite suspicion of the drinking and bathing water.'—*Op. cit.*, p. 63.

After the two most important factors in relation to health, viz., air and water, SOIL and CLIMATE occupy a secondary, although by no means unimportant place. As their practical bearing is less direct and universal, we will dismiss them briefly. *Soil* may affect health (1) by its conformation and elevation. Thus, amongst hills, the unhealthy spots are enclosed valleys, where the air must stagnate, and ravines. On plains, the most dangerous spots are at the foot of hills which store up water, unless a ravine cuts off the drainage. (2) Vegetation exerts an important influence. If we regard vegetation as divisible into herbage, brushwood, and trees, it may be laid down as a general rule, that herbage is always healthy, and in the tropics, is of great importance in cooling the ground, both by obstructing the sun's rays and by aiding evaporation; that brushwood is almost always bad, but that its removal may cause a temporary increase of malarious disease, on account of the disturbance of the soil; and that trees should seldom be removed, unless they decidedly interfere with the movement of the air, for in cold countries they shelter from cold winds—in hot, they cool the ground—and in both they may afford protection from malarious currents. The present condition of St. Thomas in the West Indies, which is now one of the most pestilent sites we are acquainted with, is mainly due to the insane destruction of its trees. The island of Mauritius, which has lately been visited by one of the most universal and destructive forms of fever ever recorded, has similarly suffered from the same cause. (3) The mechanical structure of the soil is of hygienic importance in various points of view. Thus, *heat* is very differently absorbed by different soils under the same conditions of exposure. Assuming that sand with a little lime has the maximum power of retaining heat, and that its capacity be represented by 100, then the capacity of clay will range from 76·9 to 66·7; while that of chalk will be 61·8, and that of humus as low as 49. Hence, we see the comparative coldness of the latter soils as compared with sand. The capacities of these soils for absorbing and retaining moisture are in the reverse order.

As a general rule, there seems to be the following connection between the geological characters of a site and its probable healthiness. *Granitic*, *Metamorphic*, and *Trap Rocks* are usually healthy: there is generally a slope, so that water runs off readily, the air is dry, vegetation moderate, and drinking-water generally good. They are, however, supposed to be unhealthy when they have become disintegrated, as at Hong-Kong, into a dark-colored soil. *Clay-slate rocks* are regarded as healthy, for very similar reasons; water, however, is often scarce. Of the varieties of *Limestone Rocks*, the hard oolite is the best and the magnesian (which, if possible, should always be rejected as a site) the worst. *Chalk*, when unmixed with clay, forms a very healthy soil; but if it be mixed with clay, it loses its permeability, and is often damp and cold. The air is pure, and the water, though hard, is clear, sparkling, and pleasant. The *Sandstones*, if permeable,

* The water of the Peiho and other rivers in the north of China is so impure, and has so offensive a smell during winter, that the Chinese never drink it except as tea, when it seems to lose all its bad effects. It is only by using their 'brick-tea' to purify the water of the steppes, that the Tartars render the water drinkable.

are healthy; but if, from an admixture or underlying of clay, they lose this property, they are often damp. The water must be carefully examined. The hard millstone grits are very healthy. *Gravels* of any depth are healthy, except water rises through them. Dr. Parkes considers gravel-hillocks as the healthiest of all sites, and the water as being very pure. *Clay*, *Dense Marls*, and *Alluvial Soils* must be regarded with suspicion. Such soils, and especially the deltas of rivers, should, if possible, be avoided as sites, and if they must be chosen, thorough sub-soil draining, careful purification of the water, and elevation of the houses far above the soil, are the measures to be adopted. According to Dr. Forbes Watson, nearly one-third of the whole surface of India is covered by alluvial soil.

CLIMATE.—The most important climatic conditions connected with the air are *temperature, humidity*, and *movement, weight, and composition of the air*. Under the head of temperature we might enter into the general subject of acclimation; we must, however, confine ourselves to the remark, that Europeans from temperate climates seem to flourish in countries not much hotter than their own, as in some parts of Australia and New Zealand, although it is yet too soon to decide whether the general vigor of the race will improve or diminish. In countries with a yearly mean of 20° F. higher than the home climate, as in many parts of India, the race seems to dwindle, and gives indications of dying out. The endemic diseases of Europeans in the tropics are liver-disease and dysentery, but it is uncertain how far other influences may be at work besides heat in the production of these diseases. Rapid changes of temperature are always dangerous. The sudden check to the free action of the skin caused by a cold wind, is sure to give rise to catarrh, inflammations, and neuralgia. The Registrar-general's returns show that when the temperature in London falls from 45° to 27°, the weekly mortality is increased by 400, bronchitis being the disease which mainly causes this increase—an affection which usually does not prove fatal in more than about 40 cases weekly. The fatal influence of extreme cold in depressing the nervous system, and giving rise to a sleep from which there is no awakening, is noticed in the article COLD. According to their humidity, climates are also divided into *moist* and *dry*. The most agreeable amount of moisture to most persons is when the relative humidity* is between 70 and 80 per cent.

In chronic lung-diseases, a still moister air is most pleasent, and serves to allay cough. The morbid effects of undue moisture are always associated with rise of temperature. As a general rule, warmth and great humidity are less oppressive than cold and great humidity. There seems to be close relation between the spreading and the checking of certain epidemic diseases and the relative moisture of the atmosphere. The malarious diseases are most intense when the moisture is excessive; while plague and small-pox are checked by a very dry atmosphere. Yellow fever seems unaffected by this atmospheric condition. That the humidity of a climate, irrespective of other climatic relations, is not injurious to life, may be inferred from a comparison between the climates of England and Ireland. The number of persons over 100 years of age is, in proportion to the population, five times as great in Ireland as in England, and the greatest longevity has been observed in Connaught, the wettest of the provinces.†

See Mapother, *op. cit.*, p. 134.

The *movement of the air* is another climatic condition of importance, but it must be considered in connection with heat and moisure. A cold wind abstracts the bodily heat in proportion to its velocity; while a hot wind, if dry, increases evaporation, and may thus partly neutralize its own heating power. Variations in atmospheric pressure are of great importance in relation to health. 'In ascending mountains,' says Dr. Parkes, 'there is rarefaction, i. e., lessened pressure of air, lowered temperature, and lessened moisture above 4000 feet; greater movement of the air; increased amount of light; greater sun-radiation, if clouds are absent; and the air is freer from germs of infusoria.'

'Owing to the rarefaction of the air and watery vapor, there is greater diathermancy of the air; the soil is rapidly heated, but radiates also fast, hence very great coolness of the ground and of the air close to it at night.'—*Op. cit.*, p. 418. The physiological effects of lessened pressure begin to be perceptible at somewhat less than 3000 feet, at which altitude the mercury falls 3 inches. The pulse is quickened by 15 or 20 beats, and the breathing by 10 or 15 inspirations per minute; there is increased evaporation from the skin and lungs, while the urinary secretion is probably diminished. At an elevation of 6000 or 7000 feet, as in the Swiss Alps, the effect of the mountain air shows itself in a marked improvement in digestion, sanguification, and in nervous and muscular vigor. At great heights, there is swelling of the superficial vessels, and occasional bleeding of the nose and lungs; and a sensation of weight is felt in the limbs from the lessened pressure on the joints. A residence for some time in a mountain-air is of great value in all anæmic affections, from whatever cause they may arise. Neuralgia, gout, and rheumatism are all benefited by high alpine positions (see Weber *On the Climate of the Swiss Alps*, 1864); and scrofula and consumption are almost absent in the true alpine regions, while patients affected with these diseases, if brought to such a climate, rapidly improve. On the other hand, pneumonia, pleurisy, and acute bronchitis are more common in high regions than lower down. The disease formerly known as 'mountain asthma' seems, from Weber's observations, to be common pulmonary emphysema combined with or followed by chronic bronchitis.

FOOD is a subject which has been already considered in the articles DIET and FOOD AND DRINK. There are, however, certain points connected with it which obviously fall within the domain of hygiene; as, for example, (1) the quantity of the different kinds of food required for persons of different sexes and ages, and under varying conditions of life and climate; (2) the determination of the best articles of food in each class, and whether they are in a proper state for use. The first of these subjects is to a considerable degree discussed in the article DIET. The latest and probably the most accurate statements on this subject are those of Pettenkofer and Voit (quoted in Parkes's *Sanitary Report of the Army for* 1865); a strong average man requires, according to these physiologists, 5·22 oz. of dry nitrogenous matters, 3·63 oz. of fat, and 13·3 oz. of carbohydrates. They also find that when the food is sufficient, the daily excretion of carbon from the lungs is 8·92 oz. or 3902 grains. We may add that an average man, at moderate work, takes, in 24 hours, from $\frac{1}{18}$th to $\frac{1}{20}$th of his own weight in solid and liquid food—viz., from 34 to 46 ounces of so-called solids, as bread, meat, &c.; and from 50 to 80 ounces of water. The ratio of the solid to the liquid food is generally 1 to 2, but may be 1 to 6. Great bodily exercise requires a greater increase of the solid than of the liquid food.

It may be interesting to many readers to know the amount and nature of the daily diet of an English soldier* on home service and the railway navvy:

Soldier.	Oz.	Navvy.	Oz.
Meat	12	Meat	13·7
Bread	24	Bread	28·5
Potatoes	16	Potatoes	7
Other vegetables	8	Other vegetables	0·57
Coffee	0·33	Butter	0·57
Tea	0·16	Cheese	1·7
Salt	0·25	Beer	37
Sugar	1·33	Coffee	0·5
Milk	3·25	Cocoa	1·1

Deputy-inspector-generals O'Flaherty and Taylor, and Assistant-surgeon Spurway, published, in 1867, important articles on the diet of soldiers in the 7th volume of the *Statistical, Sanitary, and Medical Reports for the year* 1865, from which it would appear that, *inter alia*, an addition to the fatty food would be expedient. For information on the *Dietary of Workhouses and Prisons*, we must refer to Dr. E. Smith's admirable report on the former subject, and to Dr. Lankester's paper, 'On Prison and Workhouse Dietaries,' read before the Health Department of the Social Science Congress at Belfast—an abstract of which may be found in the *British Medical Journal* for November 2, 1867. The whole subject of prison dietaries requires revision. While in some favored institutions the prisoners live in comparative luxury, in others the dietary scale is far too scanty. The Irish prisons are especially faulty in this respect; the daily expense of the food per head seldom reaching fourpence, and in some jails being only *twopence!*

At Waterford jail no food is allowed from 3 P.M. to 8 A.M., and in the Irish jails generally a pint of skim milk constitutes the whole animal diet. It is understood that a commission has been issued to report upon this subject. The proper arrangement of diet for the sick is a matter of great difficulty. In hospitals, fixed scales must, as a matter of convenience, be adopted; but almost every special case requires a modification. For further information on special diets, the reader is referred to Moleschott's *Physiologie der Nahrungsmittel;* (1860); to Dr. Dobell's useful *Manual of Diet and Regimen;* and to Dr. Smith's *Practical Dietary for Families, Schools, and the Laboring Classes.*

The diseases connected with food are so various that we can only notice the most important. Passing over those which arise from excess of food generally, or of one of its classes, with the remark, that a prolonged excess of albuminates gives rise to congestion and enlargement of the liver, and a general state of plethora, while excess of starchy matters may possibly affect the

* By *relative humidity* we express comparative moisture, complete saturation being assumed to be 100. It is determined by dividing the weight of vapor actually existing in the air (or the absolute humidity), by the weight of vapor which would have been present if the air had been saturated.

† The average annual relative humidity of Ireland is 85, but on many days it attains as high a point as 94.

* We learn from Froude's *History of England*, that in the reign of Edward VI. the English soldier's rations during war were, meat, 2 lbs.; bread, 1 lb.; light French wine, 1 pint.

muscular fibres of the heart and voluntary muscles, and certainly often renders the urine saccharine, we proceed to notice the diseases produced by the deficiency of food. The history of epidemic fevers in all ages and countries shows the close relation between famine and fever. The *Irish famine* of 1847—1849 is now a matter of history. In those three years, no less than 579,721 cases were treated in the hospitals alone. Fleeing in despair, emigrants carried the germs of disease with them; and the so-called *ship-fever* which followed destroyed its thousands. Its malignity was most appalling. In one vessel, 329 out of 349 passengers caught the fever, and 117 died; and the mortality in Liverpool, induced by the contagion of the fever-stricken Irish who landed there, suddenly became the highest ever recorded in any modern town—the death-rate being raised to 70 per 1000.

During the three years, 1865, 1866, and 1867, the death-rate of this town was 36, 42, and 30. Dr. Mapother is of opinion that the introduction of the potato as an almost sole article of diet has been productive of much harm, in consequence of the deficiency of that root in nitrogenous matters and in salts of lime and magnesia.* To this source he traces indigestion, consumption, scrofula, rickets, ophthalmia, and chronic rheumatism. The deprivation of starchy food, on the other hand, can be borne for a long time if fat be given; but the simultaneous deprivation of fat and starch soon induces illness, though albuminates be supplied.

With regard to salt meat, it must be recollected that the brine, if it has been used several times, occasionally becomes poisonous. The evidence as to the power of diseased meat when eaten to excite disease, is—if we except the cases in which entozoa are present—very unsatisfactory. We have the evidence of Sir Samuel Baker and others that certain African tribes eat without injury meat swarming with maggots. In this country, the flesh of healthy animals, when decomposing, is sometimes eaten with impunity, and sometimes occasions severe gastric intestinal disorders. There is reason, however, to believe that if slightly tainted meat, poultry, or river fish be washed in a very dilute solution of Condy's fluid, previous to being cooked, all danger is removed. The occasional occurrence of a poison in sausages and even in pork pies is well known, although its nature is not clearly understood. The fresh flesh of diseased animals assuredly causes injurious effects in many cases, but not in all. In the early stage of acute inflammatory disease, the meat is not altered, and may be eaten with impunity. Whether the epidemic pleuro-pneumonia of cattle renders their flesh unfit for use, is an open question. (See Mapother, *op. cit.*, pp. 217—224, who decidedly condemns its use, and Parkes, *op. cit*, pp. 161—166, who quotes conflicting evidence.) The discrepancy of evidence is equally great regarding anthrax and malignant pustule. The death of sheep from splenic apoplexy or braxy, and from small-pox, renders their flesh unfit for food; while the flesh of cattle destroyed by foot-and-mouth disease and by typhoid fever has been largely used in France without injury. The detection of the adulterations of the ordinary articles of food is a very important duty in relation to hygiene; on this subject, we must refer to Hassall's great work, and to our article FOOD.

The object of CLOTHING is to preserve the proper heat of the body by protecting it both from cold and heat, and thus to prevent the injurious action of sudden changes of temperature upon the skin. The most important materials of clothing are cotton, linen, wool, silk, leather, and india-rubber. *Cotton*, as a material of dress, wears well, does not readily absorb water, and conducts heat much less rapidly than linen, but much more rapidly than wool. From the hardness of its fibres, its surface is slightly rough, and occasionally irritates a very delicate skin. Its main advantages are cheapness and durability. In merino it is mixed with wool in various proportions, and this admixture is far preferable to unmixed cotton. *Linen* is finer in its fibres than cotton, and hence is smoother. It possesses high conducting and bad radiating powers, so that it feels cold to the skin; moreover, it attracts moisture much more than cotton. For these reasons, cottons and thin woollens are much preferred to linen garments in warm climates. *Silk* forms an excellent underclothing, but from its expense, it can never come into general use. *Wool* is superior both to cotton and linen in being a bad conductor of heat, and a great absorber of water, which penetrates into the fibres and distends them (hydroscopic water), and also lies between them (water of interposition). 'This property of hydroscopically absorbing water is,' as Dr. Parkes observes, 'a most important one. During perspiration, the evaporation from the surface of the body is necessary to reduce the heat which is generated by exercise. When the exercise is finished, the evaporation still goes on, and to such an extent as to chill the frame.

'When dry woollen clothing is put on after exertion, the vapor from the surface of the body is condensed on the wool, and gives out again the large amount of heat which had become latent when the water was vaporized. Therefore, a woollen covering, from this cause alone, at once feels warm when used during sweating. In the case of cotton and linen, the perspiration passes through them, and evaporates from the external surface without condensation; the loss of heat then continues. These facts make it plain why dry woollen clothes are so useful *after* exertion. In addition to this, the texture of wool is warmer, from its bad conducting power, and it is less easily penetrated by cold winds.' *Op. cit.*, p. 353. *Leather* is used not only for shoes, boots, and leggings, but in cold windy countries, for coats. Leather and sheep-skin coats are in common use in Turkey, Tartary, Persia, the Danubian Provinces, and in Canada, where buffalo-skins are often used. For persons specially susceptible to cold, and of delicate organization, a chamois leather jacket worn over a flannel waistcoat may be recommended with advantage during the winter months. *India-rubber* clothing must be used with extreme caution. From its being impenetratable to wind, and from its condensing and retaining the perspiration, it is decidedly objectionable; while, on the other hand, its protection against rain is a very valuable property. The Council of Health of the French army have refused to admit waterproof garments amongst their soldiers; and in this country it has been prohibited amongst the London postmen.

In relation to protection against heat, we have to consider the color and not the texture of clothing. White is the best color, then gray, yellow, pink, blue and black. Hence, in hot countries white or light gray clothing should be preferred.

The shape and weight of all articles of clothing should be such as to allow of the freest action of the limbs, and in no way to interfere by pressure with the processes of respiration, circulation, or digestion. In a complete treatise on hygiene, a discussion on the relative advantages and disadvantages of the various articles of clothing used by both sexes would find a proper place, but our limited space totally precludes us from entering into this subject.

ATTENTION to the STATE OF THE SKIN is of great importance in a hygienic point of view, the perspiration and sebaceous matters which are naturally poured out upon the surface of the body, with an intermingling of particles of detached epidermis, fragments of fibres from the dress, dirt, &c., if not removed, gradually form a crust which soon materially interferes with the due excreting action of the skin. There is little doubt that the daily use of the matutinal *tub*, which less than half a century ago was unheard of, and is now a matter of necessity with most healthy persons who have the means of using it, has contributed materially to harden the system against attacks of colds, rheumatism, &c. When a tub and sponge happened to be unattainable, a wet towel rubbed over the body, followed of course by a dry one, is a good substitute.

EXERCISE is the subject that next claims our consideration, and we shall briefly notice its effects on the different systems of organs. (1) The most important effect of muscular exercise is produced on the *lungs*, the quantities of inspired air and of exhaled carbonic acid being very much increased. Taking the air inspired in a given time in the horizontal position as unity, a man walking 3 miles per hour inspires 3·22; and if carrying 34 lbs., 3·5; a man walking 4 miles per hour inspires 5; and when walking 6 miles per hour, no less than 7. Almost twice as much carbonic acid is exhaled during exercise as during rest. Hence, muscular exercise is necessary for the due removal of the carbon; and it is obvious that in a state of prolonged rest, the carbonaceous food must be diminished, or the carbon will be liable to accumulate in the system; and further, it is clear that for strong exercise, carbonaceous food should be freely given. (2) The action of the *heart* rapidly increases in force and frequency during exercise. The increase in the number of beats may range from 20 to 30, and is sometimes much more. After exercise the heart's action is diminished. Excessive exertion may do harm by inducing pulmonary congestion, and even hæmoptysis, palpitation, hypertrophy, valvular disease, and occasionally rupture; while deficient exercise probably tends to induce tuberculous disease of the lung, weakness of the heart's action, and probably dilatation and fatty degeneration. From these facts we learn, that when a person commences any new form of exercise or gymnastics, the heart's action should be watched, and if the pulse rise to 120 or more, the exercise should for the time cease.

(3) The *skin* becomes red from increase of blood in the capillaries, and the perspiration is increased, being at least doubled. The bodily heat is kept down by cutaneous evaporation, which reduces the temperature. During exertion, there is very little danger of chill, but the danger becomes great when the exertion is

* Potatoes contain 74 per cent. of water, 1·5 of albuminates, 0·1 of fat, 23·4 of starch, cellulose, &c. (the carbo-hydrates), and 1 of salts. The chief ingredients of the salts are potash, about 50 per cent.; and phosphoric acid, about 13 per cent. The juice of the potato abounds in salts of organic acids (citric, tartaric, &c.), which on incineration are converted into carbonates—the carbonic acid thus formed amounting to 13·3 per cent. The relative proportion of fat to albuminates in the food which is most easily digested, and at the same time produces the greatest mechanical force, is as 1 to 2; in the potato, it is as 0·1 to 1·5, or as 1 to 15. Again, the starchy matters should be to the nitrogenous as 3 to 1 in the best diet: in the potato, they are as 23·4 to 1·5, or as 14 to 1 nearly. On this subject see the article MUSCULAR FORCE, ORIGIN OF.

over, because there is then a rapid fall in the heat of the body, while the evaporation of the skin continues. Hence, while the skin may be freely exposed during exercise, it must be covered immediately afterwards, in order to prevent any feeling of coolness on the surface. (4) The *muscles* grow to a certain limit, but over-exercise of any special group may produce wasting. Care must be taken that the exercise is of such a nature that all the muscles, and not single groups, should be brought into play; and that in early training, long intervals of rest should intervene between the periods of exercise. (5) The effect of exercise on the *mind* is not clearly determined; great bodily activity is often observed in association with full mental activity; but there is a fear that, in our great public schools and universities, boating and cricket are supplanting more useful subjects, and leaving too little time for the due performance of intellectual work. (6) *Digestion* is improved by exercise. The appetite increases, and nitrogenous substances, fats, and salts, especially phosphates and chlorides, are required in greater quantity than in a state of rest. (7) The *change of tissues* is increased by exercise, or, in other words, the excretions give off increased quantities of carbon, nitrogen, water, and salts. The muscles require much rest for their reparation after exercise, and they then absorb and retain water, which seems to enter into their composition. So completely is the water retained in the muscles, that the urine is not increased for some hours. Hence, observes Dr. Parkes, there is an absolute necessity of water for the acting muscles, and the old rule, held by trainers, of only allowing the smallest possible quantity of fluid, must be wrong.

The amount of exercise which should be taken by an adult healthy man is a subject of great importance. Professor Haughton, in his *New Theory of Muscular Action*, calculates that a laboring man daily exerts a muscular force to a degree which may be expressed by saying, that he would raise to the height of 1 foot from 250 to 350 tons. For persons not obliged to labor, the force expended, including that required for the ordinary avocations of life, should average 150 tons, which is equivalent to walking about 9 miles daily. It is unfortunately impossible to arrange scales of exercise for invalids, women, and children. Professor Haughton has shown that walking on a level surface is equivalent to raising the $\frac{1}{20}$th part of the weight of the body through the distance walked. When ascending a height, a man of course raises his whole weight through the height ascended. Using his formula, $\frac{W + W'D}{20 \times 2240}$ (where W is the weight of the person, W′ the weight carried, D the distance walked, 20 the coefficient of traction (see FRICTION), and 2240 the number of pounds in a ton), we obtain as a result the number of tons raised 1 foot; and on applying it, we get the following table :

Kind of Exercise.	Weight done in Tons lifted one foot.
Walking 1 mile	17·67
" 20 miles	353·4
" 1 mile, and carrying 60 lbs.	24·75
" 20 miles, " "	495

Thus, a march of 10 miles, with a weight of 60 lbs. (which is about the weight a soldier carries when in marching-order, but without blankets and rations), is a moderate day's work. A 20 miles' march with this weight is a very hard day's work. As a continuous effort, Professor Haughton believes that walking 20 miles a day without a load (Sundays excepted) is good work.—For a discussion on the various forms of exercise, as horse-exercise, boating, dancing, and gymnastics, we may refer the reader to Mapother, *op. cit.*, pp. 263—268. In connection with the subject of exercise, the reader is referred to the article MUSCULAR FORCE, ORIGIN OF.

The CONSTRUCTION OF HOUSES, especially of dwelling-places for the poor, and public lodging-houses, next claims our notice. There can be no doubt that the frequency and fatality of the epidemics of the middle ages were in a great measure due to unhealthy habitations. The houses were usually closely packed in crowded streets, and were often built for the purpose of defence, at a sacrifice of ventilation, lighting, draining, &c. At the present day, with all our boasted civilization, the dwellings of the poor, both in our large towns and in our country villages, are too often a disgrace to humanity. Any one may readily satisfy himself on this point by reading the various government reports referred to in an early part of this article, the Annual Reports of the Medical Officer of the Privy Council, and the Reports which are annually published by many of our Officers of Health.

An article on the Sanitary State of Manchester, which appeared in the *Quarterly Journal of Science* for April 1867, reveals a condition of the dwellings of the poor which seems almost incredible to those who have not previously studied this important but uninviting subject. In many parts of Ireland, as we learn from Dr. Mapother, the dwelling-places of even the small farmers are hardly fit for a healthy existence. Dr. Tucker of Sligo draws the following picture of 'the homely hovel of a small farmer, which may be taken as the prototype of many. It was about 12 feet wide and 24 feet long. The domestic circle that dwelt therein consisted of a sick man, his wife, four daughters, one son, three cows, one horse, two calves, two pigs, and poultry—all in one common undivided house, without a partition. Generally, the pigs dwelt beneath the beds, the people in them, and the poultry overhead.' On the evils, physical and moral, arising out of such a system it is unnecessary to dwell.

Much has of late years been done in London (by the benevolence of Baroness Coutts, Mr. Peabody, Alderman Waterlow, and others) and in many other large towns to improve the dwellings of the poor, and to give them, on moderate terms, a far more healthy and commodious house-accommodation than they could otherwise obtain. Many of these improved dwellings seem fever-proof, and the death-rate has been found much lower than in adjacent places. Even without the aid of private benevolence, the erection of blocks of improved dwellings for the working-classes has proved remunerative. Five conditions are requisite in order to insure healthy habitations, on whatever scale they may be constructed : (1) A site dry and not malarious, and an aspect which gives light and cheerfulness; (2) a ventilation sufficient to carry off all respiratory contaminations of the air; (3) a system of immediate and perfect sewage removal; (4) a due supply and proper removal of water; and (5) a construction of the house such that perfect dryness of its foundation, walls, and roof is insured. For further information on this important topic, the reader is referred, *inter alia*, to the various works of Mr. Godwin, especially his *Another Blow for Life;* to Mr. Hole's interesting book entitled *The Homes of the Working-classes;* and to Dr. Mapother's *Lectures on Public Health* (2d ed. pp. 297—326).

SEWAGE is sufficiently considered in the special article devoted to that subject (see also SEWAGE EARTH-CLOSET); and we pass on to another subject closely connected with hygiene—viz., the DISPOSAL OF THE DEAD. To see the importance of this subject, the reader must know something of the changes which the body undergoes after death. A body that has been buried gradually breaks up into a large number of comparatively simple compounds, such as carbonic acid, ammonia, sulphuretted and carburetted hydrogen, nitrous and nitric acid, and certain more complicated gaseous matters with a very fetid odor, which finally undergo oxidation; while the non-volatile substances usually enter into the soil, and either pass into plants, or are carried away by the water percolating the soil. These changes are accelerated by the worms and other low forms of life that usually swarm in decomposing bodies; and the character of the soil materially influences the degree of rapidity of destruction. The bones remain almost unchanged for ages. If a body is burned, decomposition is incomparably more rapid, and different volatile combinations may arise; the mineral salts and a little carbon alone remaining. The question for our consideration is, What is the best method of disposing of our dead, so that the living may suffer the least? Putting aside the visionary schemes for turning the dead to commercial account, there are three methods for consideration—viz., burial in land or in water, or incremation.

At present, as Dr. Parkes observes, the question is not an urgent one; but it may become so in a century or two, if the population goes on increasing at the present rate. Even in our own time, a great change has taken place, and the objectionable habit of interments in and round churches in towns has been given up, cemeteries in the country being now commonly employed, except in the case of country villages. The air over cemeteries is, however, always contaminated, and water percolating through them is unfit for drinking purposes; and there is a general and very decided opinion that the vicinity of graveyards is unhealthy. The evils are lessened by making the grave as deep as possible, and by placing not more than one body in one grave. Plants should be freely introduced into every cemetery, for the absorption of organic matters and of carbonic acid; and the most rapidly-growing trees and shrubs should be selected, in preference to the slowly-growing cypress and yew. We may add that the superficial space which should be allotted to each grave varies in different countries from 30 to 90 feet, and that the depth should be at least 6 feet. It is required by law that the grave spaces for persons above 12 years of age shall be at least 9 feet by 4, and those for children under 12 years 6 feet by 3. It is likewise required that not less than 4 feet of earth should be placed over the coffin of an adult, and 3 feet above that of a child. The time which should elapse before a grave is disturbed for a new tenant varies with the soil and the distance of the body from the surface. Under favorable circumstances, a coffin containing an adult will disappear with its contents in about 10 years; while in a clayey or peaty soil, it will remain a century.

It is generally assumed that a period of 14 years is sufficient for the decay of an adult, but long before this time, all will have disappeared but the skeleton. If the question should in course of time arise between burying in the sea and burning, it will be de-

cided, Dr. Parkes believes, in favor of the former, on the following grounds: 'It is true that the impurities in burning can be well diffused into the atmosphere at large, and would not add to it any perceptible impurity. But if the burning is not complete, fetid organic matters are given off, which hang cloud-like in the air, and may be perceptible and even hurtful. As a matter of expense, too, the system of incremation would be greater than the burial at sea. In the burial at sea, the body would go at once to support other forms of life more rapidly than in the case of land-burial and without the danger of evolution of hurtful products.' On this subject, the reader may further consult the Report drawn up by Mr. Chadwick on the State of Cemetaries; the Report of the General Board of Health, 1858 (of which Mr. Chadwick and Dr. Southwood Smith were members), on the same subject; Dr. Mapother's 14th Lecture 'On the Burial of the Dead;' and a work published by M. Favrot, entitled *Histoire des Inhumations*, 1867.

The Reports to which we have just referred contain abundant evidence of the necessity for the universal establishment of mortuaries, or houses for the reception of the dead until the period of the burial. In some parts of Germany, the deposit of the dead in such houses is compulsory; and in many parts of the continent, there are laws rigidly enforcing the burial within a certain number of hours after death.

Before proceeding to consider how far our sanitary regulations have effected a saving of human life, it is expedient to give a brief notice of the chief acts of parliament which have passed, and government Reports that have been officially published, bearing on important sanitary subjects. Beginning with 1833, in which the Factory Children's Act was passed; in 1834, the practice of employing climbing boys for sweeping chimneys was abolished; in 1840 and 1841, the Act to Extend the Practice of Vaccination was passed; and in 1842, the employment of women and children in mines and collieries was abolished. Then appeared the General Local Reports on the Sanitary Condition of the Laboring Classes, 1842, which constitute, as Dr. A. P. Stewart well observes, a 'remarkable series of volumes, for which we were indebted chiefly to Mr. Chadwick, and which, revealing as they did an almost incredible state of matters in our crowded centers of population, were read by multitudes with a strange and eager interest.' —*The Medical and Legal Aspects of Sanitary Reform* (1867), p. 5. These Reports of the Health of Towns Commission led to the passing in rapid succession, of 'the Acts for Promoting the Establishment of Baths and Wash-houses in Great Britain and Ireland, in 1846; the Towns Improvement Act in 1847; the Public Health, the Nuisances Removal, and the City of London Sewers Acts, in 1848; the Metropolitan Interments Act, in 1850, followed in 1853 by a similar act for the whole of England; the Act to Encourage the Establishment of Lodging-houses for the Laboring-classes, and the Common Lodging-houses Act, in 1851; the Metropolitan Water Act, in 1852; the Smoke Nuisance Abatement (Metropolis) Act, and the Act to Extend and Make Compulsory the Practice of Vaccination, in 1853; the Merchant Shipping Act, with its stringent provisions for the preservation of the health of our merchant seamen, in 1854; the Diseases Prevention, the Metropolis Local Management, the Metropolitan Buildings, and the Nuisances Removal Amendment Acts in 1855; and the Public Health Act of 1858, which abolished the General Board of Health, and vested its powers in the Privy Council.

Since then, there have been added to the statute-book the Acts for the Purification of the Thames, in 1858 and 1866; the Act for Preventing the Adulteration of Articles of Food and Drink, in the same year; the Acts (passed in 1860, 1861, and 1864) which included, under the provisions of the Factory Acts, women and children employed in bleaching and dyeing works, in lace factories, and in the manufacture of earthenware, of lucifer-matches, of percussion caps and cartridges, of paper-staining and of fustian-cutting; the Vaccination Amendment Act in 1861; the Act for the Seizure of Diseased and Unwholesome Meat, and the Alkali Works Act, in 1863; the Sewage Utilization Act, in 1865; the Laboring-classes' Dwelling-houses Act, and the Sanitary Act, in 1866.'—Stewart, *op. cit.*, p. 6. The last-named of these acts—the Sanitary or Public Health Act of 1866—contains certain clauses with which every one should be acquainted. Its first part is an amendment of the Sewage Utilization Act, 1865, and provides, *inter alia*, that any owner or occupier of premises within the district of a sewer authority shall be entitled, under certain conditions, to cause his drains to empty into the sewer; but if a dwelling-house is without efficient drainage, the sewer authorities may require the owner to make a sufficient drain, emptying into a sewer, provided the latter be not more than 100 feet distant; and that the sewer authority may provide a supply of water for the use of the inhabitants of the district. The second part is an amendment of the Nuisances Removal Acts—the word 'nuisance' being made to include (1) any house or part of house so overcrowded as to be dangerous or prejudicial to the health of its inmates; (2) any factory or workshop not kept clean and properly ventilated; (3) any fireplace or furnace not, as far as possible, consuming its own smoke; and any chimney (not belonging to a private house) sending forth black smoke.

The rules for the removal of such nuisances are laid down. The nuisance authority, moreover, has power to enforce the cleansing and disinfecting of houses or articles therein likely to retain infection, and to fine those who disregard the injunction; to provide a proper place for disinfecting clothing, bedding, &c., and to effect the disinfection of such articles; to provide carriages for the conveyance of infected persons to hospitals, &c. The 25th clause is so important, and its nature so very little known, that we extract it *verbatim*: 'If any person suffering from any dangerous infectious disorder, shall enter any public conveyance without notifying to the owner or driver thereof that he is so suffering, he shall, on conviction thereof before any justice, be liable to a penalty not exceeding £5, and shall also be ordered by such justice to pay to such owner or driver all the losses and expenses they may suffer in carrying into effect the provisions of the act; and no owner or driver of any public conveyance shall be required to convey any person so suffering until they shall have been first paid a sum sufficient to cover all such losses and expenses.' The act further lays it down that places for the reception of the dead may be provided at the public expense, and that any justice may, on the certificate of a legally qualified medical practitioner, order the removal thither of the bodies of those who die of infectious disease;* and gives permission that special places for the performance of *post-mortem* examination may be provided.

The third part of the act is headed 'Miscellaneous.' It treats of various points for the better management of lodging-houses, lays a penalty not exceeding £5 on any person with infectious disorder exposing himself, or on any person in charge of such a sufferer causing such exposure; and a penalty not exceeding £20 on persons letting houses, rooms, or part of a house in which infected persons have been lodging, without having such houses, or rooms, and articles therein, disinfected to the satisfaction of a qualified medical practitioner (the keeper of an inn is deemed to let part of a house to any person admitted as a guest into such inn). It is very much to be regretted that most of the provisions of this and other acts bearing on public health are permissive, and not peremptory.

We may note that since 1858 a Public Health Department has been established in the Privy Council, and that the Medical Officer of the Privy Council, Mr. Simon, has, since that date, published an annual Report of the Proceedings taken under the Public Health Act, 1858. These Reports are not merely of great interest, but of the highest practical importance; and we should not omit to mention that the progress of sanitary science has been considerably advanced by the publication of an annual volume, containing a valuable series of statistical, sanitary, and medical army reports by the establishment of the Epidemiological Society and the Social Science Congress, and by the publication of their Transactions.

It is much to be regretted that the Privy Council does not more energetically carry out the powers conferred on them by the Diseases Prevention Act, 1855, and the Public Health Act, 1858. Unfortunately, however, it requires some comparatively rare and startling disease, as yellow fever, plague, cholera, or cattle-disease, to stir that august body into activity; while typhus, typhoid, and small-pox may ravage our crowded towns and undrained villages, and carry off their thousands of victims, unless in very extreme cases, to which the public press may have called attention. (Of the half million deaths that occur annually in England, more than 20,000 are due to typhus and typhoid;† while in England and Scotland, more than 5000 persons annually fall victims to small-pox.‡) By the Sanitary Act, 1866, the Home Secretary is empowered to interfere, if he see fit, on complaint made to him of the default of any local authority. It is sincerely to be hoped that he will unsparingly put forth the power intrusted to him.

Passing from what has, and what has *not*, been done by government, let us consider what are the duties of local authorities, and how they discharge them. On this subject, Dr. Stewart gives us much information in his pamphlet already referred to. To such an extent has non-interference prevailed that, except in London, the appointment of Medical Officers of Health, and even of inspectors of nuisances, is optional. He ascertained, that of 570 places under the Local Government Act, 1858, and the Public Health Act, 1848, with populations varying from 214 to 200,000, 50 have no inspectors of nuisances, 153 have each one; while in 347, one man holds the double or treble offices of surveyor, inspector, and collector. In the metropolitan districts, with a population of above 3,000,000, the sanitary force is most unequally

* Liverpool alone, so far as we know, has as yet taken advantage of this clause. The Council have erected three mortuaries; and a mortuary chapel for the Roman Catholics has been built partly at the expense of Mr. Hutcheson, a Protestant gentleman, and partly by subscription. (Stewart, *op. cit.*, p. 74.)

† According to Dr. W. Budd, typhoid alone is the cause of from 15,000 to 20,000 deaths in England.

‡ For data on this subject, see the foot-note to p. 813.

divided, for, while 2 subdistricts, with a population of 4000 and 10,000 respectively, have the services of one inspector, St. Marylebone and St. Pancras, with respective populations of 163,000 and 211,000, have each of them only two.

A few words on the duties, qualifications, and position of the Medical Officer of Health, will find a fitting place here.* His duties and qualifications are thus laid down in an Instructional Minute of the General Board of Health, dated December 20, 1855:

'He will make himself familiar with the general features of the place, with its previous sanitary state, and with its existing provisions for health—viz., the levels, inclinations, soil, wells, and water-springs; with its meteorological peculiarities; with its burial-grounds, slaughter-houses, lodging-houses, &c.; he will see to the general healthiness of his district, inquire into the cleanly and waterproof condition of houses, examine the drinking-water, and observe whether diseased meat or adulterated articles of food are exposed for sale; and will report weekly and annually to the Local Board.' These are but a few of his duties, for the proper performance of which (as the Minute goes on to add), special qualifications in science are required. 'These lie in pathology, including vital statistics, in chemistry, and in natural philosophy.'

For these accomplishments, the town of Aberdare offers 8½*d.* a day, or 12 guineas a year, for looking after the health of its 35,000 inhabitants; while Paisley gives £20 for the sanitary superintendence of a population of 48,000.

Fifty pounds is a common salary, except in the metropolis; the most liberal salaries are £350 at Birkenhead and Hackney, £400 at St. Marylebone, £500 at Edinburgh and Leeds, £600 London (Proper), while Liverpool has nobly raised the salary to £1000. Surely £500, £600, and £1000 are not too much for Edinburgh, London, and Liverpool to pay, in order to secure the services of such men as Littlejohn, Letheby, and Trench. Dr. Russell, the medical sanitary officer for Glasgow, has £600 a year; and Dr. Gairdner, one of the first of our living hygeists, is retained as consulting officer at £100 a year. Not only is the medical officer's salary dependent on the caprices of the local board, who may dismiss him at pleasure, but, as Dr. Stewart truly observes, 'the very efficiency with which he performs his duties may be an unpardonable sin in the eyes of a majority of his masters. His statements of facts may touch the interests of some, his suggestions of remedies may excite the displeasure of others; and if the soundness of his position cannot be assailed by reasoning, passion may suggest—as it has before now suggested—a reduction of salary or a threat of dismissal, as likely to bring the offender to his senses.' Not only is this disgraceful form of pressure brought to bear *directly* on the Medical Officer of Health, but *indirectly* on those who have the power of electing or dismissing him. An amusing incident of this nature is mentioned in Dr. Stewart's pamphlet. When Dr. Robinson was appointed Officer of Health for Leeds, he found that he had to grapple with unparalleled privy abominations, piggeries by hundreds, numerous slaughter-houses, the gigantic smoke-nuisance, and an average death-rate of 30 in 1000. The battle between science and filth was prolonged and terrific, and the piggeries were made the battle-field.

The pig-owners, taking alarm at Dr. Robinson's energy, formed themselves into a 'Pig Protection Society,' summoned ward-meetings, and commenced an active canvas, for the purpose of turning out of the council all who would not pledge themselves to vote for Dr. Robinson's dismissal. The case, after being twice heard before the magistrates, who declared that the pigs were a nuisance, and must be removed, was finally settled on appeal by the recorder, who gave an order, not for the eviction of the pigs, but for the daily removal of the manure, for the due enforcement of which a separate inspector would be required for every pig-sty! Under these conditions, is a Medical Officer of Health fairly encouraged to discharge his proper duties?

The next points to which we shall direct attention are the NUMBER OF DEATHS occurring annually in England and Wales, and the CAUSES OF THESE DEATHS; and we shall then proceed to inquire how far the deaths from some of our most fatal diseases might have been prevented by due attention to sanitary measures.

We learn from the Twenty-eighth Annual Report of the Registrar-general of Births, Deaths, and Marriages in England, which was published in 1867, and gives the results for the year 1865, the following statistical facts, which bear more or less closely on our subject. The population of England, the births, deaths, and excess of births over deaths, are tabulated from the year 1838, when the system of registration came in force; and from this table we extract the numbers for 1838, 1848, 1858, and for 1861—1865 inclusive:

Years ending Dec. 31.	Estimated Population in middle of year.	Births (exclusive of still-born).	Deaths.	Excess of Births.
1838	15,312,256	463,787	342,760	121,027
1848.....	17,340,492	563,059	399,833	163,226
1858.....	19,471,291	655,481	449,656	205,825
1861.....	20,119,314	696,406	435,114	261,292
1862.....	20,336,417	712,684	436,566	276,118
1863.....	20,554,137	727,417	473,837	253,580
1864.....	20,772,308	740,275	495,531	244,744
1865.....	20,990,946	748,069	490,909	257,160

From these figures, we learn, *inter alia*, that in a quarter of a century the population has added 5,000,000 to its strength, and that there is a steady increase (with occasional exceptions) in the annual number of births and deaths, and in the excess of the former; the number of births having increased during that period 46 per cent., and that of deaths 43 per cent. The following is an abstract of Dr. Farr's letter to the Registrar-general on the causes of death in England in 1865: In every 1000 deaths, 381 of the population fell before local diseases, 235 were struck down by zymotic diseases, 182 by constitutional diseases, 160 by developmental diseases, and 36 died violent deaths; the remaining 6 were deaths from causes not ascertained. *Local diseases*—the inflammations and functional diseases of organs—carried off 184,877 persons in England, causing 9 of the 23 deaths per 1000 of the living. It is the deaths from diseases of the vital organs that swell this number so high—22,272 deaths from heart diseases, nearly as many (21,774) from diseases of the digestive organs, more than thrice as many (69,952) from diseases of the respiratory organs so essential to life, and a number nearly as large as this last (60,264) from diseases of the nervous system.

The number of deaths in England ascribed to bronchitis has rapidly increased; it was but 21,528 in 1856, had advanced to 32,346 in 1860, and in 1865 reached 36,428. Softening of the brain is another disease that has increased rapidly of late years, and in 1865 was fatal to 1051 males and 627 females: these deaths would formerly have been classed under paralysis and other heads. The deaths from diseases of the nervous system include 26,722 from convulsions, occurring chiefly in children. Among the rarer deaths from local diseases, 5 are referred to fright, 3 to grief, and 43 to melancholy. The second most fatal class of diseases—the *zymotic* (epidemic and contagious)—is swelled chiefly by fevers and by diarrhœal disease. It swept from life in England 113,948 persons in 1865, the majority of them young children under 5 years of age. The deaths by cholera in England in 1865 were 1291; by diarrhœa, 23,531. The deaths by fever—typhus, typhia, and typhinia*—which were 13,012 in the year 1860, rose to 23,034 in 1865, and five-tenths of them were registered among four-tenths of the population. The deaths from scarlatina were 17,700, and from diphtheria, 4145. The deaths attributed to syphilis rose to 1647; 437 persons died from intemperance, and 612 from *delirium tremens;* 74 from privation; 19 from hydrophobia; 4 from glanders, for horses as well as dogs, communicate some of their diseases to men.

Worms are put down as the cause of death in 153 cases, one of which is ascribed to *Trichina spiralis*. The third class of deaths is from *constitutional diseases*, diathetic or tubercular, which were fatal to 88,504 persons in 1865. These diseases have this in common with the zymotic, that they are diffusive; and human tubercle is, even when introduced by inoculation, capable of inducing tubercular deposits in the organs of animals. The prevalence of phthisis in the armies of Europe is considered to be probably due in part to the inhalation of expectorated tubercular matter, dried, broken up into dust, and floating in the air of close barracks. Dr. Farr remarks that to test this may be difficult, but the origin and propagation of the most fatal of all human diseases deserves full investigation. The inquiry should also extend to cancer and the other constitutional diseases, among which should perhaps be included diabetes. Among the deaths from constitutional diseases may be noted gout, as increasing every year. Gout is five times as common in men as in women, and is very rarely fatal under 35 years of age. To it, 361 deaths were attrib-

* On this subject Dr. Letheby has published an excellent Memoir, which will be found in the *Medical Press and Circular* for August 7 and 14, 1867; and Dr. Rumsey's address *On State Medicine in Great Britain and Ireland* (Lond. 1867), may also be consulted with advantage.

*In the National Returns, all cases of fever are set down as Typhus, which is thus made to include pure *Typhus* with blood-spots (*petechiæ*) on the skin, which is exceedingly fatal (more than 20 per cent. of the cases in the London Fever Hospital proving fatal), is generated in crowded populations, and is very infectious; *Typhia* or *Typhoid Fever*, which is endemic, is characterized by an eruption of rose-red spots on the skin, and by ulceration of Peyer's glands, and is usually generated by the intestinal evacuations of typhoid patients, which should therefore always be submitted to the action of disinfectant agents (its mortality in the London Fever Hospital is rather less than 20 per cent.); and, lastly, *Typhinia*, which is commonly known as *relapsing* or *famine fever* (it is epidemic and infectious in times of scarcity and famine, and is comparatively harmless, the deaths amounting to only 2½ per cent.). For the introduction of the terms *Typhia* and *Typhinia*, we are indebted to Mr. Farr (see his 24th Annual Report of Births, Deaths, and Marriages in England, 1863, p. 214).

ated in 1865. Unlike gout, dropsy is most fatal to women; and the substitution of dropsy in women for gout in men after the age of 45 is worthy the attention of pathologists. Cancer is more than twice as fatal to women as it is to men. The mortality by all constitutional diseases is rather less than it was in the decade 1850—1859; and this is partly due to the decrease of the number of deaths referred to phthisis; still these deaths reached 53,734 in 1865, the greater part of them occurring in adults; and more than half the deaths of young women between 20 and 25 were caused by phthisis.

The fourth class of diseases—the *developmental*—were fatal to 77,806 persons in England in 1865: 8791 infants born alive died from being premature; and other 22,436 died of debility before they were a year old. Besides 1333 deaths by puerperal fever, and 2490 ascribed to childbirth, 490 women died of specific diseases complicated by parturition. The deaths by ordinary diseases of the 560,000 *enceinte* women, constantly existing in the population of England, could not be entirely distinguished from the deaths of other women of the same age; of course they were subject to the same diseases as others, but probably the class of mothers belongs to what, in a certain sense, the insurance offices call select lives. The list of developmental diseases closes with the deaths of 28,709 persons from old age, 154 of the men and 402 of the women being of the age of 95 and upwards. Thus we reach the last class of deaths—the 17,374 persons who were destroyed by *violent deaths;* 15,232 by accident or negligence, 443 under circumstances bringing the case under the legal denomination of homicide, 1392 by suicide, 6 on the scaffold, and the remaining 301 not classed. These are the several ways in which 490,909 persons died in England in 1865.

Now let us see how many of the above diseases are more or less preventable, and how far we have already been successful in diminishing them. There are parts of England in which, for each 1000 persons living, there die annually only 15;* while there are other parts that, of each 1000 persons, 30 or more† die annually. The 15 and the 30 are said to be the respective death-rates of these places. The average London death-rate is 25; and the most common death-rate in country districts and small towns through all England and Wales is 20. The Registrar-general's Return, published in January 1868, showing the annual rate of mortality in the large towns of the United Kingdom for the year 1867, enables a comparison to be made of the death-rates in the last three years—1865 being the first year of the publication of these results. Thus, the average annual rate of mortality per 1000 persons living in the great cities in each of the years 1865, 1866, and 1867 respectively, was as follows: Birmingham, which is on one of the healthiest sites in the kingdom, 25, 24, and 24; the density of population (persons to an acre) in 1867, was 44. Hull, 27, 24, and 25; density, 30. Bristol, 24, 25, and 23; density, 35. Edinburgh, 28, 27, and 27; density, 40. Dublin, 26, 28, and 27; density, 33. Salford, 29, 29, and 29; density, 22. Glasgow, 33, 30, and 29; density, 87. Manchester, 33, 32, and 31; density, 81. Leeds, 31, 33, and 27; density, 11. Liverpool, 36, 42, and 30; density, 96. The annual mortality in Sheffield, in each of the years 1866 and 1867, was 28 and 25; density, 10. In Newcastle-on-Tyne the annual mortality, in 1866 and 1867 respectively, was 32 and 31. The results for London, in each of the three years 1865—1867 respectively, were, annual mortality per 1000 of population, 25, 26, and 23; density, 40. In comparing the rate of mortality in one town with that of another, it should be borne in mind that of the English towns, Bristol, Leeds, and Liverpool have each a medical health officer. Birmingham, Hull, Salford, Manchester, Sheffield, Newcastle-on-Tyne have no medical health officer, but most of these towns, however, have benefited from the efficacy of hygienic measures.

It is obvious that if, by sanitary precautions, we could reduce all the death-rates to 15, or even to 20, an enormous saving of human life would result.‡ In the year 1865, Mr. Simon suggested that the time was come for attempting to ascertain the amount of benefit to the public health that had been derived from the works of sanitary improvement—especially of drainage and water-supply—that had been already completed, and he was authorized to institute the inquiry, with the assistance of Dr. Buchanan, as an inspector. The result of the inquiry, which relates to 24 towns,§ with an aggregate population of more than 600,000 persons, is now published, and we shall give a brief abstract of the results which have been obtained. The numerical results are given in the accompany table (page 824), where A shows at each place in the list what difference there has been, since sanitary works were established, in the *general death-rate* in 10,000 of the population, this number being taken instead of 1000 to obtain more accurate numerical results. B gives the general death-rates of A, *minus* the inconstant influence which has been exerted by the chief infantile epidemics; and similarly E gives the means of eliminating from A the influence of the cholera epidemics of 1848—1849, 1854, and 1866. The columns C to G inclusive are for comparing the quantities of particular kinds of deaths caused in each of the places in the two compared periods. Such 'special death-rates,' used with caution, yield the most useful of all conclusions as to changes wrought in the public health.

From the table, which is fraught with the most valuable information, in the most condensed form, we learn that, omitting the influence of cholera, there has been a diminution in the death-rate in all but five cases, where the rate has been stationary. In four of the towns—viz., Cardiff, Newport (Mon.), Macclesfield, and Croydon—the reduction amounted to 24, 23, 20, and 18½ per cent. With regard to the *contagious diseases, small pox*, which is capable of being rooted out by an efficient system of vaccination, is not noticed here, and *typhus fever* has scarcely occurred in the towns selected for inquiry. The time has hardly come for estimating the effect of works of sewerage and water-supply upon measles, scarlatina, and hooping-cough, inasmuch as epidemics of these diseases may revolve in long periods. *Measles* and *hooping-cough* seem, however, to have slightly declined. *Typhoid* has very much diminished with the ample supply of good water, and the purification of the atmosphere from decomposing organic matter, by the abolition of cess-pools, by draining, &c. In Salisbury, Stratford, Croydon, and Merthyr, the annual death-rate from typhoid has diminished 75, 67, 63, and 60 per cent. respectively; and in all the towns except three there was more or less diminution. In these exceptional cases, it was found that sewage gases were, by a defect of the outfall arrangement, forced into the houses.*

Diarrhœa appears to have been reduced by purification of air and water. Removal of subsoil water has not affected it. While in three towns the death-rate from this disease has been diminished 50 per cent. or more, in Ashby it has increased 100, and in Rugby, 200 per cent. These anomalous results are ascribed to the prevalence of the disease in the respective workhouses. *Cholera epidemics* appear, says Dr. Buchanan, to have been rendered practically harmless in the towns examined, as may be seen by the comparison of the death-rates per 10,000 in the three last epidemics:

	1848—1849.	1854.	1866.
Merthyr	267	84	20
Cardiff	208	66	15½
Alnwick	205	..	..
Salisbury	180	14½	..
Newport	112	1½	12
Brynmawr	100	..	..

Pulmonary phthisis has diminished in certain of the towns, and the diminution seems due to the drying of the soil, which has in most cases accompanied the laying of main sewers; and the greater the influence of the sewerage in drying the subsoil is, so much the greater is the diminution of the death-rate from this disease. At Salisbury, it is 49 per cent. of its former rate; at Ely, 47; at Rugby, 43; at Banbury, 41; and at Worthing, 36. Failure to reduce consumption is most observable either where the soil already contained little water, or where—the town water passing by the surface or in superficial drains—the deep drainage consisted of impervious pipes, laid down in compact channels, so that no extensive drainage of water could occur either through or alongside of them.

It does not seem that the sewerage of towns, by the removal of excreta and house-slops, has acted to reduce the amount of their death-rate by consumption. *Diseases of the lungs* other than consumption have undergone no regular reduction. Dr. Buchanan concludes this most valuable Report with the observation that the progress made by the inhabitants of most of the towns in decency, cleanliness, self-respect, and morality, was at the least as striking as the improvement in their health, measured by the mortality returns.

* In an article on 'Public Health,' in the *Quarterly Journal of Science* for January 1868, it is stated that at Sandown, in the Isle of Wight, which is thoroughly drained and well supplied with pure water, the death-rate for the last five years has been only 11 in 1000. As a contrast, we may take the village of Child's Hill, in the parish of Hendon, in which there is no efficient drainage, and where the open cesspools connected with the privies often overflow into the ditches and discharge their contents into the river Brent. Here, out of an entire population of 1000, there were 70 deaths in 1867, mainly from epidemic typhoid.

† We have already mentioned that the death-rate at Liverpool not very long ago reached 70; see also the preceding note.

‡ As in the year 1865, the population of England was 20,990,946, while the deaths were 490,909; the general death-rate for that year is 23·4. If this rate could have been reduced to 15, the number of lives thus saved in that year would have amounted to 176,324!

§ Twenty-five towns were visited, but we have omitted Ottery St. Mary, because it seems to have yielded no information.

* Worthing is the town in which the increase of fever is greatest, and this need not excite surprise when we learn that on the side of the water-tower of the town is a shed containing the engine which performs the double duty of distributing the water to the houses and the sewage to the land. To enable this to be effected, there are two wells within 50 feet of one another, sunk in a porous soil, one for the reception of the sewage, and the other for the drinking-water. Moreover, the water-well is in bad condition, and the water supply is neither constant nor sufficiently abundant. See article in *The Medical Press*, 1867. [Happily, this has been amended, and Worthing is now a noted watering-place, the utmost care being devoted to the water supply and sanitary arrangements.]

TABLE ILLUSTRATING THE IMPROVEMENTS OF PUBLIC HEALTH WHICH RESULT FROM PROPER WORKS OF DRAINAGE AND WATER SUPPLY.

Population in 1861.	Towns in Order of their Population.	Periods for which the Death-rates are compared.		DEATH-RATES PER ANNUM, TOTAL AND PARTICULAR, PER 10,000 OF GENERAL POPULATION, FOR EACH OF THE COMPARED PERIODS.															
				A		B		C		D		E			F		G		H	
				General Death-rates		General Death-rates after excluding Small-pox and other Infantine Epidemics.		Typhoid Fever.		Diarrhœa, excluding Cholera so called.		Cholera in each of the three Epidemics.			Phthisis.		Phthisis and other Pulmonary Diseases of women aged 15—55.		Death-rates of Infants under one year of age.	
		Before the Works.	*After the Works.*	*Before the Works.*	*After the Works.*	*Before the Works.*	*After the Works.*	*Before the Works.*	*After the Works.*	*Before the Works.*	*After the Works*	1848—49.	1854.	1866.	*Before the Works.*	*After the Works.*	*Before the Works.*	*After the Works.*	*Before the Works.*	*After the Works.*
160,714	Bristol	1847—51	1862—65	24½	24	21 5/8	20 5/8	10	6½	10⅛	9½	82	11	1½	31	25½	16	13⅛	54	52
68,056	Leicester	1845—51	1862—64	26 4	25 2	23 6½	22 5⅜	14 3/5	7⅘	16	19⅛	1	10	..	43⅜	29¼	17⅘	16	84¼	81
52,778	Merthyr	1845—55	1862—65	33 2	26 2	29 2⅛	22 1¼	21⅛	8⅜	11½	6¼	267	84	20	38⅜	34⅛	15½	13⅜	80¼	61
39,693	Cheltenham	1845—57	1860—65	19 4	18 5	18 2	17 2	8	4⅜	8⅛	7	..	..	..	28⅜	21¼	15	11⅜	40½	37
32,954	Cardiff	1847—54	1859—66	33 2	22 6	29 4	19 1½	17½	10½	17¼	4½	208	66	15½	34⅜	28⅜	all ages and both sexes 66	58⅜	?	?
30,229	Croydon	1845—50	1857—64	28 7	19 0	20 7	17 8¼	15	5½	10	7	27	21	2	?	?	all ages and both sexes 59½	49	?	?
29,417	Carlisle	1845—53	1858—64	28 4	26 1	24 4	22 5	10	9⅜	11⅛	12½	22	6	..	32	35 2/5	16½	16⅜	71	65½
27,475	Macclesfield	1845—52	1857—64	29 8	23 7	26 3⅛	21 7½	14¼	8½	11⅛	11	9	1	..	51½	35 3/5	28⅛	22	77½	59¼
24,756	Newport	1845—49	1860—65	31 8	21 6½	27 5	18 7½	16⅛	10⅛	11	6½	112	1½	1/2	37	25	14	12½	67¼	53¼
23,308	Dover	1843—53	1857—65	22 5½	20 9	20 3	18 7	14	9	9½	7	40	10	4⅜	26½	21¼	13⅛	11¼	47⅜	40⅛
10,570	Warwick	1845—55	1859—64	22 7	21 0	20 9¾	19 1⅛	19	9	5⅜	8	10½	..	..	40	32⅛	16⅜	14⅜	51¼	46¾
10,238	Banbury	1845—53	1857—64	23 4	20 5	21 4	18 4½	16	8½	11⅛	5½	2	1½	..	26⅜	15⅜	14⅜	9½	53	45
9,414	Penzance	1843—50	1856—65	22 1	22 2	19 7½	20 0⅜	7½	8	5⅛	9⅛	..	..	..	30⅜	29	13¼	14	?	?
9,030	Salisbury	1844—52	1857—64	27 5	21 9	25 3⅜	19 8½	7½	1¾	6⅛	2⅛	180	14½	..	44⅛	22⅜	all over 20, both sexes 53½	38½	43	40
8,664	Chelmsford	1843—52	1855—65	19 6⅛	21 5	18 0	18 7⅛	12	12⅜	7	8	4	.	..	32⅛	32⅜	12⅜	14⅛	44	42¾
7,847	Ely	1845—52	1859—64	22 8	20 5½	21 0	18 6¼	10 2/5	4½	3⅜	4¼	..	22	..	31	16⅜	all ages; both sexes 48	36	50⅛	42⅛
7,818	Rugby	1845—51	1855—64	19 1	18 6	16 4	16 4½	10	9	2⅛	7½	..	..	..	28½	16½	15	7	42½	45
7,189	Penrith	1845—52	1856—64	25 3¼	25 0	23 5½	23 0½	10	4½	3 5/6	4 5/6	9½	2½	..	39½	37½	17	19½	55 4/6	55½
6,823	Stratford	1845—53	1860—64	21 7	20 2	21 2¼	17 8	12⅓	4	11¼	5⅜	..	..	..	26⅜	26½	14	13	46	48
6,494	Alnwick	1845—51	1856—64	26 2	24 7	24 0	22 1½	13½	8⅜	7	4⅜	205	..	..	28⅓	33	13½	17⅛	?	?
6,334	Brynmawr	1843—52	1856—65	27 3½	23 2⅜	23 2	20 9	23½	10½	5	4⅜	100	..	..	28⅜	30	14⅜	13⅜	76½	69
5,805	Worthing	1843—52	1857—65	15 5	15 3	13 9	13 6½	7½	9¼	4⅜	5½	..	..	..	30½	19½	14⅜	9¼	24¼	22⅛
4,490	Morpeth	1845—52	1856—64	26 2	24 7	23 4	22 5	16½	10	8½	14½	14	11½	..	30½	28	14	14⅜	56	27½
3,840	Ashby	1845—51	1855—64	21 6	20 2½	21 3	18 4	13⅛	5¾	4	8⅛			..	25½	31⅛	16	13	48	31

In various articles on special disorders, as Scurvy, Small-pox, and Typhoid Fever, we have pointed out how completely they are under the control of sanitary or dietetic measures. In his excellent chapter 'On the Prevention of Diseases in the Army,' Dr. Parkes gives the following list of diseases, with the methods to be adopted for their prevention—viz.: (1) *Specific Diseases*—paroxysmal fevers, yellow fever, cholera, typhus exanthematus, bubo plague, typhoid fever, relapsing fever, bilious remittent fever, eruptive fevers, erysipelas, hospital gangrene; and (2) *Non-specific Diseases*—dysentery and diarrhœa, liver disease, insolation, phthisis, scurvy, military ophthalmia (gray granulations on the palpebral conjunctiva), and venereal diseases.*

It is the miasmatic diseases which form the first order of the class of zymotic diseases, which seem most under our control. We have shown in a previous page that recent researches tend to show that various of these diseases owe their origin to fungi. We shall conclude this imperfect sketch of the history, progress, and results of sanitary science with a history of the recently-discovered *cholera-fungus*, and with a notice of the other recent scientific investigations regarding the nature and prevention of this disease (which may be regarded as a supplement to the article CHOLERA). At the international congress held at Weimar, in 1867, the cholera-fungus was the great center of interest. The subject had been investigated by Professors Hallier and De Bary, two of the leading German mycologists, and the latter drew up a Report, the following abstract of which is given by Mr. Simon*: 'Both observers find in cholera evacuations, and in the intestinal mucus of the dead body, definite organic structures, zoogloea, consisting of excessively fine granules, clustered more or less densely in the interspaces of a jelly, which more or less abundantly surrounds them. The granules divide and subdivide themselves, to form beaded threads, which interlace, in immense numbers, into felted masses in the mucus.

'The further development of these organisms has yet to be determined. Dr. Thomé, by sowing them, has got, after some time, larger, round, cell-like bodies, which rapidly multiplied, and also abundant filamentous fungi (*cylindro-tænium*), on which grew cylindrical spores, capable of developing again to filaments. Views as to the mutual relations of these cells, filaments, and spores, are for various reasons to be expressed only with reserve; and the study of them is so immensely difficult, that definite results cannot at once be expected. The significance of these fungi would be greatly increased if they should be shown to exist in the

* In connection with diseases or affections which may be totally, or in a very great measure prevented, is short-sightedness. Dr. Cohn, of Breslau, has examined the eyes of 10,060 school-children, out of which number 1730, or 17·1 per cent., were found to be short-sighted. No village-children were affected until they had been at least half a year at school. Dr. Cohn attributes the evil, in a great measure, to the bad construction of the school-benches, which force the children to read with their books close to their eyes, and with their heads inclining downwards.

* A much fuller abstract (by Dr. Buchanan) of Professor Hallier's recent researches into the natural history of the cholera contagion, as contained in his pamphlet, entitled *Der Cholera-Contagion: Botanische Untersuchungen, Aertzen und Naturforschen mitgetheilt*, 1867, is given in pp. 512—515 of the Appendix to Mr. Simon's Ninth Report, to which that able pathologist, has added a most instructive note on the earlier microscopic observations that had been instituted, especially by our own countryman, on the cholera evacuations. On the subject of cholera the reader should also consult Dr Parkes's *Sanitary Report (Army Medical Department) for* 1865 (published in 1867), in which he discusses the recent additions to our knowledge of (1) The specific cause of cholera—the cholera-fungus; (2) The spread of cholera by intercourse; (3) Its communication by the so-called premonitory diarrhœa; (4) its spread by the agency of water; (5) and its prevention by disinfecting the discharges by means of carbolic acid, sulphate of iron, and salts of zinc.

blood as well as in the bowels of the sick; but this, though from some inquiries it seems probable, must at present be deemed questionable.' It has been since ascertained that this fungus requires a high temperature (86° to 112° F.) for its fructification, and therefore, cannot be of European origin. 'It cannot,' adds the same high authority, 'be too distinctly understood that the person who contracts cholera in this country is *ipso facto* demonstrated, with almost absolute certainty, to have been exposed to excremental pollution; that what gave him cholera was (mediately or immediately) cholera-contagium discharged from another's bowels; that, in short, the diffusion of cholera among us depends entirely upon the numberless filthy facilities which are let exist, and specially in our larger towns, for the fouling of earth, and air, and water, and thus, secondarily, for the infection of man, with whatever contagion may be contained in the miscellaneous outflowings of the population.

'Cholera, ravaging here at long intervals, is not Nature's only retribution for our neglect in such matters as are in question. Typhoid fever and much endemic diarrhœa are, as I have often reported, incessant witnesses to the same deleterious influence; typhoid fever, which annually kills some 15,000 to 20,000 of our population, and diarrhœa, which kills many thousands besides.'

We may further refer to the French treatises on hygiene by Becquerel, Levy, Tardieu, and Vernois; but the best in any language is that of Dr. Parkes, from which we have, with the author's permission, freely borrowed.

[Sanitary science, diverging for a little into the sphere of the possible, has depicted a new earthly paradise, which has interested the British public all the more, that it is proposed to plant it on English ground. In a lecture delivered at the Brighton meeting of the Social Science Association in 1875, Dr. B. W. Richardson gave an ingenious and happy sketch of a model and ideal City of Health, perfect in its sanitation, where the death-rate would be infinitely lessened, and where all preventible diseases would be well-nigh stamped out. As described by Dr. Richardson, *Hygeia*, the City of Health, might contain a population of 100,000, living in 20,000 houses, built on 4000 acres of land, with an average of twenty-five persons to an acre. The houses, which in the business part of the town must not exceed 3 or 4 stories in height, would rest on arches of solid brick-work, and as there would be no lower kitchens or areas, the space would be used as a passage for air. The main thoroughfares might consist of three wide streets, running east and west, crossed by others from north to south. Trees would be planted at the side of the pathways. Beneath the main streets would run a sub-way or railway, along which the heavy traffic would pass. The spaces at the backs of the houses would be all gardens.

The houses of the wealthy and all the public buildings standing apart would be surrounded with garden spaces, adding to the beauty and healthfulness of the city. The streets could be paved with wood set in asphalt, all accumulations of mud being washed away every day. In the dwellings themselves, the living-rooms ought to begin on the level of the street; the bed-rooms be on the first floor; and the kitchen, which is well lighted, be placed immediately below the roof. The roof itself would be but slightly arched, and almost flat, with a railing around it, and be available for the cultivation of flowers and other like purposes. The smoke, passed through a gas-furnace, would be sent into the air colorless and robbed of its carbon. The gas, water, and other pipes must pass along sub-ways, and so be easily accessible. An abundant supply of pure water would be introduced by iron, not leaden pipes. Ventilation would of course be elaborately provided for. The sewage, conveyed from the city by pipes copiously flushed, would be utilized at a distance therefrom. Any factories which could be called a nuisance would be placed outside the town. The unhealthy habit adopted by some workmen of working in their own homes would be forbidden and rendered unnecessary, small workshops being made available for their use at a moderate rent. Hospitals for the sick would be small and numerous, entirely detached from other dwellings, and easily removable. Ample provision would be made for baths, gymnasia, schools of all kinds, lecture-halls, libraries, and places of amusement. The town would not contain one single public-house or tobacconist's shop, neither stimulants nor sedatives being required or desired by the healthy and happy Hygeians.

To sum up the results of the system, infantile diseases would be unknown; typhus, typhoid fever, and cholera would cease to exist; and those diseases which arise from change of temperature and uncontrollable causes would be much mitigated. The death-rate would, according to Dr. Richardson's startling estimate, be reduced to 8 per thousand in the first generation, and 5 in the next. Even in Hygeia, men would, however, die at last; and when dead, would not be 'cremated,' but, in their shrouds only, or in basket-coffins, be laid to rest in cemeteries of artificially prepared soil. Some steps have been taken towards realizing this model City of Health, a site having been secured to the west of Worthing, in Sussex, at a cost of £30,000].

SA'NJAK, a Turkish word signifying 'a standard,' is employed to denote a subdivision of an *eyalet* (q. v.), because the ruler of such a subdivision, called *sanjak-beg*, is entitled to carry in war a standard of one horse-tail. The sanjak is frequently called a *liva*, and its ruler a *mirmiram*.

SANJAK-SHERIF. See FLAG OF THE PROPHET.

SAN JOAQUI'N, a river of California, U. S., rises in the Sierra Nevada, and runs first south-west to its junction with the outlet of Lake Tulare, thence north-west to its junction with the Sacramento River, 50 miles from the Bay of San Francisco. It receives numerous branches from both the coast range of mountains and the Sierra Nevada. Entire length 350 miles, for only a small portion of which it is navigable for large vessels.

SAN JOSE', a town of California, U. S., 40 miles S.-E. of San Francisco, with a considerable trade and some manufactures. Pop. (1870) 9089; (1880) 12,567.

SAN JOSE', the capital of Costa Rica, Central America, midway between the Pacific and Atlantic oceans. It stands on a tableland 4500 feet above sea-level, contains a number of important institutions, and carries on an active trade. Its port is Punta Arenas, on the Pacific coast. A line of railway, to connect S. J. with Punta Arenas and with Limon on the Atlantic, is partly made. Pop. 12,000.

SAN JUA'N DE PO'RTO RI'CO. See PUERTO RICO.

SAN JUAN DE LA FRONTE'RA, a town of the Argentine Republic, the capital of a province of the same name in the extreme west of the Republic. The town, 660 miles north-west from Buenos Ayres, stands on the right bank of a river, also called San Juan de la Frontera, which rises in the Andes, and falls into the large salt lake of Guanacache. The province is as yet only very partially settled, but exports considerable quantities of fruits and wine. The chief seat of trade is this town, which has a pop. of 20,000, almost one-third of that of the whole province.

S'ANKARA, or S'ANKARACHARYA, i. e., the *âchârya*, or spiritual teacher, S'ankara, is the name of one of the most renowned theologians of India. His date, as is the case with most celebrities of that country, is unknown. Tradition places him about 200 B C., but H. H. Wilson assigns him, with more probability, to the 8th or 9th c. after Christ. With regard to his place of birth and to his caste, most accounts agree in making him a native of Kerala or Malabar, and a member of the caste of the Nambûri Brahmans. In Malabar, he is said to have divided the four original castes into seventy-two, or eighteen subdivisions each. All accounts represent him as having led an erratic life, and engaged in successful controversies with other sects. In the course of his career, he founded the sects of the *Das'nâmi-Dan'd'ins* (see S'AIVAS). Towards the close of his life, he repaired to Cashmere; and finally to Kedârnâth, in the Himalaya, where he died at the early age of 32. His principal works, which are of considerable merit, and exercised a great influence on the religious history of India, are his commentary on the *Vedânta* (q. v.) Sûtras, and his commentaries on the *Bhaga vadgîtâ* and the principal *Upanishads* (q. v.).

His learning and personal eminence were so great, that he was looked upon as an incarnation of the god S'iva, and was fabled to have worked several astounding miracles. One of these was his animating the dead body of a King Amaru, in order to become temporarily the husband of the latter's widow, so as to be able to argue with the wife of a Brahman Mandana upon the topic of sensual enjoyments—the only topic on which he had remained ignorant, as he had always led the life of a Brahmachârin, or bachelor student. A number of works are current in the south of India relating to his life; among these, the *S'ankara-dig-vijaya*, or the conquest of the world by S., composed by *Anandagiri*, one of his disciples, is the most important.—See H. H. Wilson, *A Sketch of the Religious Sects of the Hindus;* works, vol. i. (edited by Dr. R. Rost, 1862), pp. 197. ff.; and Cavelly Venkata Ramaswami. *Biographical Sketches of Deccan Poets* (Bombay, 1847).

SANKHYA (from the Sanscrit *sankhyâ*, synthetic reasoning) is the name of one of the three great systems of orthodox Hindu philosophy. See SANSCRIT LITERATURE. It consists of two divisions—the Sânkhya, properly so called, and the YOGA (q.v.); and like the other systems (see MIMANSA and NYAYA), it professes to teach the means by which eternal beatitude, or the complete and perpetual exemption from every sort of ill, may be attained. This means is the discriminative acquaintance with *tattwa*, or the true principles of all existence, and such principles are, according to the Sânkhya system, the following twenty-five: (1), *Prakr'iti* or *Pradhâna*, substance or nature; it is the universal and material cause; eternal, undiscrete, inferable from its effects; productive, but unproduced. Its first production is (2) *Mahat* (lit. the great), or *Buddhi* (lit. intellect), or the intellectual principle, which appertains to individual beings. From it devolves (3) *Ahankâra* (lit. the assertion of 'I'), the function of

which consists in referring the objects of the world to one's-self. It produces (4—8) five *tanmâtrâ*, or subtle elements, which themselves are productive of the five gross elements (see 20—24).

Ahankâra further produces (9—13) five instruments of sensation—viz., the eye, the ear, the nose, the tongue, and the skin; (14—18), five instruments of action—viz., the organ of speech, the hands, the feet, the excretory termination of the intestines, and the organ of generation; lastly (19), *manas*, or the organ of volition and imagination. The five subtle elements (see 4—8) produce (20—24) the five gross elements—viz., *ákás'a*, space or ether, which has the property of audibleness, is the vehicle of sound, and is derived from the *sonorous* tanmâtrâ; air, which has the properties of audibleness and tangibility, is sensible to hearing and touch, and is derived from the *aërial* tanmâtrâ; fire, which has the properties of audibleness, tangibility, and color, is sensible to hearing, touch, and sight, and is derived from the *igneous* tanmâtrâ; water, which has the properties of audibleness, tangibility, color, and savor, is sensible to hearing, touch, sight, and taste, and is derived from the *aqueous* tanmâtrâ; lastly, earth, which unites the properties of audibleness, tangibility, color, savor, and odor, is sensible to hearing, touch, sight, taste, and smell, and is derived from the *terrene* tanmâtrâ. The 25th principle is *Purusha*, or soul. It is neither produced nor productive; it is multitudinous, individual, sensitive, eternal, unalterable, and immaterial. The union of soul and nature takes place for the contemplation of nature, and for abstraction from it, 'as the halt and the blind join for conveyance and guidance, the one bearing and directed, the other borne and directing.' From their union, creation is effected. The soul's wish is fruition or liberation.

In order to become fit for fruition, the soul is in the first place invested with a *linga-s'arîra*, or *súkshma-s'arîra*, a subtle body, which is composed of *buddhi* (2), *ahankâra* (3), the five *tanmâtrâs* (4—8), and the eleven instruments of sensation, action, and volition (9—19). This subtle body is affected by sentiments, but being too subtle to be capable of enjoyment, it becomes invested with a grosser body, which is composed of the five gross elements (20—24), or, according to some, of four, excluding *ákás'a*, or, according to others, of one alone—viz., earth. The grosser body, propagated by generation, perishes; the subtle frame, however, transmigrates through successive bodies, 'as a mimic shifts his disguises to represent various characters.' Some assume, besides, that between these two there is intermediately a corporeal frame, composed of the five elements, but tenuous or refined, the so-called *anusht'hâna s'arîra*.

Creation, resulting from the union of Prakr'iti (1) and Purusha (25), is *material*, or consisting of souls invested with gross bodies, and *intellectual*, or consisting of the affections of intellect, its sentiments or faculties. *Material creation* comprises eight orders of superior beings—gods, demigods, and demons; five of inferior beings—quadrupeds, birds, reptiles, fishes, and insects; besides vegetable and inorganic substances, and man, who forms a class apart. This material creation is again distributed into three classes: that of *sattwa*, or goodness, comprising the higher gods, with virtue prevailing in it, but transient; that of *tamas*, or darkness, where foulness or passion predominates; it comprises demons and inferior beings; and between these, that of *rajas*, or impurity (lit. colored condition), the human world, where passion together with misery prevails. Throughout these worlds, soul experiences pain, arising from death and transmigration, until it is finally liberated from its union with person.

Intellectual creation comprises those affections which obstruct, disable, content, or perfect, the understanding; these amount to fifty. *Obstructions* of intellect are error, conceit, passion, hatred, fear, severally subdivided into 62 species. *Disability* of intellect arises from defect or injury of organs, such as deafness, blindness, &c., and from the contraries of the two next classes; making a total of 28 species. *Content* is either internal or external—the one fourfold the other fivefold. Internal content concerns nature, proximate cause, time, and luck; external content relates to abstinence from enjoyment upon temporal motives—viz., aversion to the trouble of acquisition, or to that of preservation, and reluctance to incur loss consequent on use, or evil attending on fruition, or offence of hurting objects by the enjoyment of them. The *Perfecting* of intellect comprises eight species; it is direct, as preventing the three kinds of pain; or indirect, such as reasoning, oral instruction, amicable intercourse, &c.

Besides the 25 principles, the Sânkhya also teaches that nature has three essential *gun'as*, or qualities—viz., *sattwa*, the quality of goodness or purity; *rajas* (lit. coloredness), the quality of passion; and *tamas*, the quality of sin or darkness; and it classifies accordingly material and intellectual creation. Thus, four properties of intellect partake of goodness or purity—viz., virtue, knowledge, dispassionateness, and power; and four, the reverse of the former, partake of sin or darkness—viz., sin, error, incontinency, and powerlessness. It is worthy of notice that by power the Sânkhya understands eight faculties—viz., that of shrinking into a minute form, to which everything is pervious; of enlarging to a gigantic body; of assuming extreme levity; of possessing unlimited reach of organs; of irresistible will; dominion over all beings, animate or inanimate; the faculty of changing the course of nature; and the ability to accomplish everything desired. The knowledge of the principles, and hence the true doctrine, is, according to the Sânkhya, obtained by three kinds of evidence—viz., perception, inference, and right affirmation, which some understand to mean the revelation of the Veda and authoritative tradition.

It will be seen from the foregoing summary that the Sânkhya proper does not teach the existence of a supreme Being, by whom Nature and Soul were created, and by whom the world is ruled. It was therefore accused by its opponents to be atheistical, or to deny the existence of a creator; and it is the special object of the *Yoga* system to remove this reproach, by asserting his existence, and defining his essence (see YOGA). The truth however, is, that the Sânkhya proper merely maintains that there is no proof for the existence of a supreme Being; and the passages quoted by the opponents, to show that the founder of the Sânkhya *denied I's'wara*, or a supreme God, are quite compatible with the view, that he confined his teaching to those *tattwas* or principles which, in his opinion, were capable of demonstration. Nor is it at all probable that the founder of the orthodox Yoga would have propounded his system as supplementary to that of the Sânkhya proper, had there been that incompatible antagonism between them which must separate an atheistical from a theistical philosophy. The Sânkhya system underwent a mythological development in the Purân'as (q. v.), in the most important of which it is followed as the basis of their cosmogony. Thus, *Prakr'iti*, or nature, is identified by them with *Mâyâ*, or the energy of Brahmâ; and the Matsya-Purân'a affirms that *Buddhi*, or *Mahat*, the intellectual principle, through the three qualities, goodness, passion, and sin, 'being one form, becomes the three gods, Brahmâ, Vishn'u, and S'iva.' The most important development, however, of the Sânkhya is that by the Buddhistic doctrine, which is mainly based on it.

The Sânkhya system is probably the oldest of the Hindu systems of philosophy; for its chief principles are, with more or less detail, already contained in the chief Upanishads (see VEDA); but whether the form in which it has come down to us, and in which it is now spoken of as *the* Sânkhya, is also older than that in which the other systems are preserved, is a question as yet not solved by Sanscrit philology. That this form, however, is not the oldest one, is borne out, for instance, by the differences which exist between the Sânkhya doctrine of the Upanishads and the doctrine propounded in the first book of the Institutes of Manu on the one side, and the doctrine of the actual Sânkhya on the other.

The reputed founder of the actual Sânkhya is *Kapila* (lit. *tawny*), who is asserted to have been a son of Brahmâ, or, as others prefer, an incarnation of Vishn'u. He taught his system in Sûtras (q. v.), which, distributed in six lectures, bear the name of *Sânkhya-Pravachana*. The oldest commentary on this work is that by *Aniruddha;* another, is that by *Vijnânabhikshu*. The best summary of the Sânkhya doctrine is given by I's'wara Kr'ishn'a, in his *Sânkhya-Kárikâ*, edited by H. H. Wilson, with a translation of the text by H. T. Colebrooke, and a translation of the commentary of Gaud'apâda by himself (Oxford, 1837). For the various theories concerning the word Sânkhya, and the founder of the system, Kapila, and for the literature relating to it, see the elaborate and excellent preface by Fitzedward Hall to his edition of the *Sânkhya Pravachana*, with the commentary of Vijnânabhikshu, in the *Bibliotheca Indica* (Calcutta, 1856); and see also his valuable *Contribution towards an Index to the Bibliography of the Indian Philosophical Systems* (Calcutta, 1859). Amongst essays on the Sânkhya philosophy, the most reliable still remains that by H. T. Colebrooke, reprinted from the *Transactions* of the Royal Asiatic Society, in his *Miscellaneous Essays* (London, 1837), vol. i. p. 227, ff.

SAN LU'CAR DE BARRAME'DA, a seaport of Andalusia, in the modern province of Cadiz, and 18 miles north of the port of that name, stands on a sandy, undulating tract on the left bank of the Guadalquivir, and at the mouth of that river. It is a dull decaying place, and is notable chiefly as the mart whence inferior and adulterated vintages are exported to England as sherries. Pop. 23,000.

SAN LU'IS DE LA PU'NTA, the chief town of the province of San Luis in the Argentine Republic, is situated 445 miles west-north-west from Buenos Ayres, on a river, which falls into the large salt lake of Bevodero. S. has some trade in horses, hides, and furs. Pop. above 5000.

SAN LU'IS POTO'SI, a considerable town of Mexico, capital of the state of the same name, stands near the source of the river Tampico, and 200 miles west of the port of that name on the Mexican Gulf. It stands on a plateau 6350 feet above sea-level, is well built, containing many handsome edifices, chiefly ecclesiastical, and is surrounded by gardens. Its markets are well supplied, and

it carries on a considerable trade with the neighboring states. Shoes, hats, and hardware are the chief manufactures, and woven fabrics and liquors are imported from Tampico. Pop. 34,600.

SAN MA'RCO IN LA'MIS, a town of South Italy, in the province of Foggia, 18 miles north-north-east of Foggia. It has some trade in corn, wine, oil, and silk. Pop. above 15,000.

SAN MARI'NO. See MARINO, SAN.

SAN MATE'O, a town of Venezuela, South America, in the department of Cumana, and 50 miles south-south-west of the town of that name. Pop. 7000.

SAN MIGUE'L, a town of Central America, in San Salvador, and about 80 miles east of the city of that name. It is said to be the chief trading town in Central America. At its annual fair of La Paz, 15,000 strangers assemble, and business to the amount of 2,000,000 dollars is transacted. About five miles west of S. M. is a volcano, 6680 feet high, which was in a state of eruption in 1848, and again in 1855. Ordinary pop. 10,000.

SAN MINIA'TO, a city of Central Italy, province of Florence, and 21 miles west-south-west of the city of that name. S. M. is a fine old episcopal city, adorned with many monuments, and is famous in the history of the Florentine Republic. Pop. 2785.

SANNAZARO, JACOPO, a distinguished Italian poet, of Spanish descent, was born at Naples, July 28, 1458. Love for a young lady called Carmosina Bonifacia, whom he has celebrated under the names of Harmosine and Filli, was what developed his poetical faculty. The lady being insensible to his passion, he sought to forget her in travel. It was during his absence that he composed the *Arcadia*, a medley of prose and verse, of which Tiraboschi, the historian of Italian literature, thus speaks: 'The elegance of the style, the propriety and the choiceness of the expressions, the descriptions, the imagery—everything, in fact, is fresh and original.' The work was greatly admired, and in the course of a century went through sixty editions. It has given its author the reputation of being an Italian classic. S., after his return to Italy, was invited to the Neapolitan court, and composed some comedies for the amusement of the royal family, of which only one has been preserved. He died at Naples in 1530 or 1532. His other productions are *Sonetti e Canzoni*, *Eclogæ VI.* (reckoned by some his most perfect performance); *Elegiarum Libri III.; De Morte Christi ad Mortales Lamentatio;* and *De Partu Virginis, Libri III.*, mostly written in Latin verse. S.'s life has been written by Crispo and J. A. Volpi. See also Tiraboschi's *Storia della Letterat. Ital. VII. Part* iii.

SAN NICA'NDRO GARGANICO, a town of Southern Italy, in the province of Foggia, 26 miles north of the city of Foggia. Pop. 8186. It is situated on Mount Gargano, and is one of the most populous towns among those mountains. The lands belonging to it are very fertile, and great herds of cattle and sheep are reared there. It trades in grain, wool, and wine.

SAN NI'COLAS, or SAN NICOLAO, one of the Cape Verd Islands (q. v.).

SANPO. See DIHONG, BRAHMAPUTRA.

SAN RE'MO, a city of Northern Italy, province of Porto Maurizio, 27 miles east-north-east of Nice. It is built on the slope of a rising ground on the shores of the Mediterranean. Its fine cathedral, the Santuario della Guardia, and the Santuario dell' Assunta are worthy of notice, the last having four handsome pillars of alabaster. The palace of the Marquis Borrea D'Olmo contains a fine picture-gallery. There is a seminary for priests, besides a college and many schools. Its little harbor carries on a brisk trade in oils and lemons. Nine foreign consuls reside in the town. S. R. is an ancient city, and obscure in its origin. In 1170, it was self-governed, and made an alliance with the Genoese against the Pisans. One of its bishops afterwards sold it to Genoa. 'San Remo is perhaps the mildest situation on all the Riviera. Here palms, lemon, and orange-trees grow with the greatest luxuriance, and the fruit of the date palm almost attains maturity.'—Murray's *Handbook*. In recent years, it has begun to be resorted to by English visitors, and several new and excellent hotels have been erected. Pop. (1881) 16,055.

SAN ROQUE, a town of Spain, in the modern province of Cadiz, on the bay of Gibraltar, and eight miles north-north-west of the town of that name. The salubrity of the climate, and the cheapness of living, have attracted hither many foreign families, especially English. Pop. (1877) 8729.

SAN SALVADO'R, the smallest, though the second in point of population, of the Central American Republics (see AMERICA), consists of a strip of territory stretching along between Honduras and the Pacific, and bounded on the W. by Guatemala, and on the E. by Fonseca Bay, which separates it from Nicaragua. It averages 180 miles in length, by about 40 in breadth, and contains an area of 7230 English sq. m., with a population (according to the census of 1878) of 482,422, or 67 to the square mile. The northern frontier is formed by a portion of the great Cordillera chain, and parallel to this range, and between it and the Pacific sea-board, runs another range of mountains along the whole length of the country, breaking it up into an inland valley, and a long low rich belt along the coast. This central range is highly volcanic in character, and has 16 volcanic peaks ranging in height from 7386 to 4000 feet high. S. S. possesses numerous lakes, the largest of which is Guija, about 90 miles in circumference and abounding in fish. The greater portion of the interior valley, and the alluvial strip lying along the coast, are of extreme fertility, and agriculture is extensively and successfully practised, to the almost total exclusion of pastoral pursuits. The principal agricultural products are indigo, sugar, and maize, cotton also being successfully cultivated in the districts around La Libertad, and the Bay of Jiquilisco. The coast from Acajutla (30 miles from the western frontier) to La Libertad is known as the *Costa del Balsamo*, or Balsam Coast, as in the woods of this district is produced the famous balsam known as 'Balsam of Peru,' in such quantities that from 17,600 to 22,000 lbs. av. are annually exported. The mineral wealth of S. S. is not great, but rich veins of silver are found at Tabanco in the north-east, and mines of iron in the west near Santa Ana. S. S. has considerable export trade in indigo (which is known in trade as 'indigo of Guatemala,' and is reckoned the finest of all) and sugar, as well as turpentine, cocoa, cotton, and spices. The annual value of exports amounts to about 3,200,000 dollars, and that of imports to 2,000,000 dollars. The revenue is between 2,000,000 and 3,000,000 dollars, the expenditure being a little less. The debt in 1880 was 2,078,885 dollars.

The climate of S. S. is salubrious, and the temperature is lower than might be expected from the low latitude and general want of elevation of the country.

The bulk of the population is composed of Indians and mixed races, there being about 300,000 of the former, and about 190,000 of the latter. There are about 9000 whites (of Spanish origin), and 1000 negroes. The Indians are of the Aztec race, speak the Spanish language, and profess the Roman Catholic religion (the one established by statute), but retain many of their old heathen rites, and live in a certain degree apart from the rest of the population. They have the rights of citizens, but generally exercise them under the advice of the government. The government is carried on by a president, vice-president, and two ministers, one for foreign affairs and finance, and the other for internal business and war. The legislature consists of two chambers, an upper one of 12 senators, and a lower of 24 representatives. Education is well provided for, every village of 50 inhabitants being bound by law to support a school, and there is a university in the capital, San Salvador (q. v.), which is well endowed by the state. The standing army is 1000 men.

S. S. originally called *Cuscatlan*, 'the land of riches,' is said to have been, previous to the immigration of Europeans, the best peopled and most civilized country in America. It was conquered after a long and obstinate contest by Pedro de Alvarado, a lieutenant of Cortes, and under the Spanish rule was one of the most flourishing portions of the Guatemalan kingdom. In 1821, it threw off the yoke, and joined the Mexican Confederation, from which, however, it seceded in 1823. The several trials since made of a union among the Central American States have ended in the dissolution of all political connection; and S. S. is now an independent republic. In 1863, war broke out between S. S. and Guatemala, in which Honduras joined the former, and Nicaragua the latter. The result was the defeat of S. S., and the expulsion of the president from the country. The government has taken active measures towards developing the resources of the country.

SAN SALVADOR, the capital of the republic of San Salvador, was founded in 1589, and supplanted an older town which had been built in 1528 by a brother of Pedro de Alvarado. It was the capital of the Union of Central America from 1823 till 1839. In 1854, it was a fine, well-built city, adorned with numerous splendid buildings, and containing a population of more than 30,000, but on the night of April 16th it was completely destroyed by an earthquake, and about 100 lives lost. In January 1855, it again became the seat of government, and its population is now above 14,000. Violent shocks of earthquake in 1879 and 1880 did damage here and around Lake Ilopango. The trade of S. S. is carried on mostly through the port of La Libertad, which is about five miles distant.

SAN SALVADO'R, or BA'NZA—the former being the Portuguese, and the latter the native name—a town of Africa, the capital of Congo (q. v.). It is 120 miles south-east-by-east from the mouth of the estuary of the river Congo, in a mountainous district near the source of the river Lelunda. Pop. 20,000.

SANSANDI'NG, a large town in the north-west of Africa, in Bambarra, about 20 miles north-east of Sego, on the left bank of the Niger, here called the Joliba. A considerable trade in salt, beads, coral, gold-dust, and cotton cloth is here carried on. Pop. from 10,000 to 11,000.

SANSCARA, or SANSKARA (lit. completing, perfecting), is the name of the ten essential rites or ceremonies of the Hindus of the first three castes. They are the ceremonies to be performed at the conception of a child; on vitality in the fœtus, in the fourth, sixth, or eighth month of pregnancy; and at the time of his birth, before dividing the navel string; the ceremony of naming the child on the tenth, eleventh, or hundred-and-first day; the ceremony of carrying the child out to see the moon on the third lunar day of the third light fortnight, or to see the sun in the third or fourth month; of feeding him in the sixth or eighth month (or at other stated periods); the ceremony of tonsure in the second or third year; of investiture with the string in the fifth, eighth, or sixteenth year—when he is handed to a *guru* to become a religious student; and the ceremony of marriage, after he has completed his studies, and is fit to perform the sacrifices ordained by his sacred writings.

SANSCR'IT, or SANSKR'IT (from the Sanscrit *sam* = Gr. *syn*, 'with, together.' and *kr'ita*, 'done,' with an epenthetic *s*, imparting greater emphasis to the sense of the compound; hence, 'thoroughly done, finished, accomplished') is the name of the ancient language of the Hindus; in which their whole sacred literature, and by far the greatest amount of their numerous ritual, legal, poetical, and scientific works, are written. S. belongs to that stock of languages commonly called the Indo-European, or Indo-Germanic, which includes the Indian, the Medo-Persian, the Græco-Latin, the Germanic, the Lithuanian-Slavonian, and the Gallo-Celtic families. It is therefore intimately allied to the ancient and modern languages comprised in each of these families, itself being the parent of the *Prâkr'it* (q. v.) dialects, the *Pâli* (q. v.), and the languages spoken in the north of India. Compared with the ancient languages kindred with it, S. has come down to us in a state of preservation and development so much superior to theirs, that it must be looked upon as the principal means which enables us to understand the affinity, and in general the linguistic laws which pervade the structure of these languages. The essay of Franz Bopp, *Ueber das Conjugations system der Sanskrit Sprache*, dated 16th May 1816, began a new era in the study of language. See PHILOLOGY, BOPP.

There are two great periods into which the history of the S. language may be conveniently divided: the first embracing the language as contained in the Vedic hymns (see VEDA); and the second, that represented by the so-called classical S.; in which the epic works, the law codes, and the later literature are written. Between the two there is a transition period of the language, to which the Brâhman'a and ritual portion of the Vedas, and the Upanishads, may be assigned. In the language of the Vedic hymns, the grammar is less developed and much less settled than in the classical S.; it contains, moreover, many forms which at the second period became obsolete, or altogether disappeared from use; the structure of its sentences, too, is simpler, though it is more elliptical than in classical poetry. Another main difference between the two periods lies in the sense of its words. Though this is the same in many words of the Vedic hymns and the classical literature, still there are numerous words, which, though the same in form at both periods, have a sense which differs according as it belongs to the one or the other class of writings. The difficulty thus presented by the Vedic hymns is in a great measure removed by the commentators who explain the meanings of the Vedic words, and, in doing so, follow tradition, which, considering the peculiarities of Hindu history, and also internal evidence, is in all probability immemorial, and therefore the safest if not the only guide in the understanding of the oldest Vedic works.

That their explanations may have become unsafe in some instances, would be but natural; but it is certain that these instances are the rare exceptions; and it is likewise certain that when modern Sanscritists—and several of these only imperfectly acquainted with S. grammar,—have attempted to supersede those traditional meanings by interpretations which they suppose better suited to the context, or to some assumed etymology of their own, their rendering may better adapt the Vedic to the classical vocabulary, but is sure to falsify that understanding which the Hindu mind had of its oldest and most sacred works, and on which its further historical development is based. In the transition period of the Brâhman'a and ritual portion of the Vedas and the Upanishads, grammar and vocabulary offer similar difficulties to those of the Vedic hymns; but though for this reason the aid of the commentaries is likewise indispensable, they are much less numerous; and in those works of this extended period, which probably were composed at the classical epoch, the difference between the two is even inconsiderable. In comparing S. with other kindred languages, it is therefore necessary not to lose sight of these periods of the language, and of the peculiarities inherent in them.

SANSCRIT LITERATURE. The most natural, and, at the same time, the most scientific distribution of Sanscrit literature would be that according to the dates at which its writings were composed. The actual condition of Sanscrit philology, however, renders such a course impossible; for, with the exception of very few works, no date whatever is known to which they could be safely assigned. (See INDIA—*Religion;* VEDA.) In spite, therefore, of an apparent plausibility with which some authors have propounded a regular literary chronology of Sanscrit works, even with figures or dates appended to them, the general reader will do well to look upon all such dates as imaginary, and to rest satisfied with the hope, that perhaps future results of Sanscrit philology may afford a more satisfactory settlement of this vexed question of Sanscrit chronology. Under these circumstances, the only possible arrangement of Sanscrit literature is that suggested by their contents, irrespectively of the time at which they were composed, but, under each head, in that order which, within large margins, may be suggestive of consecutiveness.

1. *Religious Literature.*—It comprises, in the first place the Vedas, and the mystical, philosophical, and ritual works connected with them (see VEDA and UPANISHAD); and secondly, the PURAN'AS (q. v.) and TANTRAS (q. v.), besides prayer-books and smaller works, and treatises of less importance relating to the modern worship, based on the two latter classes of works.

2. *Law Literature.*—It is comprised under the name of *Dharmas'âstra* (from *dharma*, law—religious and civil—and *s'âstra*, book), and its origin is traceable to the ritual Sûtras relating to the Vedas. A complete Dharmas'âstra consists of three portions: the first treating of *Achâra*, or 'established rules of conduct,' comprising such matters as education, marriage, the funeral rites, the duties of a king, &c.; the second treating of *Vyavahâra*, or judicature, including law, private and criminal, and under the former, for instance, the law of inheritance and adoption; the third, on *Prâyas'chitta* or penance, treating, besides this subject, also of impurity, the duties of a devotee, transmigration, and final beatitude. The chief extant representatives of this class are the codes of MANU (q. v.) and YAJNAVALKYA (q. v.). Less complete than the latter—for it does not contain the Vyavahâra portion—is the code of PARAS'ARA (q. v.); but it deserves special mention, as the modern Hindus consider it to have been especially composed for the requirements of the Kaliyuga, or the present mundane age, and as it is cited, therefore, as *the* authority, for instance, on the question, and in favor, of the remarriage of Hindu widows.

For practical purposes, especially those concerning Vyavahâra, the chief actual authorities are the commentaries on Manu, *Yâjnavalkya*, and similar works, and the digests which have grown up from them. Amongst the former, the MITAKSHARA (q. v.), by Vijnânes'wara, occupies the principal rank; and amongst the latter, the *Chintâman'i*, *Vîramitrodaya*, *Vyavahâra-mayûkha*, *Smr'itichandrikâ*, and *Vyavahâra-Mâdhavîya*, which generally defer to the authority of the *Mitâksharâ;* and, besides these, the *Dâyabhâga* of Jîmûtavâhana, which, like the *Dâyatattwa* of Raghunandana, differs from it on several important questions, for instance, on that relating to the hereditary rights of women. (See MITAKSHARA). As on the Vyavahâra, there are numerous smaller treatises on the Achâra and Prâyas'chitta.

3. *Poetical Literature.*—(*a.*) The two great epic poems. See RAMAYAN'A and MAHABHARATA.

(*b.*) *The Modern Epic Poems.*—Their subject-matter is entirely borrowed from the two great epic poems and other legendary works; and their only merit consists in the art bestowed by their authors on the versification, and all that relates to the æsthetical canon of Hindu poets, which, in some respects, may meet with the approbation of western critics, but, in others, would require in the European reader a total abnegation of his ideas of poetical beauty, in order to make these poems acceptable to him. Minute descriptiveness, elaborateness of diction, and an abundance of figures of speech, are some of the characteristics of these poems, amongst which those of Kâlidâsa approach nearest our standard of poetical worth. One of them, the *Bhattikâvya*, which relates to the history of Râma, was purposely composed for illustrating rules of grammar and formations of words of special interest. In another, the *Râghava-Pândavîya*, the ambiguity of the diction is so studied, that the poem may be interpreted as relating to the history of Râma, or other descendants of Das aratha (see RAMAYAN'A), or to that of the descendants of Pân'd'u (see MAHABHARATA).

The following are the *Mahâ-kâvya* or great poems of this class: the *Raghuvans'a* and *Kumârasambhava*, by Kâlidâsa (q. v.); the *Nalodaya*, also ascribed, though probably wrongly, to the same poet; the *Bhat't'ikâvya*, or the poem by Bhat't'i; the *S'is'upâlabadha*, by Mâgha, hence also called the *Mâghakâvya;* the *Naishadîyacharita*, by S'rîharsha; the *Kirâtârjunîya*, by Bhâravi; and the *Râghava-Pân'd'avîya*, by Kavirâja (i. e., the prince of poets), as the author calls himself.

(*c.*) *Lyric and Erotic Poetry.*—Several works of this class are more of a descriptive character, and would differ therefore from

what in European poetry might be included under this head. The principal works belonging to it are the following: the *R'itusanhâra*, or a description of the seasons, attributed to Kâlidâsa (q. v); the *Meghadûta*, or the cloud-messenger, also supposed to have been written by Kâlidâsa—a poem in which a demigod, separated by fate from his wife, is imagined to make a cloud the messenger to her of his woes, and incidentally, as it were, describes his course over a large tract of India; the *Amarús'ataka*, or hundred stanzas of Amaru, on amatory feelings and scenes, the natural sense of which commentators have twisted also into one of a mystical character, so as to make them appear less objectionable, especially as they were supposed by some to have been composed by the celebrated theologian S'ankara, when he had animated the dead body of King Amaru (see S'ANKARA); these stanzas have an epigrammatic character, and share in this respect the style of the first S'ataka, or hundred verses on love, by Bhartr'ihari; the *Bhâminîvilâsa*, by Jagannâtha Pan'd'itarâja, in four books, the second of which is connected with amatory subjects, while the third is a beautiful elegy on the death of the poet's wife; the *Gitagovinda*, by Jayadeva, who probably lived in the 12th c., which, in ten sections, describes the amours of Kr'ishn'a with the cowherdesses, his separation from his wife Râdhâ, and his ultimate reconciliation with her, and which, like the *Amarús'ataka*, has also been explained in a mystical sense, Kr'ishn'a then being represented as the soul which for a time becomes estranged from the supreme soul, its original source, but finally returns to it. This poem differs from those mentioned before in being intended for singing and for representation at a festival held in honor of Vishn'u; it combines the lyric and the melo-dramatic character.

(*d.*) *Didactic Poetry.*—A portion of this class of poetry may be included under the former head, since even such works as the *Amarús'ataka*, and the erotic stanzas of *Bhartr'ihari* have much of the sententious character; another is contained in the episodes of the *Mahâbhârata*, and another forms a considerable portion of the books of fables. The chief special representatives of this class are, 'the three *S'atakas*,' or hundred stanzas on love, good and wise conduct, and renunciation of worldly desires, by *Bhartr'ihari*. Similar pieces of poetry are the hundred stanzas of *Chânakya*, and some stanzas in the anthology of *S'arngadhara*, called the *S'arngadharapaddhati*. Others have been collected in various modern anthologies such as the *Nitisankalana* and the *Kavitâmr'itakûpa*. For the poem *Bhagavadgîtâ*, see under YOGA.

(*e.*) *Dramas.*—The plays of the Hindus are not numerous; they were only acted on special occasions, and the subject of the plot is with predilection borrowed from the legendary literature of ancient India. Hindu dramatists have little regard for unity of time, place, and action; and with the exception of Kâlidâsa, they must be considered as inferior in poetical worth to the renowned dramatic writers of ancient Greece and of modern Europe. Besides the reasons to be sought for in the religious, mystical, and metaphysical tendencies of the Hindu mind, a free development of the Hindu drama was probably also impeded by the heavy and artificial canon which weighed upon Hindu dramaturgy, and which, ascribed to sacred sources, and looked upon as a law not to be transgressed by any dramatic poet, did not allow much scope for poetical imagination, and would keep down any free movement upon which it might have ventured.

The various kinds of dramatic performances, the number of their acts, the characters of the plays, the conduct of the plot, the sentiments to be represented, and even the modes of diction—all these were strictly regulated; so much so, that in spite of the differences which must exist between different authors and plays, there is still a kind of uniformity which pervades the whole Hindu drama, and must strike any one unacquainted with this elaborate dramatical canon. It must suffice here to mention a few of its peculiarities. All dramatic composition is divided, according to it, into two great classes—the *Rûpaka* or performance, and the *Uparûpaka*, or the minor *Rúpaka;* the former containing ten species from the *Nât'aka*, or the play *par excellence*, which represents exalted personages, down to the *Prahasana*, or farcical comedy; and the latter with eighteen species. Neither class contains the species 'tragedy'—which is incompatible with a belief in fate, one of the main features of the Hindu mind. Every drama opens with a prelude in the form of a dialogue between the stage manager and one of his company, in which the name of the author and of his work, and such prior events as the spectators should know, are brought before the audience. The first part of this prelude is a prayer invoking the benediction of some deity in favor of the assembly. The piece thus being opened, is then carried on in the usual manner; but so long as the same act lasts, the stage is never left empty, but the entrance of a new personage is always announced by a special person. The piece closes as it began, with a benediction. The principal characters of the play are the hero (*nâyaka*) and the heroine (*nâyikâ*). The former is either *lalita*, gay, thoughtless, and good-humored; or *s'ânta*, gentle and virtuous; or *dhîrodâtta*, high-spirited, but temperate and firm; or *udâtta*, ardent and ambitious; but as each of these categories is again subdivided, they become multiplied to 144 kinds.

Equal minuteness is displayed in specifying the classes of the heroines. The hero has his antagonist in the *pratinâyaka*, or counter-hero; and each of these may have his officers, ministers, and friends. The heroine, on her part, has always a confidential companion, who is often her foster-sister. The subordinate characters are described as being eunuchs, mutes, dwarfs, foresters or barbarians. Two characters, however, deserve special notice, as being peculiar to the Hindu stage—the *Vit'a* and the *Vidúshaka*. The *Vit'a* may be the companion of a man or woman; he is generally on familiar, yet dependent terms, with his associate, and though somewhat like the parasite of the Greek comedy, yet not rendered contemptible; if a female, she is a courtesan. The *Vidúshaka* is the humble companion of a prince or man of rank; he is always lively, sometimes witty, and, according to the definition of his attributes, he is to excite mirth by being ridiculous in person, age and attire. He is, curiously enough, always a Brâhman. The plays have eight, or according to some, nine *rasa*, or characteristic flavors: these *rasas* are love, mirth, tenderness, fierceness, heroism, terror, disgust, wonder, and tranquillity; and they again consist of conditions with numerous divisions and subdivisions. The manner according to which the form of speech is regulated, is another peculiarity of the Hindu drama. Only the hero and the principal personages speak Sanscrit, but women—with rare exceptions—and the inferior personages speak Prâkr'it; the various, higher or inferior, idioms of that language being adapted to their higher or inferior character. See PRAKR'IT. The oldest known Sanscrit drama is the *Mr'ichchhakat'i*, or 'the Clay Cart,' by King S'ûdraka, which, in the opinion of H. H. Wilson—who translated it in his *Select Specimens of the Theatre of the Hindus*—was written in the 1st c. B.C.

Of other dramas may here be mentioned *Abhijnâna-s'akuntala* (see S'AKUNTALA) and *Vikramorvas'i*, by Kâlidâsa (q. v.), to whom also the drama *Mâlavikâgnimitra* is attributed; *Mâlatîmâdhava*, *Mahavîracharita*, and *Uttararâmacharita*, by Bhavabhûti; *Ratnavalî*, by S'rîharsha; *Mudrârâkshasa*, by Vis'âkhadatta; *Hanumannât'aka*, fabled to have been composed by the monkey Hanumat (q. v.); and *Anargharâghava*, by Murâri. A drama of a peculiar nature is the *Prabodhachandrodaya*, by Kr'ishn'amis'ra, who, in the opinion of Goldstücker, expressed in the preface to his translation of this drama, lived at the end of the 12th century. Its leading personages are all of a transcendental kind; such as the supreme spirit, faith in Vishnu, volition, organ of imagination, opinion, devotion, quietude, friendship, &c., on the one side; and error, egotism, hypocrisy, love, voluptuousness, anger, avariciousness, &c., on the other; and its object is to represent the victory of the former over the latter. The general dulness of the play is relieved by a number of sectarian worshipers, who appear on the scene, each eulogising the truth of his own religion, and ridiculing that of his antagonist. That this drama, which would baffle the patience of a European audience, was acted 'before King Kîrtivarman, who, with his whole assembly, was very eager to see it,' the poet relates in the prelude to it. An imitation of this drama is the *Chaitanyachandrodaya*, by Kavikarn'apura. For the translation of several of these dramas, and an account of others, see H. H. Wilson's *Select Specimens of the Theatre of the Hindus* (2 vols., London, 1835).

(*f.*) *Fables and Narratives*—Fables, as such, occur, and are referred to, as early as in the great epic poems; but the oldest *collection* of fables is the *Panchatantra* (q. v.); and after it, the *Hitopades'a* (q. v.). These works are considered by the Hindus to belong to the class called *nîtis'âstra*, or works on conduct and polity, since the morals drawn from the fables, and expressed in sententious verses, with which they are interwoven, are the object for which these collections were made. A different class of writings are the ghost-stories, merely composed for amusement, such as the *Vetâlapanchavins'ati*, or the 25 tales of the vampire; and the *S'ukasaptati*, or the 70 tales of the parrot; and the *Sinhâsanadwâtrins'ati*, or the 32 tales of the statutes on the throne of Vikramâditya. A work of a higher order is the *Vr'ihatkathâ*, 'the Grand Tale,' or *Kathâsaritsâgara*, 'the Ocean for the Rivers of Tales, by Somadeva of Cashmere. Amongst narratives of the romance class, the most celebrated are, the *Das'akumâracharitra*, or the 'Adventures of the Ten Princes,' by Dan'd'in, who lived about the middle of the 11th c., edited, with an elaborate preface, by H. H. Wilson; *Kadambarî*, by Vânabhatta; and the *Vâsavadattâ* by Subandhu, a critical account of which work is given by Fitzedward Hall, in the preface to his edition of it (Calcutta, 1859.

(*g.*) *Chronicles*—Historical works, in the European sense of the word, do not exist in Sanscrit literature. The same causes which have clouded all Hindu chronology, and even, at recent periods of Hindu history, have transformed historical facts into myths, seem to have rendered the Hindu mind indifferent to the research and the recording of *historical* truth. The only approach to historical works is found in some chronicles, though these, also, are

not devoid of fictitious narratives. The most renowned among them is the *Râjataraṅgin'î* (q. v.), or the Chronicle of Cashmere, by Kalhana. A modern work of a similar kind, but of much smaller extent, is the *Kshitîs'avans'âvalîcharita*, or the Chronicle of a series of royal families who reigned in Bengal. It was composed in the middle of the last century.

4. *Scientific Literature.*—(*a.*) *Philosophy.* See the articles SANKHYA, YOGA, NYAYA, VAIS'ESHIKA, MIMANSA, VEDANTA.

(*b.*) *Grammar.*—That a scientific study of grammar was cultivated at a very early period of Hindu literature, is borne out by the testimony of the oldest glossator on the Vedas, YASKA (q. v.). The oldest extant work, however, on Sanscrit grammar is posterior to the work of Yâska; it is the grammar of Pân'ini (q. v.), which was criticised by Kâtyâyana (q. v.) in the *Vârttikas*, these, again, being commented on and criticised by Patanjali in the *Mahâbhâshya*. (See PAN'INI, where some of the principal later works connected with his system are mentioned.) That the *Prâtis'âkhyas* (see VEDA) did not precede the grammar of Pân'ini, has been shown by Goldsücker in his *Pân'ini, his Position in Sanscrit Literature*, &c. Of authors of grammars, not following the technical system of Pân'ini, the principal are, Hemachandra, a Jaina (q. v.) writer, and Vopadeva, who probably lived about six centuries ago, and is especially esteemed in Bengal.

(*c.*) *Lexicography.*—It consists of glossaries of words and *dhâtus*—a term which may be vaguely rendered by 'roots,' or 'radicals,' though it does not imply, to the Hindu grammarian, the idea of a linguistic *element*—and of commentaries on these glossaries. The oldest known glossary of *Vedic* words—nouns and verbs—is the *Nirukta* (q. v.) of Yâska. Renowned glossaries of *classical* words are the *Amarakosha*, by Amarasinha, who is probably not later than the 3d c., after Christ; the *Abhidhânaratnamâlâ*, by Halâyudha; the *Haimakosha*, by Hemachandra; and the *Vis'waprakâsa*, by Mahes'wara. (For other works of this class, see Wilson's *Sanscrit, English Dictionary*, preface to 1st ed. 1819; and Colebrooke's *Miscellaneous Essays*, vol. i. p. 50, ff.) The glossaries of *dhâtus* are called *Dhâtupât'has*. The oldest was probably composed by Pân'ini himself, and is the groundwork of the existing works of this name, though the latter contain numerous additions of later forms. The chief commentary on the *Dhâtupât'ha* is that by the celebrated Mâdhavâchârya (q. v.).

(*d.*) *Prosody.*—Sanscrit prosody admits three sorts of metre: one governed by the number of syllables, and which is mostly uniform or monoschematic, in profane poetry, but not so in various passages of the Vedas; the other regulated by feet equivalent to two long syllables, or to four short; and the third regulated by the proportion of syllabic instants, without noticing the number of feet. Some Sûtras (q. v.) connected with the Vedas contain rules on the Vedic metres; but the principal work on Vedic, as well as profane prosody is the *Chhandah's'âstra*, by Pingala, which has been commented on by various writers, the most conspicuous of whom is Halâyudhabhat't'a. A short treatise on prosody; which only exhibits the most common sorts of metre, the *S'rutabodha*, is attributed, but probably wrongly, to Kâlidâsa (q. v.).

(*e.*) *Art of Poetry.*—It is treated in works on dramaturgy, and works on the poetical art in general. The oldest work on the dramatic art is the *Sûtra* of Bharata; a later one is the *Das'arûpa* by Dhananjaya. Some of the principal works of the latter category are the *Kâvyaprakâs'a*, by Mammat'a, the *Kâvyadarsa*, by Dan'd'in, and the *Sâhityadarpan'a*, by Vis'wanâtha Kaviraja. Several other works of this class are especially concerned in the explanation of figures of speech.

(*f.*) *Works on Music.*—In general, they treat of notes, musical scales, melodies, the art of singing, and musical instruments; and some of them also of the art of dancing and performing. The melodies, or *Râgas*, are represented as deities, who have wives, the *Ragin'îs*. Their number is uniform in the different works, and it is probable that the passages in dramas and other poetical works intended for singing were written to suit these fixed melodies, and not that the melodies were composed after the poet had performed his task. The principal works of this kind are the *Sangîtaratnâkara*, by Sârngadeva, the *Sangîtadarpan'a*, by Dâmodara, and the *Sangîtadâmodara*, by S'ubhankara. Special treatises relate to the melodies alone.

(*g.*) *Amatory Art.*—Works treating of this art purport methodically to explain and to classify all that relates to love, and they refer for many of their statements to the oldest authorities. The chief work on this subject is the *Kâma-Sûtra* of Vâtsyâyana.

(*h.*) *Astronomy and Arithmetic.*—The calendars connected with the Vedas are the earliest evidence of Hindu proficiency in astronomy; they presuppose a knowledge of a solar year of 365 days, and their date is assumed by Colebrooke to belong to the 13th c. B.C., while others would place them a few centuries later. The scientific works of later Hindu astronomers are professedly based on five ancient systems, or Siddhântas, called the Paulis'a-, Romaka-, Vâs'isht'ha-, Saura-, and Paitâmaha-Siddhânta; and the earliest renowned author among these astronomers is Aryabhat't'a, who, according to Colebrooke's calculation, did not live later than the 5th c. after Christ. From the quotations by Brahmagupta, it appears that Aryabhatta 'affirmed a diurnal revolution of the earth on its axis, that he possessed the true theory of the causes of lunar and solar eclipses, and that he noticed the motion of the solstitial and equinoctial points, but restricted it to a regular oscillation, of which he assigned the limit and the period.' See, for further detail, Colebrooke's *Algebra*, &c. (Lond. 1817, p. 38). His principal work, the *Aryâsht'as'ata*, is at present only known from the quotations of Brahmagupta, Bhat't'otpala, and others; but his other works, the *Das'agitikâ* and *Aryabhat't'iya*, are extant. Varâhamihira, the next important astronomical writer, a native of Ujjayini, lived about the beginning of the 6th c. after Christ. His compilation of the five Siddhântas, the *Panchasiddhântikâ*, is not yet recovered; but several of his astrological treatises, and the scholia on them by Bhat't'otpala or Utpala are preserved, and his *Br'ihatsanhitâ* has been recently edited by Dr. H. Kern (Calc. 1865).

Another great astronomical authority is Brahmagupta, who appears to have written towards the close of the sixth, or the beginning of the following century; his work bears the title of *Brahmasiddhânta*, and it was followed up by Bhâskara, who, in the middle of the 12th c., composed a celebrated work, the *Siddhântas'iromanî*, translated by Lancelot Wilkinson (Calc. 1861). The *Sûryasiddhânta* has been edited by Fitzedward Hall (Calc. 1859); and two translations of it are due, one to E. Burgess in the *Journal* of the American Oriental Society, accompanied with notes by Whitney (New Haven, 1860); another to Bâpûdeva S'âstri (Calc. 1861), but whether this Siddhânta is the Saura, one of the five original Siddhântas above mentioned or a later work bearing a similar title, is matter of doubt. That Hindu astronomy is largely indebted for its progress to the kindred sciences of western nations, may be inferred from the occurrence in Sanscrit of terms which are of Arabic and Greek origin. Thus, the terms *horâ, dreshkân'a, liptâ, kendra*, &c., are easily traced to the Greek *hora, dekanos, lepta, kentron*, &c.—That works on Hindu astronomy contain more or fewer chapters or passages which no longer concern astronomy, but belong to the sphere of astrology, can be no matter of surprise, considering the intimate connection in which, in India, religion and superstition stand to every branch of human knowledge, and much more especially to one concern—the heavenly bodies. There are, moreover, numerous works which are purely astrological, merely treating of nativities and the influence of the planets on certain periods of the day or month, and the occurrences that would take place at them. Among celebrated writers on algebra, it must here suffice to name Varâhamihira and Bhâskara. See Colebrooke's *Algebra* as quoted above.

(*i.*) *Medicine.*—The origin of Hindu medicine is referred to the god Brahman, from whom the Ayurveda, or 'the science of long life,' was obtained by Daksha, who communicated it in his turn to the As'wins. Some time after this, mankind, in consequence of their wickedness, becoming afflicted with numerous diseases, the Munis, or saints, met in the Himalaya Mountains to search for a remedy. A long list of these saints is given by *Charaka*, one of the greatest medical writers, and it is so far of interest as it contains several names known in Hindu history, and which thus may be probably connected with the early study of Hindu medicine. The two greatest medical authorities the works of whom are still extant are *Charaka* and *Sus'ruta* (q. v.). Both treat of the duties of physicians and their pupils, of anatomy and physiology; hygeology; materia medica, pharmacy, and preparations of medicine; surgery; the diagnosis, prognosis, and treatment of a considerable number of diseases; midwifery, toxicology, &c. Several chapters in them are devoted to omens and portents, as well as to the evil influence of planets and demons on the human body. Charaka, who is older than Sus'ruta, contains more mythological detail than the latter. Of the authorities quoted by Charaka, Atreya seems still preserved in a work, the *Atreyasanhitâ*, which is far less scientific and complete than either the work of Charaka or Sus'ruta, and therefore appears to have preceded them.—See also T. A. Wise, *Commentary on the Hindu System of Medicine* (London, 1860).

(*j.*) *Architecture.*—Treatises on architecture, sculpture, &c., are collectively called *S'ilpas'âstra*. There appear to have been 32, or, according to some, 64 standard treatises on these arts, but of these only a few are probably still in existence. The most important of them is the *Mânasâra*, which consists of 58 chapters, each of which is devoted to a particular topic—such as measures used in architecture; the different sites to be selected for building temples and houses; the mode of determining the different points of the compass; the several sorts of villages, towns, and cities, with directions for building them; the different parts of an edifice, its ornaments, pedestals, bases, pillars, &c.; the various sorts of temples; the construction of porticoes, gates, palaces, &c.; the construction of images, and cars in which the gods are carried in procession, together with the ceremonies attending the consecra-

tion of images; the mode of determining the propitious moment for commencing to lay the foundation of an edifice, &c. See for further detail, Râm Râz, *Essay on the Architecture of the Hindus* (London, 1834).

For a more copious supply of titles of books on the subjects mentioned, the reader may consult Gildemeister, *Bibliotheca Sanscrita*, Bonn (1847), and the printed catalogues of the Library of the India Office, of the Sanscrit MSS. of the Bodleïan Library at Oxford, and of the Sanscrit MSS. of the Royal Library at Berlin.

SANSCULOTTES, i. e., 'without breeches,' was the name given in scorn, at the beginning of the French Revolution, by the court party to the democratic 'proletaires' of Paris. The latter accepted this superfine reproach with sardonic pride, and the term soon became the distinctive appellation of a 'good patriot,' more especially as such a one often made a point of showing his contempt for the rich by neglecting his apparel, and cultivating rough and cynical manners.—This is the current interpretation in England (as in Carlyle's works); but it should be observed that Littré, the best authority on French etymology, makes no mention of breechlessness in the sense of raggedness in his definition of the word; but, on the contrary, says that the Sansculottes 'were so called because they gave up the knee-breeches in fashion during the *ancien régime*, and took to wearing trousers or pantaloons.' The other notion of raggedness must have been tacked on later by a wilful pun. Towards the close of the Convention, the name, connected as it had been with all the sanguinary excesses of the period, fell into bad odor, and soon disappeared.

SAN SEBASTIA'N, a rising seaport city in the north of Spain, capital of the Basque province of Guipuscoa, 381 miles north-north-east of Madrid by the North of Spain Railway. It is built on a peninsula, at the southern base of a conical hill, called Mont Orgullo, 400 feet high, commanding a most striking view, and crowned with a castle strong enough to have obtained for itself the name of the Gibraltar of the north of Spain. Since its almost total destruction during the Peninsular War, the town has been rebuilt on a regular rectangular plan. The streets are narrow, and are bordered by high houses, and having curtained balconies in front. On the east of the town is a confined gulf, formed by the embouchure of the Urumea; and on the west is a magnificent roadstead, protected against enemy and tempest by the isle of Santa-Clara, and a series of rocks, which offer to vessels only a narrow and dangerous pass.

The roadstead is bordered by a beautiful shore, which, on account of its suitability as a watering-place, attracts visitors from all parts of the country. The town communicates with the mainland by a narrow tongue of land, and by a bridge leading across the Urumea, and connecting S. S. on the peninsula with the railway station on the mainland. By means of the North of Spain Railway, which was inaugurated by the king of Spain, 15th August 1864, the town is placed in direct communication with Madrid and Paris. Commerce increases. Near 200 vessels, of about 50,000 tons, yearly enter and clear the port; annual value of imports, £430,000, and of exports, £73,000. The exports consist principally of wool, flour, wine, cutlery, firearms, copper-ore, and lead; the imports are salted fish, sugar, silk and cotton and linen goods, cocoa, machinery, &c. Pop. (1877) 21,355.

S. S. has suffered from numerous sieges in the wars between France and Spain. The most memorable was that in 1813, when S. S. was defended against Wellington by a French garrison of 3000 men. When the defenders surrendered, 5000 of the English troops had been killed or wounded. The victors, in spite of their officers, but according to the usages of war, committed disgraceful excesses.

SAN SEVERI'NO, a city of Central Italy, province of Macerata, 15 miles west-south-west of the city of that name. It is well built, and has handsome palaces, the finest of which are the Palazzo Comunale, and that of the bishop. The neighborhood produces exquisite wine, oil, and fruit, and cattle are reared on the pasture grounds. Pop. 4700.

SAN SEVE'RO, a city of Southern Italy, province of Foggia, with 16,500 inhabitants, stands in a delightful and fertile open country, producing abundance of grain, tobacco, and wine, and affording rich pasturage. It was once remarkable for the industry and activity of its population. In 1799, it was taken, and nearly destroyed by the French. The cholera committed fearful ravages here in 1865.

SA'NTA A'NNA, or ANA, a town of Central America, in the state of San Salvador, and 32 miles north-west-by-west from the town of San Salvador. Pop. about 10,000.

SANTA ANNA, Don Antonio Lopez de, ex-president of Mexico, was born in Jalapa, in 1798. While a mere youth, he entered the Spanish army, and became lieutenant-colonel in 1821. When Mexico determined to throw off the Spanish yoke, S. A. greatly distinguished himself at the head of the Mexican troops. The Spanish royalists were expelled from Vera Cruz, and he was elected governor of the city and province. Iturbide had established an imperial rule over Mexico (q. v.), but his tyranny having worked his downfall, S. A. proclaimed, in 1822, a Mexican republic, which was recognized by every foreign state except Spain. He was incessantly engaged in quelling the civil wars kindled by the aristocratic and democratic factions. In 1829, he engaged and put to flight a division of Spanish troops which invaded Mexico by way of Tampico, with the view of again bringing Mexico under Spanish rule, The separation of Texas (q. v.) from the Mexican union was vigorously but unavailingly opposed by Santa Anna. In 1837, differences arose with France, and a division of French troops landed at Vera Cruz. They were gallantly engaged by S. A., who drove a portion of them into the sea at the point of the bayonet. In this action he received a bullet in the leg, which rendered the amputation of the limb necessary. In 1838, the French took Vera Cruz, and obtained the settlement of their differences.

In 1847, war having been declared by Mexico against the United States, S. A. took the command of the Mexican forces. He offered a gallant but ineffectual resistence to the troops of Generals Scott and Taylor. The city of Mexico having been stormed and taken by the Americans under General Scott, the war was at an end, and S. A. retired from Mexico. During 30 years he had disputed the direction of affairs with Bustamente, Herrera, Cevallos, and other chiefs of parties, being at one time dictator, and at another disgraced and an exile. In 1853, Mexico, torn by civil dissensions, and falling into anarchy, again recalled Santa Anna. He declared himself president for life, and a civil war was the immediate result. In 1855, he was driven from the country. During the government of Juarez, 1858—1863, S. A. was looked up to as their chief and future ruler by an influential party in Mexico. On the establishment of a hereditary monarchy under Maximilian of Austria as emperor, S. A. returned to Mexico, having first signed an act of adhesion to the empire. He soon, however, began to intrigue for his own return to power, issuing addresses to the people as emperor and was ordered to leave the country. After some residence in the United States, S. A. planned an expedition against Juarez; but ere a landing at Vera Cruz had been effected, S. A., with his secretary, was taken prisoner. He was condemned to death, but pardoned by Juarez, on condition of his leaving Mexico. He afterwards resided on Staten Island, New York, where he spent his time cock-fighting and playing at three-card monté. On the death of Juarez in 1875, he returned to Mexico, where he died in 1876. He was regarded by his countrymen as their ablest general, and he was more successful than any other Mexican ruler in quelling the miserable civil wars, though he sometimes showed unjustifiable cruelty. He was also accused of being greedy of wealth, and unscrupulous in the means of obtaining it. He received the Grand Cross of Charles III. of Spain, and the Grand Cross of the Red Eagle of Prussia.

SANTA CRUZ (Teneriffe), the capital of the Canary Islands (q. v.), and the chief seaport of the group, stands on the north-east side of the island of Teneriffe. Its port, the safest in Canaria, has recently been extended and improved by the construction of two moles, with a united length of about 5400 feet, which enclose a large space of water, affording excellent anchorage in from two to nine fathoms. When completed, these works will be of inestimable value, in a commercial point of view, to the island. The streets of S. C. are broad, the houses whitewashed and flat-roofed, and several of the public buildings striking in appearance. The town is defended by several forts and redoubts. Formerly, large quantities of wine of excellent quality were grown in Teneriffe, and shipped for export at S. C.; now, however, the principal article of export from this, and also from the other islands, is cochineal. Coals from England, together with manufactured goods, hardware, and furniture are imported. Of the imports at S. C., more than a third come from England, and the annual imports amount to about £160,000. Pop. 13,228.

SANTA CRUZ. See Virgin Islands.

SANTA CRUZ DE LA PALMA, the capital of Palma, one of the Canary Islands (q. v.). It stands on the east coast of Palma, on a spacious bay from 7 to 10 fathoms deep. Pop. about 5000, employed partly in manufactures of silks and hosiery.

SANTA FÉ, city and capital of the territory of New Mexico, U. S., built among the Rocky Mountains, on a plain 7047 feet above the sea. It is an old Spanish Mexican town, and contains 4 Roman Chatholic churches, mission churches, and government buildings. It is now connected by rail with St. Louis, and with the Pacific. Pop. (1880) 6635.

SANTA FÉ, a town of the Argentine Republic, on the right bank of the Salado, a large branch of the Parana, 250 miles north-west-by-north from Buenos Ayres. Pop. 15,000.

SANTALA'CEÆ, a natural order of exogenous plants, mostly trees and shrubs. The leaves are undivided, sometimes minute.

The perianth is superior, 4—5-cleft. The stamens are 4 or 5, opposite the segments of the perianth, and inserted into their bases. The ovary is 1-celled, with 1—4 ovules. The fruit is 1-seeded, nut-like, or drupaceous.—There are about 110 known species, natives of various parts of the world, the European and most of the North American species being obscure weeds, whilst the trees of the order occur chiefly in the East Indies, New Holland, and the South Sea Islands. SANDAL-WOOD (q. v.) is the produce of plants of this order. The leaves of *Osyris N palensis* are used for tea. Some species are used in medicine in their native countries. *Fusanus acuminatus* is the Quandang Nut of New Holland. Its taste and qualities resemble those of Sweet Almonds, as do also those of the seed of the *Cervantesia tomentosa* of Peru. *Pyrularia oleifera*, the Buffalo Tree or Oil Nut, has a large seed, from which, in the Southern States of America, oil is obtained.

SA'NTALIN, or SANTALIC ACID, the coloring matter of *Pterocarpus santalinus*, or red sandal-wood, is readily obtained by digesting the rasped wood in alcohol, and then precipitating the santalin by the free addition of water. It is little used in this country as a dye-stuff, but it is employed in India both in dyeing silk and cotton. It is in consequence of the santalin contained in it that red sandal-wood is retained in the *Pharmacopœia* as a coloring agent for tinctures, &c.

SANTA MARGHERI'TA BELI'CÉ, a city of Sicily, in the province of Girgenti, with 7500 inhabitants. From the lands belonging to it, grain, wine, and oil are exported. Woven goods and hats are manufactured for export.

SANTA MARGHERITA DI RAPA'LLO, a pleasant town in the province of Genoa, situated on the sea-coast about 3 miles from Rapallo. The Genoese coral fishery is carried on principally by feluccas fitted out here, and manned by the bold seafaring population. Pop. (1871) of S. M. di R. (also called Santa Margherita Ligure), 4750.

SANTA MARI'A DI CA'PUA-VETERE, a city of Southern Italy, in the province of Caserta, with about 16,800 inhabitants. It is not handsome but new, and its population increases every year. The neighboring soil is very fertile, and produces abundance of grain, fruits, oil, and excellent wines. Its manufactures consist of cloth and other woven materials and hats.

SANTA MA'RTA, a town of the United States of Colombia, the capital of a province, on a bay of the Carribean Sea, 400 miles east-north-east from Panama. There is a good harbor, defended by a castle and several batteries. Pop. 8000.

SANTA MAU'RA, or LEUCA'DIA (anc. also *Leucadia* and *Leucas*, so called from its white cliffs), one of the Ionian Islands, off the west coast of the ancient Greek province of Acarnania, from which it is now separated by a passage about a mile wide, although it was in early times connected with the mainland by an isthmus. The canal across the isthmus, which converted the peninsula into an island, is said to have been cut by the Corinthians. S. M. is about 22 miles long, and has a breadth ranging from 6 to 9 miles. Area about 180 sq. m.; pop. 20,147. Its surface is very uneven. It is traversed by a range of hills from north to south, which end at the southern extremity in the high white cliffs called by the Italian sailors of the Levant Cape Ducato (a corruption of *Leucates*), but better known under the name of 'Sappho's Leap.'

SANTA'NDER, an important and thriving seaport of Spain, in the modern province of the same name, stands on a magnificent bay, an inlet of the Bay of Biscay, about equally distant from Oviedo on the west, and San Sebastian on the east. The bay on which the town is placed is from two to three miles wide, and about 4 miles long, and is accessible to the largest vessels at all times of the tide. The situation of the town, on a headland protected by a hill, is picturesque; among its edifices few are either interesting from their appearance, or important from their character. Of its former convents one now serves as a theater; another as a cigar-factory, giving employment to about 1000 people. Numerous new houses, and handsome warehouses, and commercial establishments of various kinds have been erected recently. The fine harbor of S., with a commodious entrance, is accessible at all tides, and unobstructed by a bar. Several important improvements have recently taken place here. The half of the province of S. may be said to be impregnated with iron, copper, zinc, and other ores; though, hitherto, the timidity of native capitalists has rendered the quantity extracted comparatively small.

In one year, 12,625 tons of iron and copper ores, together with a quantity of quicksilver and cobalt, were shipped from the port of S. to Great Britain alone, and mostly to Newport and Swansea. Wheat is an important element in the trade of Santander. The annual exports amount to about £1.500.000; and of that sum the exports of wheat and flour alone amount to the value of £1.400,-000. The imports—the chief articles of which are sugar from Cuba; textile fabrics from England, France, Belgium, and Germany; and salted cod-fish from Norway—amount to about £1,-800,000. A railway runs south from S. to Venta de Banos on the Great North of Spain Railway; and in the middle portion of it, from Barcena to Reynosa, a distance of 21 miles, there are 22 tunnels. Pop. 41,000. Area of province, 2111 square miles; pop. (1877) 235,299.

SANTARE'M, an interesting old town and river-port of Portugal, on the right bank of the Tagus, 46 miles north-east of Lisbon by railway. It carries on an active trade in the products of the fertile vicinity with Lisbon, with which there is steam-communication by river as well as by rail. Pop. about 8000.

SANTEE', a river of South Carolina, U.S., which rises in the Blue Ridge, in North Carolina, by two principal branches, the Congaree and Wateree, and flowing south-east, empties into the Atlantic Ocean. Lat. 33° 6'. It is navigable 150 miles to Camden, and is bordered, in its lower course, by rice-swamps and pitch-pine forests.

SANTERRE, ANTOINE JOSEPH, a French revolutionist, who for some time exercised an influence quite disproportioned to his feeble abilities, was born at Paris, 16th March 1752. He followed the trade of a brewer in the Faubourg Saint-Antoine, and his wealth, probity, and generosity towards his *employés* gave him an immense influence in the district. On the establishment of the National Guard in 1789, he received the command of a battalion, and took part in the storming of the Bastile. During the year 1792, the Jacobin agitators of the faubourgs often met in the brewery of S., and it was there that the *émeute* of the 20th June was preconcerted, on which occasion S., along with Saint-Huruge, marched at the head of the mob who invaded the Assemblée Nationale, and turned out the Girondists. He also played a conspicuous part on the 10th of August, when he was invested with the dignity of general-commanding of the National Guard. In October he was named Field-marshal (*Maréchal de Camp*), and in April 1793 he got the 'authorities' to let him off scot-free for a debt of some 50,000 livres, which he owed the exchequer in the shape of taxes on the beer manufactured by him—the minister of finance arguing that, inasmuch as S 's beer was drunk for the most part by 'patriots' (not always careful to pay their score), it ought not to be subjected to 'duty.' But greater things were yet in store for the privileged brewer. On the 30th of July, he was appointed a general of division in the French army, and wishing to do something to justify this strict military office, he marched at the head of 20,000 men against the Vendéan royalists, but was miserably beaten, and in consequence recalled. Shortly after, he was arrested and imprisoned, and only obtained his liberty after the death of Robespierre. He then withdrew into private life; but his fortunes and his popularity alike declined, and in 1800 we find him begging money and employment from Bonaparte. The latter, who saw clearly enough that S. was intrinsically an incapable fool, declined to employ him, but restored him to his military rank. S. died 6th February 1809.

Owing to the calumnies of royalist writers, S. commonly figures as one of the ferocious monsters of the Revolution. There is positively no evidence, however, for such an opinion. Though he was hugely fond of 'brave words,' and menaced his opponents with all the bellicose grandiloquence of a French revolutionist, he was nearly as soft in the heart as in the head. Some witty contemporary made the following epitaph on him:

> Ci-gît le général Santerre,
> Qui n'eut de Mars que la bière.

SANTIAGO, the largest of the Cape Verd Islands (q. v.).

SANTIA'GO DE CHI'LI, capital of the republic of Chili, and of a province of the same name, an archbishop's see, and the seat of the supreme government, stands at the western base of the Andes, 1800 feet above sea-level, and 90 miles east-south-east of Valparaiso. It was founded in 1541 by Pedro de Valdivia, but it has only recently acquired importance. Its climate is delightful; the plain on which it stands is extensive, and fertile in vines figs, melons, and other fruits, and the scenery, looking towards the range of the Andes, is of the grandest description. The valley or plain of S. is sprinkled with tasteful villas and well-cultivated farms. The city is arranged in squares, and the houses are generally low, and are built around a court or garden, which is intended as a place of refuge during the earthquakes that frequently occur here. But of late years it has become the fashion, in spite of the earthquakes, to build costly houses of two, three, and even four stories, with a façade towards the street. The Alameda, shaded with poplars, and cooled by two streams of running water, is a pleasant promenade. The Mint, a portion of which serves as one of the president's palaces, and as offices for the ministers, is the handsomest of the public buildings, many of which, however, are beautiful structures. The university comprises the five faculties of philosophy, mathematics and physical sciences, medicine, law, and theology.

There are important educational institutions (including a nor-

mal school), and a library and museum. On the west side of the great square, which is adorned with a fine fountain, is the cathedral. On December 8, 1863, one of its churches, that of La Compania, was destroyed by fire during service, and 2000 out of the 3000 of the congregation—the victims being mostly women—met a dreadful death. Gold, silver, and lead are exported, and the imports are chiefly manufactured goods, wines, and spirits. The chief trade is with Valparaiso by the Valparaiso and Santiago Railway, opened in 1863. Pop. (1875) 148,264. Area of province, 9000 sq. m.; pop. (1875) 362,712.

SANTIA'GO DE COMPOSTE'LLA, an important and once famous city of Spain, formerly the capital of Galicia, and, from the number of pilgrims by whom it was annually visited, the Mecca of Spain, is extremely picturesque in appearance, from its hill-girt situation on an irregular uneven site, 40 miles south of Coruña. The cathedral, occupying the site of a former edifice of the same nature, was founded in 1082, and its buildings, comprising a cloister, the archbishop's palace, &c., cover more than three and a half acres. The great square is a spacious area, and occasionally used as a bull arena. In front of the town-house is an equestrian statue of Sant Jago (St. James the Elder, the patron saint of the city and of Spain), whose body, according to a monkish legend, was discovered near this by a hermit—a star miraculously pointing out the spot, whence the name Compostella (*campus stellæ*, 'field of a star'). It was removed to Santiago in 829. The bones of the saint are believed by the people to be built into the foundations of the cathedral. A desolate appearance is imparted to the town from the number of tenantless and ruined nunneries and convents which it contains. Leather is manufactured, and the making and carving of small silver graven images employ a number of silversmiths. Pop. (1877) 24,192.

SANTIAGO DE CU'BA, formerly the capital of the island of Cuba, and now the chief town of the eastern department of the island, stands on a bay on the south coast at the mouth of a stream of the same name. It is hemmed in by mountains, and is reputed the most unhealthy place in the island. Its harbor is deep, well protected, and fortified. It communicates by railway and telegraph with the other towns of the island. As a seat of commerce, it takes rank after Havana and Matanzas. Pop. 45,000.

SA'NTONIN ($C_{30}H_{18}O_6$) is a vegetable principle possessing slightly acid properties, obtained from the seeds and flower-heads of several species of *Artemisia*. The British Pharmacopœia gives *Santonica*, 'the unexpanded flower-heads of an undetermined species of artemisia,' imported from Russia, as its source. It is one of the most efficacious of the class of medicines known as anthelmintics or vermifuges, the most obstinate cases of ascarides and lumbrici almost always yielding to its prolonged use. Pure santonin may be given in powder combined with scammony or rhubarb, the dose being from half a grain to two grains, according to the age of the child. The French prescribe it in the form of lozenges made with white sugar and mucilage; they are readily obtained in this country, and usually act satisfactorily. Küchenmeister, one of the highest authorities on the subject of intestinal worms, prefers the use of santonate of soda, which he obtains by digesting an alcoholic solution of santonin with carbonate of soda, evaporating and crystallizing. The dose is from two to eight grains mixed with sugar. Two very peculiar symptoms occur after the administration of santonin. The urine often acquires a reddish tint, which may give rise to an unfounded suspicion of the presence of blood in that fluid; and under its influence, vision becomes remarkably affected for a few hours, every object appearing either yellow or green to the patient. No satisfactory explanation of the latter phenomenon has yet been given.

SA'NTOS, one of the chief ports of the province of São Paulo (q. v.) in Brazil, 34 miles south-south-east of the city of São Paulo, of which it is the port. It stands on the northern side of the island of Engua Guaçu, and commands a fine bay. Sugar, coffee, and other products of the interior are transported to S. by troops of mules; and salt, flour, and other imported goods find their way back by the same means. It is stated that 200,000 mules arrive here laden during the year. 160,000 sacks of coffee are exported annually. Pop. stated at 8000.

SAN VICE'NTI. See SAN SALVADOR.

SAO FRANCI'SCO, a large river of Brazil, rises, as the Paraopeba, in the province of Minas Geraes, in lat. about 20° 40′ S.; long. 43° 25′ W. It flows north, north-east, and east, and in its lower course it separates the provinces of Bahia and Sergipe from Pernambuco and Alagoas. Its first considerable affluent is the Rio das Velhas, which joins it from the right in lat. 17° 45′ S. Above the junction of the Velhas, at Pirapora, where the river is 1782 feet broad, and 1700 feet above sea-level, there is a fall of 17 feet. From the mouth of the Velhas (1666 feet above sea-level) to the falls of Paulo Affonzo, the river is navigable for 920 miles; and from these falls to the mouth of the river, a distance of about 140 miles, it is navigable for larger vessels and steamers. Its entire length is 1652 miles, and its breadth at its mouth is 3486 feet.

SAONE, a river of France, an affluent of the Rhone (q. v.), rises in the dep. of Vosges, at Vioménil, in the Faucelles Mountains, at the height of 1476 feet above sea-level, and flows south past Gray, Châlons, and Maçon to its confluence with the Rhone at Lyon. Entire length, 312 miles, of which 170 miles are navigable.

SAONE-ET-LOIRE, a dep. of France, bounded on the E. by the dep. of Jura and the river Saône, and on the W. by the dep. of Nievre and the river Loire. Area, 3300 sq. m.; pop. (1881) 625,589. The country consists for the most part of vast and fertile plains, separated by rich vine-clad hills. The fertility is greatest in the vicinity of the two main streams. Horses of a small but vigorous breed are reared; the excellent and abundant pasturage supports numerous herds. The wines, of which 15,400,000 gallons are made annually, are well known as *vins de Mâcon*. Agriculture, iron-mining, and manufactures of cotton fabrics, leather, pottery, fire-arms, &c., are all actively carried on. The dep. was formed in 1790 out of four districts of the ancient province of Burgundy—Maconnais, Charollais, Chalonnais, and L'Autunois. It now forms five arrondissements, of which Mâcon is the capital.

SAONE, HAUTE, a dep. in the north-east of France, bounded on the N. by the dep. of Vosges, and on the E. by that of Haut-Rhin. Area, 2050 sq. m.; pop. (1881) 295,905. About one-half of the entire area is in cultivable land, and more than a fourth part, comprising the north and north-east districts, is covered with forest-clad mountains. In the south and south-west, are fertile plains, bounded by hills, covered with vines or timber. The climate of this rich champaign district, with its bulwark of mountains against the north and north-east winds, is remarkably mild and healthy. Sheep, including some flocks of the merino breed, and cattle are reared in large numbers. Fruits are largely cultivated; and 6,600,000 gallons of wine and 220,000 gallons of brandy are made annually. The arrondissements are Gray, Lure, and Vesoul, and Vesoul is the capital.

SAO PAU'LO, a southern maritime province of Brazil, bounded on the N. by the province of Minas Geraes. Area, 169,050 sq. m.; pop. (1872) 837,354. Its coast-line—part of which in the north-east is high and rocky, though the rest is low—is about 400 miles in length. Sugar, coffee, rice, millet, and tobacco are staple crops; horses, cattle, and swine are reared for export; and among the minerals are the precious metals and gems. There are several commodious harbors, and the capital is São Paulo.

SAO PAULO, city of Brazil, capital of the province of the same name, stands on an uneven elevation between two small streams, tributaries of the Tiete, 220 miles west-south-west of Rio de Janeiro. There is an Academy of Laws, attended by about 500 legal students. The general appearance of the town is picturesque, and the vicinity and suburbs are beautiful. Pop. stated at 22,032.

SAO PEDRO DO RIO GRANDE. See RIO GRANDE DO SUL.

SAP, the fluid which circulates in plants, and is as indispensable to vegetable life, as the blood to animal life. Entering by the roots of the plant (see ENDOSMOSE), it ascends through the cells and vessels of the stem, proceeding to the surface of the leaves and utmost extremities of the system, and having been exposed, chiefly in the leaves, to the influences of air and light, returns through the bark, a portion ultimately reaching the root and being excreted there, whilst another portion probably enters again into circulation with the new fluid entering from the soil. See CIRCULATION OF SAP. Sap in its most simple state, the ascending or crude sap, consists chiefly of water, mucilage, and sugar; the elaborated sap varies much more in its properties in different plants, forming the peculiar juices of the plants. The elaborated sap always contains much less water than the ascending sap.

Plants seem to derive their supply of sap not only from the soil by their roots, but also from the atmosphere by the Stomata (q. v.) of their bark and leaves; and some, especially succulent plants, are capable of existing and increasing in size although entirely severed from the soil. The ascending sap appears to find its way through the whole wood of the stem in ligneous plants, but chiefly through the alburnum or sap-wood. The elaborated sap has been named LATEX (q. v.).—The ascent of the sap is one of the most wonderful phenomena of spring, and seems to depend not so much on the state of the weather, for it begins in the depth of winter, as on the plant having had its sufficient period of repose, and being therefore constrained by its very nature to renewed activity.

SAP, in Military Engineering, is a narrow ditch or trench, by which approach is made from the foremost parallel towards the glacis or covert-way of a besieged place. The sap is usually made by four sappers, the leading man of whom rolls a large

gabion before him, and excavates as he progresses, filling smaller gabions with the earth dug out, and erecting them on one or both sides to form a parapet. The other sappers widen and deepen the sap, throwing more earth on to the parapet. A sap is considered to advance in average ground about eight feet per hour. From the nearness of the enemy's works, running a sap is an extremely dangerous operation. When possible, therefore, it is carried on at night; in any case the sappers are relieved at least every hour. When a sap is enlarged to the dimensions of a trench, it bears that name.

SA'PAJOU, a name sometimes applied to all that division of American monkeys which have a prehensile tail, and sometimes limited to those of them which are of a slender form, as the genera *Ateles* (q. v.), *Cebus* (q. v.), &c.

SAPINDA'CEÆ, a natural order of exogenous plants, consisting of trees and twining shrubs furnished with tendrils, and a few herbaceous climbers. Their leaves are often marked with lines of pellucid dots. The flowers are in racemes or racemose panicles, hermaphrodite or unisexual. The calyx is 4—5-partite, or consists of 4—5 sepals. The petals are 4—5, occasionally wanting, hypogynous, usually having an appendage in the inside. The stamens are usually 8—10; often inserted into the disc, which is fleshy, and sometimes glandular. The ovary is generally 3-celled, the cells containing one or few ovules. The fruit is fleshy, or *samaroid*, or capsular. The order contains about 380 known species, natives of warm climates, especially of South America and India; none of them natives of Europe, although the HORSE-CHESTNUT (q. v.) is now as well known in many parts of it as most of its native trees.—The timber of some species is valuable, particularly that of *Pteroxylon utile* and *Hippobroma alatum*, natives of the Cape of Good Hope, the former known there by the name of *Nieshout*, and the latter of *Pardepis*. Some are used in medicine as astringents. Narcotic and poisonous properties are very generally developed—also a saponaceous principle, especially in the genus *Sapindus* (see SOAP BERRY). Yet GUARANA BREAD (q. v.) is made from the seeds of a species of this order; the leaves of another (*Cardiospermum halicacabum*) are used as a boiled vegetable in the Moluccas; and the fruits of some species are excellent.

SAPODI'LLA PLUM, the name given in the West Indies to the fruit of *Achras Sapota* and other species of *Achras*, a genus of the natural order *Sapotaceæ*. The seeds are aperient and diuretic, but an overdose is dangerous. The pulp of the fruit is subacid and sweet, and it is much esteemed for the dessert in the West Indies. The fruit of *Achras mammosa* is called MARMALADE. The NASEBERRY, also of the West Indies, belongs to this genus.

SAPONIFICA'TION. See OILS AND FATS, and SOAP-MAKING.

SA'PONIN ($C_{24}H_{20}O_{14}$) is a vegetable principle contained in various plants, including the *Saponaria officinalis*, or Soap-wort, the *Polygala Senega*, several varieties of *Lychnis*, the fruit of the horse-chesnut, &c. It is readily extracted from the root of soap-wort by means of boiling alcohol, which, as it cools, deposits the saponin as an amorphous sediment. It derives its name from its behavior with water, in which it is soluble in all proportions, yielding an opalescent fluid which froths when shaken, like a solution of soap, if even $\frac{1}{1000}$th part of saponin be present. Its solution, or an infusion of soap-wort, is sometimes employed in place of a solution of an alkaline soap, for cleansing the finer varieties of wool from grease.

SAPOTA'CEÆ, a natural order of exogenous plants, consisting of trees and shrubs, often abounding in milky juice. The leaves are leathery, entire, and without stipules. The flowers are axillary; the calyx regular persistent, generally with five divisions; the corolla monopetalous, hypogynous, deciduous, regular, its segments usually equal in number to those of the calyx, rarely twice or thrice as many. The stamens are inserted on the corolla, fertile ones generally as many as the segments of the calyx, and generally with alternate sterile ones. There is no disc. The ovary is superior, with several cells, each cell with one ovule. The fruit is fleshy; the seeds nut-like, sometimes cohering; the *testa* bony and shining, with a very long, opaque, and softer scar on the inner face.—There are considerably more than two hundred known species, chiefly natives of the tropics, and the remainder of sub-tropical countries. One of the most recently discovered species is also already one of the most important, *Isonandra gutta*, which produces GUTTA PERCHA (q. v.).—The fruits of some are pleasant, as the SAPODILLA (q. v.), and other species of the genus *Achras*, the STAR APPLE, and other species of *Chrysophyllum* (q. v.), different species of *Mimusops; Imbricaria Malabarica* and *I. maxima*, various species of *Lucuma*, &c. The genus BASSIA (q. v.) contains species valuable for the oils which they yield. The seeds of *Mimusops elengi* also yield oil abundantly.

SAPPAN WOOD, SAPAN WOOD, or BUKKUM WOOD, the wood of *Cæsalpinia Sappan* (see CÆSALPINIA), an East Indian tree, about forty feet high, with twice pinnate leaves, and racemes of yellow flowers. The wood is much used as a dye-wood, yielding a good red color, which, however, is not easily fixed. It is a very considerable article of export from Singapore and other ports of that region both to Calcutta and to Europe.

SAPPER, the name given to a private soldier in the corps of Royal Engineers.—The name of the corps was formerly Royal Sappers and Miners.—The pay of a sapper is £20, 10*s*. 7½*d*. a year, with extra pay when at work; the number of such men for 1877–78 was 2952. Only men of good character, already adepts in a mechanical trade, are eligible for this service, which is very popular, as an intelligent sapper frequently passes into some situation in civil life for which his practical military training specially fits him. Many sappers are excellent surveyors, photographers, and draughtsmen.

SA'PPHIRE, a gem excelled in value by no precious stone except diamond, and regarded as a variety of Corundum (q. v.), highly transparent and brilliant. It is sometimes colorless, and the colorless kind, called *White S.*, is sometimes sold as diamond. It more frequently exhibits exquiste color, generally a bright red or a beautiful blue; more rarely, gray, white, or green. The red variety is the Oriental Ruby (q. v.) of lapidaries; the blue is that commonly called S., and which has received this name from ancient times. It is found crystallized, usually in six-sided prisms, terminated by six-sided pyramids; and is sometimes found imbedded in gneiss; but it more frequently occurs in alluvial soils. It occurs at Bilin in Bohemia, and Expailly in Auvergne, but more abundantly in some parts of the East.

Ceylon is famous both for its rubies and its sapphires, the latter being the more abundant. They occur with garnets and other minerals, in a stratum of water-worn pebbles firmly imbedded in clay, in which there are occasional lumps of granite and gneiss. But nothing has yet been done to seek for them in their original situation in the mountain rocks. A piece of S., which was dug out of the alluvium within a few miles of Ratnapoora in 1853, was valued at upwards of £4000. The S. was one of the stones in the breastplate, of the Jewish high-priest. Among the Greeks, it was sacred to Jupiter.—The name *Girasol S.* is given to a beautiful variety with a pinkish or bluish opalescence, and a peculiar play of light. The *Chatoyant S.* has more pearly reflections. The *Asteria S.* has in the midst of it a star of six bright rays, resulting from its crystalline structure.

SA'PPHO, along with Alcæus, the chief representative of the Æolian school of lyric poetry, was born either at Mitylene or at Eresos in Lesbos. She was only six years old when she lost her father Scamandronymus. She was contemporary with Alcæus, Stesichorus, and Pittacus, with the first of whom she lived in friendly intercourse, as is seen in the surviving lyrics of both. All that we know of her is contained in an obscure reference in the Parian Marble, and in one of the epistles of Ovid, to her having fled from Mitylene to some place of refuge in Sicily, between 604 and 592. Her famous plunge into the sea from the Leucadian rock, on finding her love for Phaon unrequited, seems to be an invention of later times. At Mitylene, she is supposed to have been the center of a literary coterie, all of them females, and most of them pupils of her own in the art of poetry. Her moral character has been the subject of controversy in modern times; the most recent disputants being the late Colonel Mure and the well-known F. G. Welcker of Bonn, who, in the *Rheinisches Museum* (1857—1858), appeared, the former, for the prosecution, and the latter for the defence.

To whatever opinion on this subject we may incline, there is no doubt of her high lyrical genius, which was the admiration of antiquity from Solon downwards, and which, as still surviving in her matchless ode to Aphrodite, enhances our regret that of the nine books of her poems, we only possess fragments. The best text is that contained in Bergk's *Poetæ Lyrici Græci* (1854); the best separate edition is Neue's (1827).

SAPUCAIA NUT, the seed of *Lecythis ollaria*, a lofty tree, which is plentiful in the forests of the north of Brazil, and belongs to the natural order *Lecythidaceæ*. The fruit is urn-shaped, as large as a child's head, and opens by a lid which falls off. Each fruit contains a number of seeds or nuts, as in the case of the allied Brazil nut. The flavor is finer than that of the Brazil nut, although, hitherto, the S. N. is much less common in our shops. Its form is oval, somewhat pointed at both ends, which are slightly bent in opposite directions. Monkeys are very fond of the S. N., and are sometimes caught in consequence of thrusting the hand into a capsule, and not being able to withdraw it when filled with a nut, whilst they obstinately keep hold of the expected prize.

SA'RABANDE, originally a slow dance, said to be of Saracenic origin; and hence a short piece of music, of deliberate character, and with a peculiar rhythm, in ¾ time, the accent being placed on

the second crotchet of each measure. The sarabande is of frequent occurrence among the *suites* or series of short pieces written by Handel, Sebastian Bach, and others of the old masters, for the harpsichord or clavichord.

SARACE'NIC ARCHITECTURE. See ARABIAN ARCHITECTURE.

SA'RACENS, a name variously employed by medieval writers to designate the Mohammedans of Syria and Palestine, the Arabs generally, or the Arab-Berber races of Northern Africa, who conquered Spain and Sicily, and invaded France. At a later date, it was employed as a synonym for all infidel nations against which crusades were preached, and was thus applied to the Seljuks of Iconium, the Turks, and even to the pagan Prussians. The true derivation of the word was long a puzzle to philologers; Du Cange deduced it from Sarah, the wife of Abraham, an opinion coincided in by the medieval Christian authors; Hottinger (*Biblio. Orient.*), from the Arab. *saraca*, to steal; Forster (*Journey*), from *sahra*, a desert; while others strove to see its origin in the Hebrew *sarak*, poor; but the opinion which has been most generally supported, and prevails at the present time, is that the word was originally *Sharkeyn** (Arab. 'eastern people'), corrupted by the Greeks into *Sarakenoi*, from which the Romans derived their word *Saraceni*. The epithet Sarakenoi was applied by the Greek writers (from the 1st c. of the Christian era) to some tribes of Bedouin Arabs in Eastern Arabia, though they do not agree among themselves as to the particular tribe so denominated. Pliny and Ammianus place the S. in Arabia Petræa and Mesopotamia, on the common frontier of the Roman and Persian empires; and the description of them by the latter, a most painstaking and accurate historian, coincides, in every important particular, with what is known at the present day of the Bedouin tribes of those regions.

SARACEN'S HEAD, a not unfrequent bearing in Heraldry. It is represented as the head of an old man, with a savage countenance.

SARAGO'SSA, or ZARAGOZA, a city of Spain, the capital of a province of the same name, and formerly of the kingdom of Aragon. It stands on the Ebro, here a muddy stream, which divides the city into two parts, and is crossed by a noble stone bridge, built in 1437. The city has an imposing appearance from a distance, being adorned with numerous slender towers and spires; but the traveler, on entering it, finds it full of narrow winding lanes, instead of streets, although the houses—which are built of brick—are of most solid structure, and many of them are the palaces of a nobility who have now ceased to reside here. These buildings, rich in finely carved decorations and magnificent cornices, are now mostly inhabited by agriculturists of a rude class; their spacious courts converted into farm-yards, and filled with dung-heaps. Everything about the city indicates decay and poverty. S. was the Celtiberian *Salduba*, but received the new name of *Cæsarea Augusta* in 25 B.C., of which the present name is a corruption. It was a place of importance under the Romans, but there are few remains of the Roman city. S. was one of the first cities of Spain in which Paganism was generally renounced and Christianity adopted; it afterwards became rich in relics, to which miraculous powers were ascribed. S. was taken by the Moors in the 8th c., and recovered from them in 1118, after a siege of five years, during which great part of the inhabitants died of hunger. It was taken by the French in 1809, after a siege of eight months, and one of the most heroic defences recorded in the history of modern warfare. See PALAFOX.

S. has a university, founded in 1474. It has two cathedrals, both interesting as specimens of architecture; but the older is in a simple and severe style; the modern one—that of *Nuestra Senora del Pilar*—is very ornate. The latter cathedral boasts of a pillar on which the Virgin descended from heaven, 40 A.D.—an event so strongly attested, that Diego de Astorga, primate of Spain, on 17th August 1720, excommunicated all who even questioned it. Pilgrims flock from all neighboring parts of Spain to this pillar and the image of the Virgin, which came down from heaven. S. suffered grievously at the hands of the French in 1809, and lost most of its treasures of art. It has a considerable trade in agricultural produce, mostly carried on by the Ebro; and manufactures of silks, woollens, and leather. Pop. (1877) 84,577.

SARA'NSK, a town of European Russia, in the province of Penza, and 80 miles north from Penza, at the confluence of the Saranga and Insara, feeders of the Sura. Pop. (1880) 13,438.

SARASWATI is, in Hindu Mythology, the name of the wife, or the female energy, of the god Brahman, the first of the Hindu Trimûrti or triad. She is also the goddess of speech and eloquence, the patroness of music and the arts, and the inventress of the Sanscrit language and the Devanâgarî letters. She was induced to bestow these benefits on the human race by the sage *Bharata*, who, through his penance, caused her to descend from heaven, and to divulge her inventions. Hence she is also called *Bharati*. She was very white, hence another of her names, *Mahas'weta*, or *Mahas'ukla* (from *mahat*, great, and *s'weta* or *s'ukla*, white).—S. is also the classical name of the river now called *Sarsooty*, which rises in the mountains bounding the north-east part of Delhi, whence it runs in a south-westerly direction, and is lost in the sands of the great desert in the country of the Bhatti. According to the Hindus, the river only disappears in this place, and continuing its course underground, joins the Ganges and Jumna at Allahabad.

SARATO'GA SPRINGS, one of the chief watering-places in the U.S., is in New York, 32 miles north of Albany. It contains 28 mineral springs, some chalybeate; some containing iodine, with salts of soda and magnesia; and all highly charged with carbonic acid. They are prescribed in diseases of the liver, chronic dyspepsia, &c. In the village are 32 hotels, some of immense magnitude; and during each season there are from 30,000 to 45,000 visitors. Pop. (1870) 7516; (1880) 10,822. A few miles to the east, near Saratoga Heights, an engagement took place on Sept. 14, 1777, between the British under Burgoyne and the Americans under Gates, the British being worsted; and on Oct. 17 the British general surrendered with an army of 5800 men.

SARATO'V, a government in the south-east of Russia, is bounded on the E. by the river Volga. Area, 32,500 sq. m.; pop. (1880) 1,988,350. In 1850 the territory *east* of the Volga, formerly part of S., was erected into the government of Samara (q. v.). Nearly half the area of S. is as yet waste land. A number of German colonists settled here in 1765—1775, and distinguished themselves by their persevering industry and by diligent cultivation of the soil. Their descendants have become an important section of the population. Cattle-breeding is carried on extensively; fishing is of considerable importance.

SARATOV, a city of Russia, capital of the government of the same name, on the right bank of the Volga, 460 miles south-east of Moscow. Though its houses are generally built of timber, the town has a rich and picturesque appearance. Its 16 churches are ornamented with numerous towers and cupolas; and its broad streets, from the character of the houses and of the elegant equipages that roll through them, have quite a European appearance. It manufactures pottery, bricks, tobacco, silk, hosiery, &c. Pop. (1880) 86,420.

SARA'WAK, a kingdom on the north-west coast of Borneo, is bounded S. and W. by Sambas, E. by Brunai, and N. by the Bight of Datu. The coast stretches from the west of Cape Datu, in lat. 2° N., and long. 109° 55′ E., to the east of the river Samerahan, in long. 111° 3′ E., a distance of nearly 70 miles. Area, 25,000 sq. m. Pop. 240,000. The Sarawak is the most important river; it has two navigable mouths, the one entering the Bight of Datu in lat. 1° 42′ 30″ N., and long. 110° 20′ 30″ E.; the other, a few miles further to the east. Other considerable rivers are the Rejang (navigable for 120 miles for vessels of more than 1000 tons), the Lûndu, Samerahan, and Sadang. A chain of mountains, 3000 feet in height, rises in S., and, with increasing elevation, tends towards the north; while others are detached, as the Samerahans, and the steep, densely-wooded Lûndu. Sandstone and granite are the prevailing rocks; porphyries, basalt, and quartzose schists also occurring. In some parts, the soil is clayey; in others, it is a rich mould. With the exception of some cultivated spots, the surface is covered with forests, which abound with wild swine, harts, and a variety of monkeys. There is excellent coal near the river Sadang. Antimony ore, which can be both easily worked and shipped, is obtainable in any quantity, copper and gold have been found, and iron ore is plentiful at Lûndu. Fine timber trees, as ironwood, ebony, sandal-wood, teak, and other sorts peculiarly adapted for shipbuilding, grow on the lands near the mouths of the rivers. Overtopping them all is the tall Camphor Tree (*Dryobalanops aromatica*), from which by incision, the valuable camphor-oil is obtained; or by felling and splitting the wood, the crystallized camphor, which is prized above that produced in any other part of Asia.

The climate is not considered unhealthy. Much rain falls from September to March, and the thermometer usually indicates about 83° F. Edible nests, wax, and aromatic woods are collected by the Dyaks for the Singapore market, and the plains are well adapted for the growth of rice and sago. In 1862, two cargoes of choice timber for ship-building were sent to the royal dockyards of Great Britain, and more attention is now being paid to that natural source of wealth. The chief exports are gutta-percha, sago flour, antimony ore, and edible birds' nests, and have a value of near £300,000 annually; and the imports, chiefly cloth, tobacco, brass-ware, opium, rice, and cocoa-nut oil, have about the same annual value. The exportation of antimony and sale of opium are monopolized by the government, and with a small head-tax, form the chief revenue.

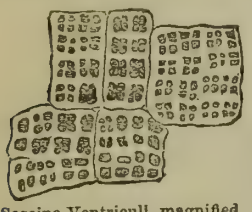
The original inhabitants are Dyaks, divided into some 20 tribes,

* *Sharkeyn*, or *Sharakyoun*, 'eastern people,' is thus opposed to *Magharibé* or *Maghribé*, 'western people,' the self-styled appellation of the inhabitants of *Maghrib* ('the west') or *Morocco*.

and speaking different dialects; they are, for savages, mild, industrious, and honest. Malays live on the coast, and the mines are worked by Chinese. From 1841 to 1868, S. was governed by Sir James Brooke (q. v.), as an independent rajah. Sir James was succeeded by his son. The rajah is an absolute sovereign, but has a legislative council of natives and Europeans. Even on the testimony of the Dutch, who view with jealousy the increased influence of the British on that coast, the new rule has done much to suppress piracy and promote the civilization and prosperity of the people.

The seat of government is the town of Sarawak, formerly called Kūtjing, about 18 miles from the mouth of the river, which is navigable for large ships. Mission-stations and schools have been erected, and the population has increased to 12,000. Trade, which is authoritatively reported to have increased about 600 per cent. since 1854, is principally carried on with Singapore.

SA'RCINA (Lat. a package), or SARCI'NULA, a genus of minute plants of very low organization, sometimes reckoned among *Algæ*, and sometimes among *Fungi*. A number of forms or species are known. The first discovered, called *S. ventriculi*, was originally observed by Goodsir in matters vomited from the human stomach. It is of a roundish quadrangular form, about $\frac{1}{100}$th to $\frac{1}{150}$th of a line in diameter; the individuals generally grouped in cubes of four, sixteen, or sixty-four in the cube, separated by rectangular striæ. Although the most common seat of sarcinæ is the human stomach, they have likewise been detected in the stomach of the tortoise, the rabbit, the dog, the ape, and in the cæcum of the fowl; in the urine, in a considerable number of cases; in the lungs; in the fæces and intestinal canal; in the fluid of the ventricles of the brain; in cholera stools; in the fluid of hydrocele; in the bones; and Dr. Lowe has noticed its existence in stagnant water. It appears from the measurements of Welcher that the sarcinæ occurring in urine are about half the size of those occurring in the stomach, and the aggregations of sarcina cells are also smaller.



Sarcina Ventriculi, magnified 1000 diameters. (Copied from the *Micrographic Dictionary*. Lond., Van Voorst.)

The occurrence of the sarcina in the urine, the fluid of the ventricles of the brain, &c., is probably a *post-mortem* phenomenon of little diagnostic or pathological importance. Its appearance in vomited fluids is, however, characteristic of a peculiar and important form of dyspepsia. The vomited matter in these cases has a faint acid smell, like that of fermenting wort, and is obviously in a state of fermentation. After standing a few hours, it becomes covered with a thick, brownish, yeast-like froth, and deposits a brown flaky sediment. On examining the froth and the deposit under the microscope, sarcinæ are found in great abundance, together with the torulæ characteristic of Yeast (q. v.). The fluid is always acid, if sarcinæ are present. The amount of vomited matter is always large, and sometimes enormous. It is usually ejected in the morning, after a night spent awake from a sense of heat, gurgling, and distention in the epigastric region; and its discharge gives almost immediate relief. Dr. Budd, one of the highest authorities in diseases of the stomach, believes that the disease consists, primarily and essentially, in some organic change, which prevents that organ from completely emptying itself, and which causes a secretion from its coats, capable, when mixed with food, of undergoing or exciting a process of fermentation; and that the development of the sarcinæ bears to this process, or to some stage of it, the same relation which the development of torulæ bears to simple alcoholic fermentation. The well-known power of sulphurous acid in checking the fermentative process, induced Professor Jenner to try the effect of sulphite of soda—a salt which readily yields its sulphurous acid—in this disease; and experience has fully confirmed the accuracy of Jenner's induction; for this salt, administered soon after a meal, or when the fermenting process is commencing, in doses varying from 10 grains to a drachm, dissolved in water, is the most effectual remedy at present known for relieving this disorder. The hyposulphite of soda, in somewhat larger doses, has a similar action.

SA'RCINE (Gr. *sarx*, gen. *sarcos*, flesh) is the name now given to a nitrogenous substance ($C_{10}H_4N_4O_2$) which has been obtained from the muscular tissue of the horse, ox, and hare; and from various glandular organs, as the liver and the spleen of the ox, the thymus gland of the calf, and the human liver, in cases of acute atrophy of that organ, in which case it is associated with xanthine ($C_{10}H_4N_4O_4$), a substance differing from it only by two atoms of oxygen. It is identical with the substance formerly known as Hypoxanthine.

SARCOLE'MMA is the term applied to the delicate sheath which invests each primary muscular fibre. See MUSCLE.

SARCO'MA is a somewhat vague term used by Abernethy and many subsequent surgical writers to designate a fleshy or firm morbid tumor. The term sarcoma is comparatively rarely met with in recent works on surgery.

SARCO'PHAGI. See CANNIBALISM.

SARCO'PHAGUS (Gr. flesh-eater), any stone receptacle for a dead body. The name originated in the property assigned to a species of stone found at Assos in Troas and used in early times, of consuming the whole body, with the exception of the teeth, within the space of forty days. The oldest known Sarcophagi are those of Egypt, some of which are contemporary with the pyramids. The earliest of these are of a square or oblong form, and either plain, or ornamented with lotus leaves; the later are of the form of swathed mummies, and bear inscriptions. The Phœnician and Persian kings were also buried in sarcophagi. The Roman sarcophagi of the earlier republican period were plain. Sarcophagi were occasionally used in the later republic, although burning had become the more general mode of disposing of the dead. The use of stone chests for the interment of distinguished persons has not been altogether discontinued in modern times.

SARDANAPA'LUS. See ASSYRIA.

SARDE, or SARDA, a variety of quartz, differing from carnelian only in its very deep red color, blood-red by transmitted light. It is rare, and brings a much higher price than common carnelian. The name is probably from Sardis. The S. was one of the stones of the breastplate of the Jewish high-priest. There were also two in the ephod. The SARDONYX is an Onyx (q. v.) containing layers of sarde.

SA'RDÉS, OR SARDIS, anciently a city of Asia Minor, the capital of Lydia, was situated in a fertile plain, between the northern base of Mount Tmolus and the river Hermus, about 60 miles east-north-east of Smyrna. Through its *agora*, or market-place, flowed the Pactolus, a tributary of the Hermus. The city is first mentioned by Æschylus. It was taken by the Cimmerians in the reign of King Ardys (680—631 B.C.). In the reign of Crœsus, the last Lydian king, S. attained its highest prosperity. It became the residence of the Persian satraps after the overthrow of the Lydian monarchy. The Athenians burned it 503 B.C., and it afterwards passed under the Romans, and was the seat of a separate provincial government. It is one of the Seven Churches mentioned in the Book of Revelation.—*Sart*, the modern Sardis, is a poor village, worthy of mention only for the ruins of the ancient city to be seen in the vicinity. Of these, the chief are those of a stadium, of a theater, and of the Acropolis.

SA'RDINE (*Clupea Sardina*), a fish of the same genus with the herring and pilchard, smaller than the pilchard; abundant in the Mediterranean, and found also in the Atlantic Ocean, although not so far north as the British shores. It is much esteemed for its flavor, and sardines preserved in oil are exported in large quantities from some of the Mediterranean ports. But the 'sardines' of the west coast of France, which are largely imported into Britain, are generally not true sardines, but young sprats—the *garvies* of the Firth of Forth—and sometimes young herring.

Sardines appear in shoals on the coasts of the Mediterranean at particular seasons, as herrings and pilchards on those of Britain. The S. fishery on the coast of Provence is chiefly in the months of May, June, and July; but the fishery for sprats, which are cured as sardines, and sold under that name in the west of France, takes place in the winter months. About the year 1880, sardines disappeared from the coasts of Brittany, where they were estimated to be worth 15,000,000 francs per annum (£600,000) to the fishermen. They are exported to the most distant parts of the world; cured with oil in tin boxes, forming a much esteemed delicacy, and, at the same time, a most wholesome article of food. To cure them in this way, they are first carefully washed in the sea, then sprinkled with fine salt; and after a few hours, the head, gills, &. are removed; they are then washed again, and spread out on willow branches or wire-work, exposed to the sun and wind, if the weather is dry, but in damp and rainy weather, to a current of air under cover. They are next put into boiling oil, in which they remain for a short time, and when they are taken out, the oil is drained away from them as much as possible, and they are put into the tin boxes, of which the shape and appearance are so familiar to everyone. The boxes being filled with sardines, are filled up with oil, the lid is soldered on, and they are placed for a short time in boiling-water, or exposed to hot steam. The boxes which have leaked or have burst in boiling are rejected, and those which remain sound are now ready for the market.

In the south of France, sardines are sometimes cured in red wine, and those so cured are called *Sardines Anchoisées*, or Anchovied Sardines.

In 1875 the 'Cornish Sardine Company' was formed at Falmouth for the purpose of preserving pilchards in oil after the

manner above described. The result is a delicacy hardly to be distinguished from French sardines. The company is thriving; and thus, it is to be hoped, tons of hitherto waste food will be utilized.

Several species of small *Clupeidæ*, much resembling the S., are found in different parts of the world, and are used in the same way as the S. of the Mediterranean. One species frequents the southern and eastern coast of Ceylon in such vast shoals, that 400,000 have been taken at a single haul of the nets in a little bay; and when the shoal approached the shore, the broken water became as smooth as if a sheet of ice had been floating below the surface.

SARDI'NIA, KINGDOM OF, a former kingdom of Italy, and the nucleus of the present *Kingdom of Italy*, included the duchies of Savoy and Genoa, and parts of those of Montferrat and Milan, the principality of Piedmont, the county of Nice, and the islands of Sardinia and Caprera, amounting in all to 19,564 English sq. m. of continental territory, with a pop. of (1857) 4,590,260, and 9205 of insular territory, with a pop. of 577,282; total area 28,769 English sq. m., pop. 5,167,542. In 1859, it was increased by the addition of the Austrian portion of the Milanese, and diminished by the cession in 1860 of Savoy and Nice to France, the change in the continental territory being shown by the following figures: area, 21,099 English sq. m.; population, 6,530,232; the insular territory remaining unaltered. The various districts above mentioned differ greatly from each other in physical configuration and climate, and the more important of these are treated in separate articles. See also ITALY. The Roman Catholic religion was established by law in March 1848; but monastic orders, with the exception of those which are also benevolent institutions, were suppressed May 28, 1855. In 1859, the army amounted to 76,172 men, and the fleet to 29 ships (none of them men-of-war), with 436 guns; the revenue (1858), which was mostly derived from customs, duties, and direct taxation, to £5,799,301; and the expenditure to £5,949,902—a want of equilibrium in the finances which had long existed, and which caused the establishment, since 1819, of a gradually increasing national debt, that amounted (1858) to £27,080,810. The annual import trade amounted (1857) to a declared value of £19,123,054, and the exports to £14,605,043.

The kingdom of S. was originated by a treaty (24th August 1720) between Austria and the Duke of Savoy (q. v.), by which the latter agreed to surrender Sicily to the former on condition of receiving in exchange the island of Sardinia, and the erection of his states into a kingdom. In 1730, *Victor-Amadeus I.*, the last Duke of Savoy and first king of S., resigned the throne to his son, *Charles Emmanuel I.* (1730—1773); but repenting his resolution, and attempting to resume the government, he was put in prison, where he died in 1732. His son, by joining with France and Spain against Austria, obtained (1735) the territories of Tortona and Novarra, to which were further added (1743), during the war of the Austrian Succession, the county of Anghiera, and the territories of Vigevano and Pavia, He was the author of the code known as the *Corpus Carolinum*. His successor, *Victor-AmadeusII.* (1773—1796), acceded to the European coalition against France, and was deprived in consequence of Savoy and Nice in 1792; but sustained by England and the pope, he raised an army, and maintained himself in his kingdom till 1796, when Bonaparte forced him formally to relinquish the territories he had lost. His son, *Charles Emmanuel II.* (1796—1802), was at first an ally of France; but the Directory, in 1798, compelled him to surrender all his continental possessions, which were then incorporated with France; and it was not till the first peace of Paris (May 30, 1814) that the House of Savoy regained its territories. The Congress of Vienna (December 1814) annexed to S. the ancient republic of Genoa, and the second peace of Paris (1815) restored a small portion of Savoy, which France still possessed, and gave the king a protectorate over the small principality of Monaco. Long before this time, Charles-Emmanuel had abdicated, and his brother *Victor-Emmanuel I.* (1802—1821), succeeded to his rights, and made his entry into Turin, 20th May 1814. His return restored the ancient misgovernment; and similar political changes in the other Italian states revived the societies of the 'Carbonari' (q. v.) and other similar secret associations, whose aims were supported by a portion of the nobility and army, and by the heir-presumptive to throne, Charles-Albert, Prince of Savoy-Carignan.

The insurrection of the army on the 9th and 10th of March 1821, brought on a general revolution. But the king having abdicated in favor of his brother, *Charles-Felix* (1821—1831), and the Austrians having come to the rescue, the insurrection was put down. Under the protection of an Austrian army of occupation till 1828, Carles-Felix re-established absolute power, recalled the Jesuits, persecuted the Protestants, and took various other measures for rooting out all opposition. On his death, the elder line of Savoy became extinct, and the succession fell to the cadet branch of Savoy-Carignan (see SAVOY, HOUSE OF), whose rights had been recognized by the Congress of Vienna, and *Charles-Albert* (q. v.) (1831—1849) ascended the throne. The liberals were gratified with some slight reforms, but the power of the clergy was untouched, and the conspiracy of 30th November 1833 at Turin, and the mad inroad of Mazzini, at the head of a small band of German, Polish, and Italian refugees, in February 1834, only disturbed the country, and confirmed the government in its despotic policy. The interior administration was, however, carried on with more energy than under the two previous reigns, through the conclusion of treaties with France, Britain, Turkey, the Low Countries, Denmark, Austria, and the Hanse Towns, &c; the construction of roads, bridges, and railways was vigorously prosecuted, and agriculture and other industries were encouraged. In 1842, the king commenced a gradual but progressive liberal policy, promulgated a limited act of amnesty to political offenders, relaxed the severity of censorship, reformed judicial administration and prison discipline, and abolished the feudal system in Sardinia. The kingdom participated in the agitations of 1846 and 1847, which affected the whole peninsula, but was wholly exempt from insurrections and conspiracies, the people contenting themselves with expressing their views and wishes in petitions and demonstrations displaying entire confidence in the government.

On February 8, 1848, the king announced a new and extremely liberal constitution, which was proclaimed some weeks afterwards; a liberal law of election was decreed, the first Sardinian parliament convoked for the 17th April, and the act of amnesty declared general. In the midst of these changes, the revolution broke out, and Charles-Albert, who was saluted with the title of 'the sword of Italy,' put himself at the head of the movement, and declared war against Austria. (See ITALY, RADETSKY, &c.) On the day after the fatal rout of Novara (13th March 1849), Charles-Albert abdicated, and was succeeded by his son, Victor-Emanuel (q. v.), who, in alliance with France, declared war against Austria in 1859; and by March 1861 was in possession of the whole of Italy, except Venetia and Rome, and exchanged the title king of S. for that of king of Italy. Venetia was added to the kingdom in 1866, and the Papal States in 1870, when the union of Italy was complete.

SARDI'NIA, ISLAND OF, the largest, after Sicily, of the islands of the Mediterranean, lies directly south of Corsica, from which it is separated by the Strait of Bonifacio, a channel only 7 miles wide in its narrowest part. S. is situated about halfway between Central Italy and Africa, and between Southern Italy and Spain. Its length is 166 miles; greatest breadth 90 miles; and area 9361 sq. miles. The country is mostly mountainous, some of the peaks of the central chain having an elevation of 6300 feet. The Limbara range, in the northwest, is granite, the diagonal chain palæozoic, and the central range of the tertiary calcareous formation; many of the peaks, especially within the semicircle formed by the Limbara range, are extinct volcanoes. The coasts are generally steep and rugged. A few islands lie off the coast, and all, of any considerable size and importance, are situated at the corners; off the north-east corner are the Maddalena group, consisting of Maddalena, Caprera, and five or six minute islets; off the north-west corner is Asinara; and off the south-west corner are San Pietro and San Antioco. The island is well supplied with streams, but none of them have a long course, and only one is partially navigable.

Soil and Climate.—Between the mountain ranges are several wide valleys of remarkable beauty and fertility. There are also several large sandy or stony districts (*macchie*), of almost irremediable sterility. The mountain sides are partly rocky and barren, partly clad with woods, and partly fitted for pasture. The climate is mild, the temperature ranging from 34° to 90°; but in the low lands, which are largely of a marshy character, and in the neighborhood of the littoral lakes, a deadly malaria (*intemperie*) prevails, especially in autumn. The inhabitants of those districts, who can afford to do so, migrate annually during the unhealthy season; and those who are compelled to remain never leave their houses till an hour after sunrise, and carefully return before sunset, taking all precautions to prevent the entrance of the poisonous gas by door or window. The inhaling of the miasma by a stranger is considered among the inhabitants to be as deadly as a dose of strong poison.

Products.—Wheat, barley, maize, oranges, and other fruits are produced in abundance, and are esteemed for their excellent quality. The vine is extensively cultivated, but, from carelessness in the process, the wine is not so good as might naturally be expected. The olive-grounds are extensive, and the produce excellent. Tobacco (of inferior quality), cotton, linseed, flax, hemp, saffron, and madder are also produced. The woods which clothe the mountain sides are chiefly composed of cork, chestnut, oak, pine, and other timber trees, which form a considerable item in the export trade. Many mountain-slopes have, however, been much deteriorated in fertility by the excessive cutting down of timber.

The bullock is the favorite animal for draught, but horses are also used; and a small species of pony, which in ancient times was much esteemed by the Roman matrons, is still found. The sheep are of ordinary quality, and the swine are said to be among the best in Europe. Few cows are kept, and cheese is obtained almost wholly from sheep's and goat's milk. Wild boars and deer are not uncommon, and the Moufflon (q. v.) is found in the Alpine woods. Foxes, rabbits, hares, and martens are so abundant that a large export trade in their skins is carried on. The fisheries are important.

Manufactures are insignificant, being mostly the result of home industry; but the royal manufactories of gunpowder, salt, and tobacco are of considerable importance. S. is rich in minerals, but these, like its other resources, are as yet little developed; silver, mercury, granite, gypsum, marble, alabaster, amethyst, and other precious stones, are found; and lead, iron, and copper are in considerable abundance. Gold, bismuth, and antimony are said to exist.

Inhabitants.—The inhabitants bear a considerable resemblance to the Greeks, and speak a barbarous dialect, composed chiefly of Spanish, Arabic and Italian; they are ignorant and bigoted, having been subjected to misgovernment and oppression from their emancipation from Roman rule till 1836, when feudal tenure was abolished, and the enormous power of the clergy somewhat reduced. They are generally stupid and indolent, clothe themselves in sheep-skins, and invariably profess the Catholic religion. The custom of the *Vendetta* is frequently practised, though not to the same extent as in Corsica.

History.—S., at first called by the Greeks *Ichnusa* and *Sandaliotis* (from its resemblance to a human foot-print), and afterwards *Sardo* by the Romans, was colonized at a very early period. The first really historical event is its conquest, about 480 B.C., by the Carthaginians, who, during their occupation, rendered the island a celebrated corn-producing country. They were forced to abandon it to the Romans (238 B.C.), who gradually subdued the rebellious natives, and made it a province of the republic; but on three several occasions, formidable outbreaks required the presence of a consul with a large army to restore the authority of Rome. From this time it was held as a subject province, and on account of its value as the 'granary of Rome,' was carefully protected from invasion. It fell into the hands of the Vandals and other barbarians, and was recovered by the Eastern Empire in 534 A.D., but was finally separated from the Roman Empire by the Saracens. They were driven out in their turn by the Pisans, one of whose deputy-governors, being supported by the Genoese, obtained the erection of S. into a kingdom (1154) by Frederick I.

The popes, who had long claimed a right of suzerainty over the island, gave it, in 1296 to James II. of Aragon; and it continued in the possession of Spain till 1708, when it was taken possession of by the British, and by the peace of Utrecht (1713) it was yielded to Austria. In 1730, Austria gave it to the Duke of Savoy in exchange for Sicily, and it has since that time formed a part of the dominions of the House of Savoy. When S. came to the House of Savoy, two-thirds of it belonged to barons of Spanish descent, and the most of the remainder to the clergy, who also levied a tithe on the whole produce, and for a century afterwards, it was shamefully neglected by the government. However, in 1836 and 1837, patrimonial rights and compulsory labor were abolished; and in 1838 and 1847, the peasants were freed from the rest of the vexatious imposts with which they were burdened. In 1847, the vice-royalty was abolished, and S. incorporated with the Sardinian kingdom (q. v.). Pop. of island (1881) 682,012. It is divided into two provinces, Cagliari in the south (area, 5326 sq. m.; pop. 421,085), and Sassari in the north (area, 4125 sq. m.; pop. 260,927). Cagliari is the capital of the whole island.

SARDO'NIC SMILE is a term applied by the older medical writers to a convulsive affection of the muscles of the face, somewhat resembling laughter. It may occur in tetanus or lock-jaw, and other convulsive affections, or may result from the action of certain vegetable poisons. The name is from a ranunculus termed *Herba Sardonica*.

SARDOU, VICTORIEN, a prolific, brilliant, and successful French dramatist, born at Paris, 7th Sept. 1831. He studied medicine, and produced his first comedy in 1854. This proved a total failure, and for a while S. was in the deepest poverty and distress. Having a few years after made a hit, he speedily became famous, and ten years later was a wealthy man. Of his innumerable pieces, *Monsieur Garat*, *Nos Intimes*, *Les Diables Noirs*, *Dora*, *Les Bourgeois de Pontarsy*, are among the best known. He became a member of the Academy in 1878.

SARGA'SSUM. See GULF-WEED.

SARI', the capital of the province of Mazanderan, Persia, is situated on the banks of a small stream, the Tejend, 18 miles south of the Caspian Sea. It is a modern town, built near the ruins of a very ancient one, and contains a pop. of about 25,000, who carry on a small trade with Russia, and with the interior of Persia. It stands in the midst of fine gardens.

SARK, one of the Channel Islands. See JERSEY.

SARMA'TIANS. The root *s-rm* in this word is in all probability the same as *s-rb*, so that it has been conjectured the name S. has the same ethnological meaning as *Serbi* and *Servi*. The oldest Greek form of the word (and the only one found in Herodotus is *Sauromatæ*. The region occupied by the S. embraced (according to Ptolemy, our chief authority) a portion both of Europe and Asia.—1. The *European S.* are found as far west as the Vistula; as far north as the Venedicus Sinus (Gulf of Riga?), or even further; as far east as the Crimea and the Don; and as far south as Dacia. Roughly speaking, their territory corresponded to modern Esthonia, Lithuania, Western Russia, and parts of Poland and Galicia. The principal, or at least the best-known nations among the European S., were the Peucini and Bastarnæ, about the mouths of the Danube, and in Moldavia and Bessarabia; the Jazyges and Roxolani, probably in Kherson, Tauris, and Ekaterinoslav; the Venedi and Gythones, about Riga, Memel, and Elbing; and the Avareni, at the sources of the Vistula.—2. *The Asiatic S.* are found as far west as the Tanais (Don), as far east as the Caspian, as far south as the Euxine and Caucasus, and as far north as the water-shed between the rivers that fall into the White Sea and the Black, but we have no distinct knowledge of their territorial possessions.

North of the Don, in the region now occupied by the Don Cossacks, dwelt the *Perierbidi;* south-east of it, about Astrakhan, the Jaxamatæ. Beyond the Perierbidi lay the Asæi, the 'horse-eating' (*Hippophagi*) Sarmatæ, the 'Royal' and Hyperborean Sarmatæ, and many others, besides a multitude of nations in the region of the Northern Caucasus. The question naturally arises: What were these Sarmatians? The vast extent of territory over which they spread, and the manifest inclusion under the name S. of different races, as, for example, Goths, Finns, Lithuanians, Circassians, Scythians, and Slaves, prove that the term was loosely used by Ptolemy and his contemporaries, just like the older Herodotean term Scythia, and is not strictly ethnological; yet Dr. Latham's view (see Smith's *Dictionary of Greek and Roman Geography*, arts. Sarmatia and Scythia), that it designated on the whole Slavic races, and in particular the north-eastern portion of the great Slavic family, may be regarded as tolerably certain. The S. figure prominently among the barbarians who vexed the north-eastern frontiers of the Roman Empire.

SA'RNO, a city of Southern Italy, in the province of Salerno, on the river of the same name, 13 miles north-west of Salerno. It is a well built town, with a very handsome cathedral containing some good paintings, and has a seminary for priests, a hospital, several paper-manufactories, and foundries. Its environs are famous for the produce of very fine silk. In the center of the town, there are springs of sulphureous and chalybeate waters. Among the buildings worthy of notice is the ancient castle of the Barberini family. Pop. 10,933.

In the plain near S., Teias, king of the Goths, in a desperate battle with the Greeks, commanded by Narses, in 553, was vanquished and slain, and the reign of the Goths in Italy brought to a close.

SARPI, PIETRO, better known by his monastic appellation, FRA PAOLO, or Brother Paul, was born at Venice, in the year 1552; became an early proficient in mathematics, as well as in general literature, resolved to embrace the monastic life, and in his 20th year took the vows in the religious order of the SERVITES (q. v.). Soon afterwards, he was appointed by the Duke of Mantua to a professorship of theology in that city; but he held it only for a short time; and returning to his order, of which he was elected provincial in his 27th year, he continued to pursue in private his studies in languages, in mathematics, in astronomy, and in all the other branches of natural philosophy, including the medical and physiological sciences, in which he attained to great proficiency, being by some writers regarded (although, as it would seem, without sufficient grounds) as entitled to at least a share in the glory of the discovery of the circulation of the blood. The freedom of some of his opinions led to his being charged at Rome with heterodox views, and although held free from actual heresy, his opinions became an object of suspicion; and in the dispute between the republic of Venice and Paul V. (q. v.) on the subject of clerical immunities, S. justified these suspicions by the energy with which he threw himself into the anti-papal party. On being summoned to Rome to account for his conduct, he refused to obey, and was accordingly excommunicated as being contumacious. The zeal of S.'s opposition to Rome drew upon him the hostility of the partisans of the Roman claim; and an attempt was even made upon his life by a band of assassins, whom the ardor of party-spirit at the time did not hesitate, although, upon mere presumption, to represent as emissaries of the Jesuits.

Fra Paolo himself openly professed to share this suspicion, and believing his life in danger, confined himself thenceforward within the enclosure of his monastery. It was in this retirement

that he composed his celebrated *History of the Council of Trent*, which has long been the subject of controversy and criticism. It was published in London by Antonio de Dominis, the ex-bishop of Spalatro, who had recently conformed to Protestantism, at first under the pseudonym of *Pietro Soave Polano*, an anagram of the real name of the author, *Paolo Sarpi Veneto;* and it almost immediately rose into popularity with the adversaries of Rome as well in England as throughout the continent. It is by no means a simple history of the proceedings of the Council, but rather a controversial narrative of the discussions, in which the writer freely enters into the merits of the doctrines under discussion, and in many cases displays a strong anti-Catholic bias. His judgment of the motives and of the conduct of the members of the Council, especially of the representatives of the pope and his partisans in the assembly, is uniformly hostile, and has been accepted by Protestants as a strong testimony against Rome from a member of the Roman Church. It must be confessed, however, that whatever judgment we may form of S.'s credibility on his own merits, it is idle to look upon him in the light of a member of the church of Rome. It is plain, from numberless declarations in his work, and from remains of his correspondence published after his death, that his opinions were strongly biassed, not merely with an anti-Roman, but even with rationalistic leanings; and Ranke does not hesitate to declare that his unsupported statements cannot be accepted with security, when there is question of a damaging narrative of some intrigue of the legates in the Council, or some cabal of the Italian bishops in the interest of Roman views. A voluminous counter-history of the Council of Trent was written by the Roman Jesuit (afterwards Cardinal) Pallavicino, which follows him into the details as well of the history as of the controversy.

It would be out of place here to enter into any comparison of these rival histories of the Council. The history of S. has been translated into most of the European languages. The French translation is by the celebrated Courrayer, and is enriched with copious vindicatory and critical annotations. S. lived in the full vigor of intellect to the age of 71, and died of a neglected cold, which led to a protracted illness, in the year 1623. His life, as an ecclesiastic, was without reproach; and his long-tried zeal in the cause of the republic had made him the idol of his fellow-citizens. He was honored accordingly by the republic with a public funeral. His *History of the Council of Trent* has been reprinted in numberless editions; and his collected works were published at Verona in 8 vols. 4to, 1761—1768, and again at Naples, in 24 vols. 8 vo, in 1790.

SARRACE'NIA or SIDE-SADDLE FLOWER, a genus of very singular marsh plants, natives of North America. *S. purpurea* is common from Hudson's Bay to Carolina; the other species are confined to the Southern States. They are herbaceous perennial plants, with radical leaves and scapes, which bear one or more

Sarracenia purpurea:
1, a flower, from which the corolla has fallen off, showing the very large 5-angled stigma; *a*, a fully expanded flower; *b*, germen; *c*, section of the fruit.

large flowers. The leaves are of very remarkable structure, the stalk being hollow and urn-shaped, and the blade of the leaf articulated at its apex, and fitting like a lid. It is from the form of the leaves that the name Side-saddle Flower is derived.—The genus is the type of the small natural order *Sarraceniaceæ*, the only other genus of which has been discovered in Guyana. The order is closely allied to *Papaveraceæ*.

SARREGUEMINES (Ger SAARGEMUND), formerly a frontier town in the N. of France, but since the war of 1870—71 in the possession of Germany, is in the province of Alsace-Lorraine, 41 m. E. of Metz. It is famous for its pottery; hempen fabrics and velvets are also made. Pop. (1880) 9573.

SARSAPARI'LLA, or SARSA. This much employed medicine is the produce of several species of *Smilax* (q. v.), although the species yielding the different kinds brought to the market have not yet been fully ascertained. Among them, the three

Sarsaparilla.

principal are believed to be *S. officinalis*, *S. medica*, and *S. papyracea;* twining shrubs, with prickly angular stems; the first with large ovate-oblong, acute, heart-shaped, leathery leaves; the second with shortly acuminate smooth leaves; the lower ones heart-shaped, the upper ones approaching to ovate; the third with membranous, oval-oblong, obtuse leaves. These shrubs are natives of warm parts of America; *S. officinalis* and *S. papyracea* being found in South America, and *S. medica* on the Mexican Andes. Some botanists regard them as mere varieties of one species.

The part of the plant used in medicine is the dried root, of which the following are the characters, as given in the British Pharmacopœia: 'Roots not thicker than a goose-quill, generally many feet in length, reddish-brown, covered with rootlets, and folded in bundles about eighteen inches long, scentless; taste mucilaginous, feebly bitterish, faintly acrid.' S. has been analyzed by various chemists, and appears to consist of volatile oil, most of which is expelled during the process of drying, of a white crystallizable neutral substance named *Smilacin*, whose composition is represented by the formula $C_{16}H_{13}O_6$, an acrid bitter resin, lignin, starch, and mucilage. S. is one of the class of medicines called Diaphoretics. The British Pharmacopœia contains three preparations of this drug—viz., the Decoction, the Compound Decoction (containing S., sassafras chips, guaiac wood-turnings, liquorice root, and mezereon), and the Liquid Extract. The cases in which they are serviceable are those of chronic rheumatism, secondary syphilitic affections, chronic skin diseases, &c. To be of any service, S. must be taken in considerable doses. The compound decoction, formerly known as the *Decoction of Sweet Woods*, is the best preparation, and should be taken in doses of four or six ounces three times a day.

The root of *S. aspera*, a native of the south of Europe, is used as a substitute for S., although of inferior quality, and is called Italian sarsaparilla.

The root of *Hemidesmus Indicus*, a climbing shrub of the natural order *Asclepiaceæ*, is used in India as a substitute for S., and is therefore called Indian sarsaparilla. The plant is common in all parts of India. The root has a peculiar aromatic odor and bitter taste. In consequence of the high price charged for genuine S., the root of *Hemidesmus Indicus*, or *Indian Sarsaparilla*, has been introduced into the British Pharmacopœia. The following are its characters: 'Yellowish-brown, cylindrical, tortuous, furrowed, and with annular cracks, having a fragrant odor, and a very agreeable flavor.' The only officinal preparation is the Syrup; but in India, where this root is highly esteemed as a diaphoretic and tonic, and is extensively used as a substitute for S., an Infusion, prepared by infusing two ounces of the root in a pint of boiling water, is generally employed, the dose being from two to four ounces three times a day. The syrup is chiefly used, in consequence of its pleasant flavor, as a vehicle for more active medicines.

In Germany, the roots of *Carex arenaria*, *C. disticha*, and *C. hirta* (see CAREX) are occasionally used as a substitute for S., under the name of German sarsaparilla.

SARTHE, an inland dep. of France, north of the Loire. Area, 2390 sq. m.; pop. (1881) 438,917. It is a country of plains, traversed by low hills and by undulations clothed with vines, of large picturesque forests, and of pleasant valleys. The soil is fertile, productive in grain and in clover; hemp is cultivated, and hempen fabrics largely manufactured. The wine produced is of a mediocre quality. The climate is healthy and temperate. Clover-seeds are exported to England and Holland, and swine and cattle

are reared in large numbers for the Paris and other markets. S. is divided into the four departments of Mans, La Flèche, Mamers and St. Calais. The capital is Le Mans. See MANS, LE.

SARTI, GIUSEPPE, one of the most skilful and learned musical composers of the 18th c., was born at Faenza in the Papal States in 1729. He studied under Padre Martini at Bologna; and in 1752 produced his first opera, *Il Re Pastore*, which was performed at Faenza with great success. He held for a time the office of *Hof Kapellmeister* at Copenhagen, but returned to Italy in 1765. In 1770, and the following years, he composed his principal operas, including *Le gelosie villane* and *Giulio Sabino*, the latter of which was enthusiastically received throughout Italy, and is highly praised by Dr. Burney. In 1779, he became *maestro di capella* of the Duomo at Milan, and gave himself to the composition of church music. In 1784, he went to St. Petersburg as music director of the court of the Empress Catharine, by whom he was treated with great liberality, and raised to the highest rank of nobility. He died at Berlin in 1802, on his way to Italy. His operas are thirty in number; but the composition by which he is now most known is his beautiful sacred terzett, *Amplius Lave Me*. S. was the musical instructor of Cherubini (q. v.).

SARTO, ANDREA DEL, one of the most famous painters of the Florentine school, was born at Florence in 1488. According to later writers, the family name was Vannucchi, and Andrea only received the name of *del Sarto* (the Tailor) from the occupation of his father; but this statement is probably erroneous. S. was a pupil of Piero di Cosimo, but formed his style mainly through study of the works of Masaccio, Domenico, Ghirlandajo, and Buonarotti. These artists inspired him with a love of fresco-painting, in which he achieved great distinction.

During 1509—1514, he executed a series of representations from the life of St. Filippo Benizzi, in the porch of the Annunziata at Florence; and in these the characteristics of his genius—dignity of composition, purity of form, freshness of color, and grace of expression—are seen at their best. In 1514 he commenced a series of frescoes from the life of John the Baptist, which were not finished, however, till 12 years afterwards. The finest works, of what may be called his middle period, are the 'Madonna di San Francesco' and the 'Contending Theologians,' both in the Florentine galleries. In 1518, Francis I. invited S. to Paris, where he painted, among other things, the picture of 'Charity' in the Louvre; but at the solicitations of his wife, he returned to Florence, where he died in 1530. To the later years of his life, which were neither happy nor honorable, belong his 'Piety,' his most celebrated fresco the 'Madonna del Sacco' (in the Annuziata at Florence), the 'Madonna with Saints' (in the Berlin Museum), and the 'Sacrifice of Abraham' (in the Dresden Gallery). His largest fresco is the 'Lord's Supper,' in what was formerly the Abbey of San Salvi, near Florence.—See Reumont's *Andrea del Sarto* (Leip. 1835).

SA'RUM, OLD, an extinct city and borough of England, was situated on a hill two miles to the north of Salisbury, in Wiltshire. It dated from the time of the Romans, by whom it was known as *Sorbiodunum*, and remained an important town under the Saxons. A Witenagemôte was held at O. S. in 960; and here William the Conqueror assembled all the barons of his kingdom in 1086. It was the seat of a bishop from the reign of William the Conqueror till 1220, when the cathedral was removed to New Sarum, now Salisbury (q. v.), and was followed by most of the inhabitants. In Henry VII.'s time it was almost wholly deserted, and has so continued till the present time. Some traces of walls and ramparts, and of its cathedral and castle, are still seen. Though without a single house or inhabitant, two members represented it in parliament, till, like many other rotten boroughs, it was disfranchised by the Reform bill of 1832. William Pitt, Earl of Chatham, first sat in parliament for O. S. in 1735.

SARVASTIVADAS, or SARVASTIVADINS (lit., those who maintain the reality of all existence), is the name of one of the four divisions of the *Vaibhashika* system of Buddhism; its reputed founder was *Rahula*, the son of *the* Buddha S'akyamuni.— See C. F. Koeppen, *Die Religion des Buddha*, (Berlin, 1857); and W. Wassiljew, *Der Buddhismus, seine Dogmen, Geschichte und Literatur* (St. Petersburg, 1860).

SARZA'NA, a city of northern Italy, in the province of Genoa, 8 miles east of Spezia. Its cathedral, built in 1200, is very rich in paintings and marbles. There is also an ancient fortress built by the Pisans in 1262. It is the birthplace of Pope Nicholas V. Pop. (1871) 5396.

S. is a very ancient city, founded 176 B.C. The adjacent city of Luni having been sacked and destroyed by the Vandals and by the Normans, its inhabitants abandoned it, and took refuge in S., to which place they removed the episcopal see in 1204. There are stills remains of the amphitheater of Luni.

SASH, in the British Army, is a military distinction worn on duty or parade by officers and non-commissioned officers. For the former, it is of crimson silk; for the latter, of crimson cotton. By officers it is worn over the left shoulder, and by non-commissioned officers it is worn over the right shoulder. There are no sashes in cavalry regiments.

SASH. The frames in which the glass of windows is inserted are called window-sashes. Common windows are usually made with an upper and lower sash, contrived so that, by means of cords or chains, pulleys, and balance-weights, they slide up and down in a wooden case.

SASIN. See ANTELOPE.

SA'SINE. (See INFEFTMENT.) The ceremony was as follows: the attorney of the party giving the right produced his warrant of title, and gave it to the bailie or representative of the other party, who gave it to the notary to be explained by the latter to witnesses, and then the first party delivered earth and ground, that is, part of the very soil, to the other in presence of the witnesses. The notary then drew up an instrument reciting what had been thus done, and which was signed by the notary and two witnesses. In England, *seisin* never had so narrow and technical a meaning as it had in Scotland.

SASKA'TCHEWAN, a large, important, and only recently-explored river of British North America, draws its waters from the Rocky Mountains, and is formed by two head-waters called the South Branch or Bow River, and the North Branch. The South Branch issues from a lake about four miles long, fed by a glacier descending from a magnificent *mer de glace*, and by a group of springs in the vicinity. A few yards north of this group of springs is another group, from which the North Branch takes its rise. The height above the sea is 6347 feet; the lat., 51° 40′ N.; the long., 117° 30′ W. The South Branch flows south-east to its junction with the Belly River in long., 111° 40′ W., then north-east to its junction with the North Branch in long., 105° W. Fed mainly from the same glacier that feeds the South Branch, the North Branch flows north past Mount Murchison, 15,789 feet above sea-level, and one of the highest peaks of the Rocky Mountains, north through Kutanie Plain, a fine prairie abounding in game, and then flows in a general eastern direction to its confluence with the South Branch. From long. 105° W., the river flows east, and falls into Lake Winnipeg. Length of main river, 200 miles; of north branch, over 550 miles. From its mouth it is navigable (on the north branch) about two-thirds of its entire length. It flows through a country rich in coal and iron, with a healthy climate, and comprising almost boundless plains suited to the cultivation of grain. At the sources of the S., there are several easily practicable routes across the Rocky Mountains, especially the Vermilion Pass.—*Journal of the Geographical Society for* 1860; Earl of Southesk's *Saskatchewan* (1875).

SA'SSAFRAS (*Sassafras*), a genus of trees or shrubs of the natural order *Lauraceæ*, having dicœcious flowers, a 6-parted membranous perianth, 9 stamens, a succulent fruit placed on the thick fleshy apex of the fruit-stalk, and surrounded by the unchanged perianth. The S.-tree (*S. officinale*) of North America, found from Canada to Florida, a mere bush in the north, but a tree of 50 feet in the south, has deciduous leaves, yellow flowers which appear before the leaves, and small dark-blue fruit. The wood is soft, light, coarse in fibre, dirty-white and reddish-brown, with a strong but agreeable smell, resembling that of fennel, and an aromatic, rather pungent and sweetish taste. The wood of the root possesses these properties in a higher degree than that of the stem, and the thick spongy bark of the root most of all. The wood is brought to market in the form of chips, but the bark of the root is preferred for medicinal use, is a powerful stimulant, sudorific, and diuretic, and is employed in cutaneous diseases, gout, rheumatism, and syphilis, generally in combination with other medicines. It contains a volatile oil, *Oil of S.*, which is often used instead. An agreeable beverage is made in North America by infusion of S. bark or S. wood; and a similar beverage was once very commonly sold at daybreak in the streets of London under the name of *Saloop*. A few saloop-venders are still to be seen plying their vocation. The leaves of S. contain so much mucilage that they are used for thickening soup—Another species of S. (*S. parthenoxylon*), possessing similar properties, is found in Sumatra.

SASSAFRAS NUTS. See PITCHURIM BEANS.

SASSA'NIDÆ, the dynasty which succeeded that of the Arsacidæ on the throne of Persia (q. v.), derived its name from Sassan, the grandfather of the newly-elected monarch ARDISHIR. The reign of the Sassanidæ is remarkable in the history of Persia, not for the extent of their sway, or the luxury and magnificence of their court, though in these respects they could vie with the Achæmenidæ at the epoch of their greatest power and splendor, but for the intense energy which they succeeded in infusing into the people at large. A comparatively small army of Greeks might and did successfully strive against the immense hordes of a Xerxes and a Darius; but the veterans of Rome could gain no

permanent laurels in a conflict with an equal force of Persians under the Sassanidæ. Ardishir made the desert of Khiva and the Tigris his boundaries, and resigned the throne to his son, SHAHPUR I. (SAPOR) (240—273 A.D.), who subdued Armenia, took Algezira (258) and Nisibis, totally routed the Romans at Edessa, taking prisoner the Emperor Valerian and the relics of his army, and overrunning Syria, Cappadocia, and other portions of Western Asia. This monarch paid as much attention to the prosperity of his subjects and the encouragement of the fine arts as he did to the extension of his power; but his enlightened plans were not carried out by his immediate successors.—NARSI (NARSES) (294—303) retook Armenia, and signally defeated the Romans under Galerius; but fortune deserted him in the following year (297).—His grandson, SHAHPUR II. (310—381), surnamed POSTHUMUS, an infant, succeeded, and Persia, during his minority, was much harassed by the Arabs, Romans, and Tartars; but Shahpur had no sooner taken in his hands the reins of government, than in return, he ravaged Yemen, punished the Tartars, and took the sole revenge at that time in his power against the Romans, by commencing a dreadful persecution of the Christians in his dominions.

A regular war speedily followed; the army of Constantius was routed at Singarah, and he was compelled to sue for peace. But the war continued, Constantius's successor, Julian, was defeated, and lost his life (363) near Ctesiphon, and the Romans were glad to conclude the humiliating peace of Dura. Armenia, Iberia, and the other Caucasian principalities were then reduced by Shahpur. The wholesome terror thus infused into the Romans effectually restrained them from aggressions for many years.—Among his successors were BAHARAM V. (420—448), surnamed GOUR, who recommenced hostilities with the Romans, the result being a partition of Armenia, and a truce for 100 years; and KOBAD (COBADES or CABADES) (488—498, 502—531), a wise and able monarch, who, on the Romans refusing any longer to pay the stipulated tribute, declared war against them, and defeated them in every engagement, concluding peace (505) on receiving 11,000 lbs. of gold. A second war, which commenced in 521, was from beginning to end in favor of the Persians, though the Romans at that time possessed a staff of generals unsurpassed at any previous epoch of their history. The war continued for some time after the accession of KHUSRU I. (q. v. (531—579), and was continued at intervals till nearly the conclusion of the century, when another great Persian conqueror, KHUSRU II. (q. v.) (591—628), ascended the throne; but the details of his annihilation of the Roman power in Asia, and the resistless march of Heraclius (q. v.), who again cooped up the Persians within the Tigris, and inflicted upon the S. a blow from which they never recovered, will be found under these names.—After four years of petty civil war, which wore out the remaining strength of the nation, YESDIGERD III. (632—651) was raised to the throne. The Arabs, who had already twice attacked Persia without success, made a third attempt in 639, and routed Yesdigerd's army at (Kudseah Cadesia) with immense loss.

Yesdigerd made another energetic attempt to rescue his kingdom; but the great battle of Nahavend, in which more than 100,000 Persians are said to have been slain, extinguished all hope of success; and the unfortunate monarch became a fugitive and a wanderer in Northern Khorassan till 651, when he was treacherously murdered.—Thus perished the dynasty which had pulled down the Romans from their proud pre-eminence among nations by the hands of a horde of robber-fanatics, under whose barbarous rule the extensive commercial prosperity and refined civilization which had been so carefully fostered for four centuries, were utterly swept away, leaving only such traces as ruined aqueducts, choked-up canals, and the still magnificent remains of almost forgotten cities.

SA'SSARI, a city in the north-west of the island of Sardinia, the chief town of the province of the same name, 8 miles from the shore of the Gulf of Asinara. It is a handsome and important archiepiscopal city, and has a vast cathedral, with many sculptures, one of which is by Canova; a university, founded in 1776; a college; and a rich library, with the MSS. of the Azuni. S. is a very busy town, and trades especially in grain, wine, fruits, wood, olive oil, and tobacco. Its harbor, Torres, is 10 miles north-west of S.; it is narrow and shallow, and does not admit large vessels. Pop. (1881) 31,596.

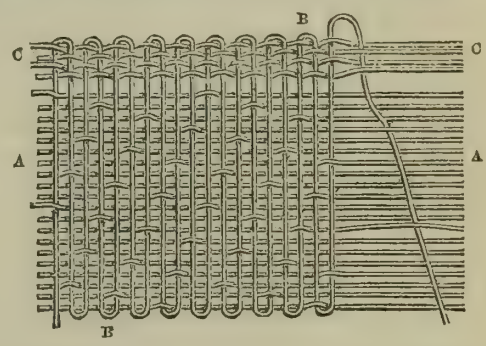
SATA'LIAH, another name of Adalia (q. v.).

SATAN. See DEVIL.

SÁTÁRÁ, generally spelled *Sattara*, a collectorate in the Southern Division of the province of Bombay, British India, is bounded on the N. by the state of Poona, and on the W. by the lofty ridge of the Western Ghauts. Area, 5371 sq. m.; pop. (1872) 1,052,853. SATARA, the capital, from which the state derives its name, one of the most salubrious and pleasant stations in the Deccan, 133 miles south-east of Bombay. Pop. (1872) 24,484.

SA'TELLITES (Lat. *satelles*, an attendant) are certain celestial bodies which attend upon and revolve round some of the planets as these latter revolve round the sun; and hence scientific men frequently apply to them the generic term, 'secondary planets.' The Earth, Mars, Jupiter, Saturn, Uranus, and Neptune, each possesses one or more of these attendants. The eclipses, inequalities, inclinations, and reciprocal attractions of the satellites, have been carefully noted from time to time, and the theory of their motions, at least of the most prominent of them, has been found to coincide with that of the moon. The satellites of Jupiter are invested with additional interest, from their eclipses having been the means of directing Römer to his great discovery of the successive propagation and velocity of light. On careful investigation, he found that the eclipses regularly happened 16′ 26″ earlier when the planet was in opposition (i. e., nearest the earth), than when it was in conjunction (i. e., furthest from the earth), a phenomenon which could only be accounted for by the supposition, that light requires 16′ 16″ to pass over a distance equal to the diameter of the Earth's orbit.

SATIN, a fabric in which so much of the weft is brought uppermost in the weaving as to give a more lustrous and unbroken surface to the cloth than is seen when the warp and weft cross each other more frequently; this will be better understood by reference to the figure than by any verbal description. A are the warp threads, of which only every tenth one is raised to allow



the shuttle to pass, but they are all raised in regular succession, so that the weaving is quite uniform throughout; B are the weft threads; and C is the selvedge, which is formed on each side of the piece of stuff by the regular method of plain-weaving, that is, by raising every other warp thread for the passage of the weft. The term satin is very rarely applied to any other than silk fabrics, woven as described; but there are woollen, linen, and cotton satins known in the markets.

SATIN-BIRD. See BOWER-BIRD.

SA'TINET, an inferior satin, woven much thinner than the ordinary kind. The term is also occasionally applied to a variety of cloth woven with cotton warp and woollen weft.

SATIN-WOOD, a beautiful ornamental wood obtained from both the West and East Indies. The former is the better kind, and is supposed to be the produce of a moderate-sized tree, *Ferolia Guianensis*, and probably other species, as there are several varieties of the wood. That from the East Indies is less white in color, and is produced by *Chloroxylon Swietenia*. Both are much used by cabinet-makers, and for marquetry, &c. The logs are usually only 6 or 7 inches square.

Chloroxylon Swietenia is a tree of the natural order *Cedrelaceæ*, growing on the mountains of the Circars in India, and in Ceylon. Sir James E. Tennent says that 'in point of size and durability, it is by far the first of the timber-trees of Ceylon. The richly-colored and feathery logs are used for cabinet-work, and the more ordinary for building purposes, every house in the eastern province being floored and timbered with satin-wood.'—Tennent's *Ceylon*.

SA'TIRE (Lat. *satira;* older form, *satura*), the name given by the Romans to a species of poetry of which they may be considered the inventors. The word *satura* (from the root *sat*, enough) is strictly and originally an adjective, meaning 'full' or 'filled;' but afterwards it came to possess also a substantive signification, and denoted a dish filled with a medley of ingredients, like the *Pot-pourri* (q. v.) of the French, or the *Olla Podrida* (q. v.) of the Spaniards. Hence, in its figurative application to a branch of literature, it throws a light on the primary character of that literature. The oldest Roman satire was a medley of scenic or dramatic improvisations expressed in varying metres (Livy, lib. 7, cap. 2), like the Fescennine Verses (q. v.); but the sharp banter and rude jocularity of these unwritten effusions bore little resemblance, either in form or spirit, to the earnest and acrimonious criticism that formed the essential characteristic of the later satire. The earliest—so far as we know—who wrote *saturæ*, were Ennius

(q. v.) and Pacuvius; but the metrical miscellanies of these authors were little more than serious and prosaic descriptions, or didactic homilies and dialogues. Lucilius (b. 148, d. 103 B.C), is universally admitted to be the first who handled men and manners in that peculiar style which has ever since been recognized as the satirical; and the particular glory of Lucilius, in a literary point of view, consists in this, that he was the creator of a special kind of poetry, which in all subsequent ages has been the terror and aversion of fools and knaves. The serious, and even saturnine gravity of the Roman mind must have readily disposed it to a censorious view of public and private vices.

After the death of Lucilius, satire, as well as other forms of literature, languished, nor do we meet with any satirist of note till the age of Horace (q. v.), whose writings are as a glass in which we behold mirrored the tastes and habits of the Augustan age. His satire, though sharp enough at times, is in the main humorous and playful. It is different when we come to Juvenal (q. v.)—a century later, when satire became a *sæva indignatio*, a savage onslaught on the tremendous vices of the capital. Persius (q. v.), who lived in the generation before Juvenal, is every way inferior, in force of genius, to the latter. After Juvenal, we have no professed satirist, but several writers, prose and poetic, in whom the satiric element is found, of whom Martial, the epigrammatist, is perhaps the most notable.

During the middle ages, the satirical element showed itself abundantly in the general literature of France, Italy, Germany, England, and Scotland. Men who have a claim to the character of satirists, *par excellence*, are Ulrich von Hutten, one of the authors of the *Epistolæ Obscurorum Virorum* (q. v.), Erasmus, (q. v.), Rabelais (q. v.), Sir David Lindsay (q. v.), George Buchanan (q. v.). In all of these writers, priests are the special objects of attack; their vices, their greed, their folly their ignorance, are lashed with a fierce rage. But it was in France that satire as a formal literary imitation of antiquity first appeared in modern times. Vauquelin (q. v.) may be considered the true founder of modern French satire. The satirical verses of Mottin, of Sigogne, and of Berthelot, of Mathurin Regnier, *L'Espadon Satirique* of Fourqueraux, and *Le Parnasse Satirique*, attributed to Théophile Viaud, are very impure in expression, and remind us that at this time a satire was understood to be an obscene work—the 17th c. scholars supposing that the name had something to do with Satyr, and that the style ought to be conformed to what might be thought appropriate to the lascivious deities of ancient Greece!

During the 17th and 18th centuries, both England and France produced professed satirists of the first order of merit, who have not been surpassed by the best either of their predecessors or successors. The names of Dryden (q. v.), Butler (q. v.), Pope (q. v.), and Churchill (q. v.) on this side of the Channel, of Boileau (q. v.) and Voltaire (q. v.) on the other, are too well known to require more than mention. Dr. Edward Young (q. v.) and Dr. Johnson (q. v.) have also made a name for themselves in this branch of literature. It may be noticed, however, as a distinguishing characteristic of Dryden, Boileau, Young, Pope, Churchill, and Johnson, and as a mark of the difference of the times in which they lived from those of the satirists of the Reformation, that it it is no longer the church that is assailed, but society, political opponents, literary rivals, &c.; the war is carried on, not so much against bad morals in the clergy, as against the common vices of men in general, or is even the expression of partisan hatreds. Swift (q. v.) and Arbuthnot (q. v.) are perhaps as great satirists as any of those we have mentioned.

Satire in the shape of political squibs, lampoons, &c., is very abundant in the 17th and 18th centuries. Butler's *Hudibras* is simply one long lampoon against the Puritans; most of the playwrights of the Restoration were royalist satirists—unscrupulous and indecent partisans. Dryden himself was but *facile princeps* of the herd. Andrew Marvell (q. v.) is the most famous name on the side of liberty. The *Beggars' Opera* of the poet Gay is a piece of very fine political satire. Gifford (q. v.) and Wolcot (q. v.), better known as Peter Pindar, also deserve mention in a historical point of view, though their intrinsic merits are small. Incomparably superior to all their contemporaries, and among the first order of satirists, are Robert Burns (q. v.) and Cowper (q. v.).—Meanwhile, in France, since Voltaire, no great name has appeared, except, perhaps, that of Béranger (q. v.), though the spirit of satire has pervaded most of the current literature, more particularly political literature, of which one of the latest expressions is the pamphlet published in 1865 by M. Rogeard against the system of government pursued by Napoleon III., and entitled *Les Propos de Labienus*. In Germany, the most conspicuous modern names are those of Hagedorn, Rabener, Sturz, Stolberg (q. v.), Kästner, Wieland (q. v.), Tieck (q. v.), and Goethe (q. v.), but none of these have adhered very strictly to the classic models of satire. Of 19th c. satirists in England, the best names are Byron (q. v.), the brothers Smith (q. v.), and Hood (q. v.) in poetry; and Hook (q. v.), Jerrold (q.v.), Thackeray (q. v.), and Carlyle (q. v.) in prose. To these may be added the name of the author of the *Biglow Papers*, James Russell Lowell.—See Sellar's *Roman Poets of the Republic* (2d ed. 1881); Browne's *History of Roman Classical Literature* (Lond. 1853); Thomson's *History of Roman Literature* (forming a volume of the *Encyclopædia Metropolitana*); Mommsen's *History of Rome;* Niebuhr's *Lectures on Roman History;* M. Viollet le Duc, article 'Satire' in the *Dictionnaire de la Conversation;* and James Hannay's *Satire and Satirists*.

SA'TRAP, in the ancient Persian monarchy, was the governor of a province, whose power—so long as he enjoyed the favor of the king—was almost absolute. He levied taxes at his pleasure, and could ape the tyranny of his great master without let or hindrance. When the monarchy of Cyrus began to decline, some of the satraps threw off their slight allegiance, and founded independent kingdoms or sultanates of their own, the most famous of which in ancient times was the Mithridatic kingdom of Pontus. See PONTUS and MITHRIDATES.

SA'TURN, an ancient Italian divinity, who presided over agriculture. His name, from the same root as *satum* (*sero*, to sow), indicates what was probably one of the earliest personifications in the Italian religion, S. being the god who blessed the labors of the sower. His identification with the Greek KRONOS by the later Græcizing myth-mongers is a peculiarly infelicitous blunder, and has led to more than ordinary confusion. The two have absolutely nothing in common except their antiquity. The Greek *Demeter* (Ceres), it has been observed, approaches far more closely to the Italian conception of the character of Saturn. The process of amalgamation in the case of Kronos and S. is visible enough. First, there is the Greek myth. Kronos, son of Uranos (Heaven) and Gæa (Earth), is there the youngest of the Titans. He married Rhea, by whom he had several children, all of whom he devoured at birth except the last, Zeus (Jupiter), whom his mother saved by a stratagem. The motive of Kronos for this horrible conduct was his hope of frustrating a prophecy which declared that his children would one day deprive him of his sovereignty, as he had done in the case of his father Uranos; but fate is stronger even than the gods, and when Zeus, had grown up, he began a great war against Kronos and the Titans, which lasted for ten years, and ended in the complete discomfiture of the latter, who were hurled down to Tartarus, and there imprisoned. So ran the common myth. But other myths added, that after his banishment from heaven, Kronos fled to Italy, where he was received hospitably by Janus, who shared his sovereignty with him. At this point the Greek myth coalesced with the Italian.

S., the old homely deity of the Latin husbandmen, was transformed into a divine king, who ruled the happy aborigines of the Italian peninsula with paternal mildness and beneficence, taught them agriculture and the usages of a simple and innocent civilization, and softened the primitive roughness of their manners. Hence the whole land received from him the name of *Saturnia*, or 'land of plenty.' His reign was that 'golden age,' of which later poets sang as the ideal of earthly happiness, and in memory of which the famous *Saturnalia* (q. v.) were thought to have been instituted. At the foot of the Capitoline, where the fugitive god had formed his first settlement, there stood in historical times a temple dedicated to his worship. Ancient artists represented him as an old man, with long, straight hair, the back of his head covered, his feet swathed in woollen ribbons, a pruning-knife or sickle-shaped harp in his hand. Other attributes, as the scythe, serpent, wings, &c., are of later invention.

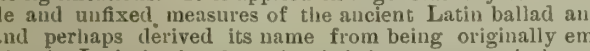
SATURN. See PLANETS.

SATURNA'LIA, an ancient Italian festival, instituted, according to the common belief of the ancients, in memory of the happy reign of Saturn (q. v.). Discarding all mythical explanations of the institution of the S. as simply incredible, and not worth the trouble of refutation, we may rationally conjecture that the S. was a rural festival of the old Italian husbandmen, commemorative of the ingathering of the harvest, and therefore of immemorial antiquity. It is not, we conceive, to be doubted for a moment that the untrammelled jollities of the S. were familiar to the farmers of Latium long before their homely national god, who blessed the labors of seedtime with abundant fruit, had been decorated with incongruous Hellenic honors, and transformed into a skyey Titan. Later ages may have introduced novel elements into the S. befitting the hybrid myth of king Saturn, but originally, no thoughtful investigator can doubt that the cessation from toil, and the wild self-abandoning mirth that marked the feast, were expressive of the laboring man's delight that the work of the year was over, and not of an artificial enthusiasm for a 'golden age' that never had been.

The great feature of the S., as we know the festival in historical times, was the temporary dissolution of the ordinary conditions of ancient society. The distinctions of rank disappeared or were reversed. Slaves were permitted to wear the *pileus*, or badge of freedom, and sat down to banquets in their master's clothes, while the latter waited on them at table. Crowds of people filled the streets, and roamed about the city in a peculiar dress, shout-

ing *Io Saturnalia;* sacrifices were offered with uncovered head; friends sent presents to each other; all business was suspended; the law-courts were closed; school-boys got a holiday; and no war could be begun. During the Republic, the S. proper occupied only one day—the 19th of December (xiv. Kal. Jan.). The reformation of the calendar by Julius Cæsar caused the festival to fall on the 17th (xvi. Kal. Jan.), a change which produced much confusion, in consequence of which the Emperor Augustus ordained that the S. should embrace the whole three days 17th, 18th, and 19th of December. Subsequently the number was extended to five, and even seven, though even in the times before the Empire, it would appear that the amusements often lasted for several days. But while the whole week was regarded in a general sense as devoted to the S., three distinct festivals were really celebrated—the S. proper; the *Opalia*, in honor of *Ops*, the wife of Saturn, and the goddess of field-labor (from *opus*, a work); and the *Sigillaria*, in which *sigilla*, or little earthenware figures, were exposed for sale, and purchased as children's toys. The modern Italian Carnival (q. v.) would seem to be only the old pagan S. baptized into Christianity.

SATU'RNIAN VERSE, the name given by the Romans to that species of verse in which their oldest poetical compositions, and more particularly the oldest national poetry, were composed. In the usage of the later poets and grammarians, the phrase has two different significations. It is applied in a general way to denote the rude and unfixed measures of the ancient Latin ballad and song, and perhaps derived its name from being originally employed by the Latin husbandmen in their harvest-songs in honor of the god Saturn (q. v.). In this sense, it simply means *old-fashioned*, and is not intended to determine the character of the metre. In is also applied to the measure used by Nævius, and a common opinion, sanctioned by the great name of Bentley, is, that it was a Greek metre introduced by him into Italy. But though the Saturnian verse is found among the measures employed by Archilochus, scholars generally incline to the opinion that this is an accidental coincidence, that the measure of Nævius is of Italian (Hermann even thinks of Etruscan) origin, and that it merely improved on the older ballad-metre—the primitive Saturnian verse. It continued in use down to the time of Ennius (q. v.), who introduced the Hexameter (q. v.). According to Hermann, the basis of the verse is contained in the following *schema :*



which, as Macaulay happily points out, corresponds exactly to the nursery rhyme,

The queén was in her párlor | éating bréad and hóney,

and is frequently found in the Spanish poem of the *Cid*, the *Nibelungen Lied*, and almost all specimens of early poetry; but in the treatment of it a wide and arbitrary freedom was taken by the old Roman poets, as is proved by the still extant fragments of Nævius, Livius Andronicus, Ennius, and of the old inscriptionary tables which the *triumphatores* set up in the Capitol, in remembrance of their glorious achievements.—See *History of Roman Literature*, by Thompson, Arnold, Newman, &c. (*Encyclopædia Metropolitana*, 1852); Browne's *History of Classical Roman Literature* (1853); Niebuhr's *History of Rome;* Preface to Macaulay's *Lays of Ancient Rome;* and Sellar's *Roman Poets of the Republic* (1863; new ed. 1881).

SATYRI'ASIS (see SATYRS) is the insanity, or the ungovernable sway of the lowest instincts and propensities, by which man becomes an animal in its savage and excited state. The ancients were acquainted with this loathsome form of alienation, in which man is the sport of foul and dangerous instincts, and recognizes no law or hindrance to the promptings of hunger, thirst, or lust. It still appears at puberty and in dotage, but is more rarely met with; and its disappearance may be hailed as significant of the predominance of the higher sentiments, or of the subjection of propensities to law, decency, and decorum.—Mason Good, *Study of Medicine*, vol. v. p. 124; Sauvages, vol. ii. p. 214.

SA'TYRS, in Greek Mythology, were a race of woodland deities, first mentioned by Hesiod, who designates them 'the race of worthless Satyrs unfit for work.' Subsequently, they figure in great numbers in the train of Dionysus (Bacchus)—their leader being that model of tipsy revelers, the never-sober Silenus! In appearance they were at once grotesque and repulsive, like all old woodland demons. They are described as robust in frame, with broad snub noses, large pointed ears like those of animals (whence they are sometimes called *theres*, 'wild beasts'), bristly and shaggy hair, rough skin, little horny knobs on their foreheads, and small tails. The S. are of course sensual in their inclinations, and ravishers of the woodland nymphs, fond of music, dancing, wine, and of the deep slumbers that follow a debauch. The Roman poets identified them with the *Fauni* of their own mythology, and gave them larger horns and those goats' feet with which they are so often represented. Ancient sculpture was fond of the Satyr as a 'subject'—one of the most famous specimens of ancient art being the Satyr of Praxiteles (q. v.).

SAUCES are preparations of various condiments, used for the purpose of giving piquancy and flavor to various kinds of food, chiefly animal. Sauces have been in use from the earliest times of culinary art. The ancients prided themselves much upon them, and used them almost wholly with fish. Sauces were used by the Greeks, but seemed to have arrived at the summit of their reputation in the time of the Roman Empire, when that called *garum*, made from a fish called *garon* by the Greeks, probably the anchovy, was considered one of the greatest luxuries of the table. Besides the garum, many other sauces were made of the tunny and other fishes. In modern times, we have sauces in great variety: there are those ready prepared, as Harvey's, Worcestershire, Yorkshire Relish, &c., the basis of which is Ketchup (q. v.), which of itself is one of the most extensively known sauces; and there are a large number prepared, when wanted, by the cook, to suit every kind of dish sent to the table. These usually consist of rich gravies, thickened with flour or other materials, and flavored with some suitable condiment. One of the reproaches of British cookery is the extensive use of a sauce called melted butter, which is usually little better than bill-stickers' paste, and which at the best is a little flour, water, and butter warmed together, and well mixed; and it is the habit to serve this to almost every kind of dish needing a sauce, whether animal or vegetable.

SAU'CISSON, or SAUSAGE, is a fascine of more than the usual strength; but the principal application of the term is to the apparatus for firing a military mine. This consists of a long bag or pipe of linen, cloth, or leather, from one inch to one and a half inch in diameter, and charged with gunpowder. One end is laid in the mine to be exploded; the other is conducted through the galleries to a place where the engineers can fire it in safety. The electric spark is now preferred to the saucisson. See BLASTING.

SAUER-KRAU'T, a preparation of the common white cabbage, well known and in extensive use in Germany and the north of Europe, where it supplies during the winter the place of fresh vegetables. The cabbages are gathered when they have formed firm white hearts; and these, sliced into thin shreds, are placed in a succession of thin layers in a cask, each layer being sprinkled with fine salt, to which some add juniper berries, cumin seed, caraway seeds, or other condiment. A board is then placed on the top, with a heavy weight, so as to press the whole down firmly, but gently. After a time, fermentation begins; and when a sour smell arises from the cask, it must be removed into a cool place, and kept for use. It is generally eaten boiled, in the same way as fresh cabbage.

SAU'GOR, a town of India, the chief town of a district in the Central Provinces, is situated in a hilly tract, on the Bees, or Bes, a feeder of the Jumna, in lat. 23° 50′ N., and long 78° 49′ E. S. is the seat of a military cantonment and of a collegiate school. The elevation is so considerable, that the climate is moderately cool; but the cantonment is unhappily in a swampy and unhealthy situation. Pop (1872) of town, 45,655; of dist., 527,725.

SAUL, the first king of Israel, was the son of Kish, a wealthy chief of the tribe of Benjamin. The circumstances that marked his election to the royal dignity are familiar to all the readers of Scripture, and need not be repeated here (see JEWS, SAMUEL). Gigantic in stature, noble in mien, and imperious in character, he appeared admirably fitted to accomplish the task of consolidating the dislocated tribes of Israel. His earlier achievements augured hopefully for his future. The deliverance of the men of Jabesh Gilead, above all, his victories over the Philistines, the Moabites, Ammonites, Edomites, and Amalekites, were unmistakable proofs of his vigorous military capacity, but gradually there showed itself in the nature of the man a wild perversity—'an evil spirit of God,' as it is called—culminating in paroxysms of insane rage, which led him to commit such frightful deeds as the massacre of the priests of Nob. Samuel, who had retired from the 'court' of S., and had secretly anointed David as king, did not cease to 'mourn' for the wayward monarch; but nothing availed to stay his downward career, not even the noble virtues of his son Jonathan; and at last he fell in a disastrous and bloody battle with the Philistines on Mount Gilboa.

SAUMAREZ, JAMES, BARON DE, a celebrated naval hero, was descended from an old French family, which had long been settled in Guernsey, and was born there, 11th March 1757. He entered the navy as midshipman at the age of thirteen, and served in the American war (1774—1782), receiving for his gallantry at the attack of Charleston (1775) the grade of lieutenant; but he was recalled before the end of this war, and placed under Sir Hyde Parker. He did good service in the action off the Dogger

Bank (August 1781), and was rewarded with promotion to the rank of commander, being soon afterwards placed under the orders of Admiral Kempenfeldt on the Jamaica station. At the great fight between Rodney and De Grasse (12th April 1782), S. commanded the *Russell*, a line-of-battle ship, and gained much distinction by his coolness and intrepidity throughout. For his gallant capture of the French frigate *La Reunion*, with one inferior in size and equipment, he received the honor of knighthood; and in command of the *Orion*, a seventy-four, he served under Lord Bridport at the battle of l'Orient, June 23, 1795. He also took a prominent part in the battle off Cape St. Vincent (February 14, 1797), and was second in command at the battle of the Nile, in which he was severely wounded. In 1801, he became a baronet, and vice-admiral of the blue; and in the same year fought his greatest action off Cadiz (July 12), defeating a French-Spanish fleet of 10 line-of-battle ships and 4 frigates, with a squadron less than half their strength, and causing to the enemy a loss of 3000 men and three ships. This contest, than which, according to Admiral Nelson, 'a greater was never fought,' gained for S. the Order of the Bath, the freedom of the city of London, and the thanks of parliament. In the Russian war, he commanded the Baltic fleet, and took or destroyed two large Russian flotillas (July 1809). In 1814, he became admiral, vice-admiral of Great Britain in 1821, was created a peer in 1831, and died at Guernsey, 9th October 1836. His life has been written by Sir John Ross (*Memoirs of Admiral Lord de Saumarez*, 2 vols., 1838).

SAUMUR, a town of France, on the left bank of the Loire, in the dep. of Maine-et-Loire; 28 miles south-east of Angers by railway. Bridges connect the town with a suburb on the right bank of the river. The river-side is lined with handsome quays, and there are good bridges and agreeable promenades. There is a great cavalry school, in which riding-masters for the army are trained. The hôtel de ville and the castle are prominent buildings. Rosaries of cocoa-nut shell and articles in enamel are manufactured. The trade of S. is in spirits, wines, hemp, and linen. Pop. (1876) 13,463.

S., formerly the capital of the province of Saumurois, was a stronghold of the Protestants during the reign of Henry IV., at which time it contained 25,000 inhabitants. Its prosperity was annihilated by the revocation of the Edict of Nantes, and its population reduced to a fourth. Perhaps the most striking event in the history of the town was its brilliant capture by Larochejaquelein, and the Vendeans, June 10, 1793. In this action, the victors, with but a slight loss, captured 60 cannon, 10,000 muskets, and 11,000 republicans.

SAUNDERSON, NICHOLAS, LL.D., a distinguished English scholar, was born at Thurleston in Yorkshire in 1682. He became blind from small-pox at the age of twelve months, but received a good education, including instruction in the classics, which was orally communicated. His strong predilection for mathematics becoming known to his friends, attempts were made with success to instruct him in arithmetic, geometry, and algebra, by means of ingenious mechanical contrivances which it is not necessary to describe. In 1707, he came to Christ's College, Oxford, as a teacher, and there delivered a series of lectures on the Newtonian philosophy, including (strange to say) a discussion of Newton's theory of optics. Four years afterwards, he succeeded Whiston as Lucasian professor, and died 19th April 1739. A valuable and elaborate treatise on Algebra, from his pen, was published in 1740 (2 vols., 8vo), and another on Fluxions, including a commentary on some parts of Newton's *Principia*, in 1756. The mental process by which he was enabled to understand the rules of perspective, the projections of the sphere, and some of the more recondite propositions of solid geometry, seems to have been peculiar to himself, and was almost wholly unintelligible to others.

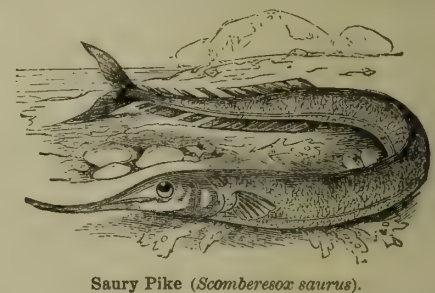
His sense of feeling was extremely acute; and he is said even to have been able to distinguish, by this sense alone, true Roman medals from counterfeits. He could judge fairly of the size of a room and of his position in it by the sound of his own footsteps, and could tell, in some inexplicable manner, when light clouds were passing across the sun's disc.

SAU'RIA, in the systems of Cuvier and other recent naturalists, an order of Reptiles (q. v.), having an elongated body, covered with scales or with bony plates; a more or less elongated tail; four limbs, or sometimes only two apparent, the rudimentary hind-limbs being concealed beneath the skin; the mouth always furnished with teeth; the ribs movable, rising and falling in respiration; the young issuing from the egg in a form similar to that of the mature animal.—To this order belong Crocodiles, Alligators, &c.; Chameleons, Geckos, Iguanas, Agamas, Varans, Teguixins, Lizards, Skinks, &c., numerous families, some of which contain many genera and species. Crocodiles and their allies, being covered with bony plates instead of overlapping scales, are by some naturalists removed from amongst the Saurians, and a place nearer to the Chelonians is assigned to them. In their general form and structure, however, they correspond with Saurians, and have no resemblance to Chelonians. The recent S. are far excelled in size and in variety of strange forms by the fossil S., as the *Plesiosaurus*, *Ichthyosaurus*, &c.

SAURIN, JACQUES, a celebrated French Protestant preacher, was born at Nîmes, 6th January 1677, studied at Geneva, and was chosen minister of a Walloon church in London in 1701. But the climate of England did not agree with his delicate health; and in 1705 he settled at the Hague, where his extraordinary gift of pulpit oratory was prodigiously admired, but not by his clerical brethren, who enviously assailed him with the accusation of heresy. The ground of their charge was that S. had attributed falsehood to God. Commenting in a thesis on the conduct of Samuel (1 Sam. chap. xvi.) when about to proceed to Bethlehem to anoint David, S. had pointed out that God certainly induced the prophet to adopt such measures and such language as could not but lead King Saul to believe what was not true. He argued, however, that the 'will of God' can never command what is criminal or wrong, and that this deception—this falsehood, as men would call it—was quite innocent and permissible. S.'s logic is not perhaps quite faultless, but he at least deserves credit for not denying the existence of a moral difficulty. The dispute was carried to the synod of Hague, and S. was subjected to a series of petty persecutions that shortened his days. He died at the Hague in 1730. As a preacher, S. has often been compared with Bossuet, whom he rivals in force, if not in grace and subtlety of religious sentiment. His chief productions are: *Sermons sur divers Textes de l'Ecriture Sainte* (La Haye, 1708—1725); *Nouveaux Sermons sur la Passion* (Rotterdam, 1732); *Discours sur les Evénements les plus mémorables du V. et du N. T.* (Amst. 1720—1728); *Abrégé de la Théologie et de la Morale Chrétiennes en Forme de Catéchisme* (Amst. 1722); and *Etat du Christianisme en France* (La Haye, 1725).

SAU'ROID FISHES, a name sometimes employed to designate fishes which approach in their structure to saurian reptiles. Of recent S. F., examples are found in Bony Pikes (q. v.) and Sturgeons (q. v.). Fossil S. F. are numerous, some of them of very large size. The teeth of *Megalichthys* are nearly four inches in length, far exceeding those of any existing fish and bony plates of the same fish have been found five inches in diameter.

SAU'RY PIKE (*Scomberesox*), a genus of fishes of the order *Pharyngognathi* and family *Scomberesocidæ*, having the body greatly elongated, and covered with minute scales; the head also much elongated, and the jaws produced into a long sharp beak, as in the Garfish (q. v.); from which, however, the present genus differs



Saury Pike (*Scomberesox saurus*).

in the division of the dorsal and anal fins into finlets, as in mackerels. One species (*S. saurus*) is common on the British coasts. It is about fifteen inches long, the back dark-blue, the under parts white; the fins dusky-brown. It approaches the coast, and enters firths in shoals, which are pursued by larger fishes, porpoises, &c.; and in order to escape from these, the S. P. often leaps out of the water, or rushes along the surface, for a distance of one hundred feet, scarcely dipping or seeming to touch the water. Hence the name SKIPPER, which it very commonly receives on the British coasts. Vast shoals sometimes enter bays, so that they may be taken by pailfuls, and great numbers are sometimes found among the sludge at the ebbing of the tide, in the upper parts of the Firth of Forth and elsewhere. The flesh of the S. P. is palatable.

SAU'SAGE, a well-known preparation of the flesh of various animals for culinary purposes. It is made by chopping the raw meat very fine, adding salt and other flavoring materials, and often bread-crumbs also, the whole forming a pasty mass. This is pressed into portions of the intestines of the animal, previously thoroughly cleaned and properly prepared. Usually, a considerable length of the intestine is filled and divided into separate sausages, by constricting it with pieces of string, at short intervals. The sausages of Lucania were very celebrated amongst the Romans. They were made of fresh pork, and bacon chopped fine, with nuts of the stone-pine, and flavored with cumin seed, pepper, bay-leaves, various pot-herbs, and the sauce called garum. Italy

is still celebrated for its Bologna sausages, and with many people the smoked sausages of Germany are highly prized; but except when quite fresh, sausages cannot be recommended as wholesome food.

SAUSAGE-POISON. It is well known that sausages made or kept under certain unknown conditions are occasionally highly poisonous; and in Germany, where sausages form a staple article of diet, fatal cases of sausage-poisoning are by no means rare. The symptoms are slow in appearing, three or four days sometimes elapsing before they manifest themselves. The poison may be described as of the narcotico-irritant character, and is very dangerous. Dr. Taylor, in his *Medical Jurisprudence*, records the cases of three persons who died from the effects of liver-sausages which had been made from an apparently healthy pig, slaughtered only the week before. The inspection threw no light on the cause of death. This case differs from those commonly occurring in Germany in this respect, that here the sausages were fresh, while the sausages which have proved poisonous in Germany had always been made a long time. Dr. Kerner, a German physician, who has specially studied this subject, believes that the poison is an acid formed in consequence of a modified process of putrefaction; others regard it as an empyreumatic oil.

SAUSSURE, Horace Benedict de, a celebrated Swiss physicist and geologist, was born at Conches, near Geneva, 17th February 1740. His education was attended to with such success that, in 1762, young S. obtained the chair of Physics and Philosophy in the university of Geneva. In 1768, he commenced the famous series of journeys which were fraught with such important consequences to science and to his own reputation; and during the course of which he visited the Jura and Vosges Mountains, those of Germany, England, Italy, Switzerland, Sicily, and the adjacent isles; the extinct craters of Auvergne, &c,; and traversed the Alps no less than 14 times, crossing them by 8 different routes. He was the first 'traveler' who ever ascended to the summit of Mont Blanc; he camped for 17 days on the Col du Géant, and finished his Alpine achievements by the ascent of Monte Rosa in 1789. During this extensive course of travel, he made numerous observations on the minerals, physical features, botany, and meteorology of the mountain ranges he visited; and these observations were found, after having undergone a searching examination, to be as correct and valuable as they were numerous. In short, they put the science of geology for the first time on a basis of fact. The work in which they are found is entitled *Voyages dans les Alpes*, &c. (Neufchatel, Geneva, Paris, 1779—1796, 4 vols.), and is much admired for its accurate and splendid descriptions of Alpine scenery. His observations were not made without considerable preliminary labor, for he found it necessary to improve his thermometer, hygrometer, eudiometer, electrometer, anemometor, and to invent other two instruments—viz., the cyanometer and diaphanometer, before his investigations, which were conducted with much care and candor, produced satisfactory results.

In 1786, S. resigned his chair; and in 1798 was appointed Professor of Natural History in the Central School of the *department of Leman* (formed on the annexation of Geneva to France); but four years afterwards, he was struck with paralysis, and after a long period of suffering, died at Geneva, 22d January 1799. Besides the great work above mentioned, he wrote numerous others, the chief of which are : *Observations sur l'écorce des Feuilles et des Pétales* (1762); *De Præcipuis Errorum nostrorum Causis, ex Mentis Facultatibus Oriundis* (1762); *De Electricitate* (1766); *De Aqua* (1771); *Sur l'hygrometrie* (1783), which, according to Cuvier, is one of the most important contributions to science in the 18th c.; and in which S. set forth his discovery of the dilatation in bulk, and diminution in specific gravity, of air charged with moisture. His 'Description of the Alps,' a portion of his great work, was published separately in 1834, at Geneva and Paris.

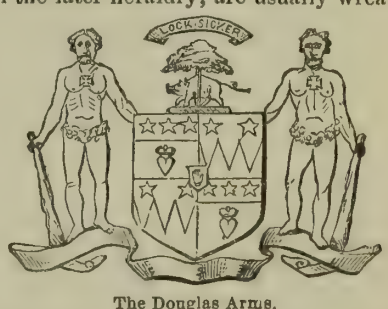
SAUTRANTIKA is the name of the second of the four great schools or systems of Buddhism, the three others being called *Vaibhâshika, Madhyamika*, and *Yogâchâra*. They recognize the authority of the *Sûtras* (q. v.), but reject that of the Abhidharma. —see C. F. Koeppen, *Die Religion des Buddha* (Berlin, 1857); and W. Wassiljew, *Der Buddhismus, seine Dogmen, Geschichte und Literatur* (St. Petersburg, 1860).

SAVAGE, Richard, an English poet, was born in London on 16th January 1696—1697. He was the fruit of an illicit intercourse between Lord Rivers and the Countess of Macclesfield, which resulted in the divorce of the lady, and the declared illegitimacy of her offspring. Lord Rivers, though permitting his name to be given to the child, seems not to have concerned himself further with him at all; and at the hands of his mother he met with only the grossest neglect. To the interference of *her* mother, Lady Mason, he was indebted for his education, received at the grammar-school of St. Albans. Afterwards, he was apprenticed to a shoemaker in Holborn, but an accident revealing to him the secret of his birth, he quitted this obscure handicraft. Repeatedly and in vain he appealed to the tender sympathies of his mother, who declined even to see him, and withheld all acknowledgment and assistance. Failing other means of subsistence, he turned his attention to literature, and at an early age produced several comedies, which met with but little success. Somewhat more fortunate was his tragedy of *Sir Thomas Overbury*, which, though indifferently received on the stage, with the author himself as actor of the leading part, obtained in print some approval, and put a little money in his purse. In 1727, he killed a man in a drunken tavern brawl—an offence for which he was tried, and sentenced to death. A pardon was, however, obtained for him on the intercession of the Countess of Hertford with the queen, and the details of his story becoming widely known, a strong feeling arose in his favor. Though his mother continued inexorable, and would, it was thought, have been well pleased to be rid of him by the hands of the hangman, certain of her relations interested themselves in him, and he was received into the household of Lord Tyrconnel, who allowed him £200 a year, and otherwise treated him with considerate generosity. His poem, *The Wanderer*, was now published; its success was great, and for a time the career of Savage was prosperous, and even brilliant. But it did not very long remain so. The inveterate irregularity of his habits involved him in difficulties with Lord Tyrconnel, and they parted with mutual recriminations. After this, he sunk irretrievably.

Though he failed in an attempt to obtain the post of poet-laureate, a poem which he wrote to commemorate her birthday so pleased the queen, that along with 'a permission to write annually on the same subject,' she conferred on him a pension of £50 a year. This sum, which might have been to him the basis of a modest subsistence, it was his regular habit to dissipate in a week's debauchery, passing the rest of his year in what disreputable fashion he could. On the failure of his pension by the death of the queen, a subscription was set on foot, mainly through the influence of Pope, with the view of sending him to live quietly at Swansea in Wales. Thither, accordingly, he retired; but happening to visit Bristol, where he lived in the reckless manner habitual to him, he was arrested for a debt of £8, and died in prison there, on the 31st July 1743.

The poetry of S., though a few vigorous lines of it continue to be remembered, is scarcely such as of itself would have sufficed for a permanent reputation. His most powerful and finished piece is *The Bastard*, in which, when he had finally broken with the relations of his mother, he held her up to public execration. Such celebrity as still attends his name he owes, however, almost entirely to the masterly life of him by Dr. Johnson, who, in the time of his own early struggles, was thrown much into his society.

SA'VAGES, or WILD MEN, in Heraldry, are of frequent occurrence as supporters. They are represented naked, and also, particularly in the later heraldry, are usually wreathed about the



The Douglas Arms.

head and middle with laurel, and often furnished with a club in the exterior hand. Savages are especially prevalent in the heraldry of Scotland. In more than one of the Douglas seals of the first half of the 15th c., the shield is borne in one hand by a single savage, who acts as sole supporter.

SAVA'NNAH, a city and port of Georgia, U. S., on the right bank of the Savannah River, 18 miles from its mouth, 90 miles south-west of Charleston, lat 32° 5′ N., long. 81° 5′ W. It is built on a sandy plain, 40 feet above the river, with broad streets shaded by beautiful trees. Its chief edifices are the custom-house, city exchange, court-house, state arsenal, theater, St. Andrew's Hall, Oglethorpe Hall, market, hospitals, and asylums. In 1874, the exports valued 50,500,000 dollars, consisting of cotton, rice, lumber, &c. The cotton exported in 1875 was 610,903 bales. Vessels of upwards of 14 feet draught discharge and load three miles below the harbor. S. is surrounded by marshes and islands, and on the river side is defended by Forts Pulaski and Jackson. It was founded in 1733 by the English general Oglethorpe. In 1776, a British fleet attempting to take the town, was repulsed after a severe action; but it was taken in 1778, and held in 1789 against the combined French and American forces. In the war of Secession.

after many unsuccessful attacks by sea, it was taken by General Sherman in February 1865. Pop. (1870) 28,235; (1880) 30,681.

SAVANNAH, a river which forms the boundary between Georgia and South Carolina, U.S., rises in the Alleghanies, on the south-western border of North Carolina, and flows south-east to the Atlantic. Its length is 300 miles, navigable to Augusta.

SAVANNAHS (Span. *savana* or *sabana*), the name given by the early Spanish settlers to the great plains or prairies (q. v.) of the North American continent.

SAVARY, ANNE JEAN MARIE RENÉ, Duc de Rovigo, a French general and diplomatist, was born at Marcq, in Ardennes, 26th April 1774, entered the army as a volunteer in 1790, and served with distinction in the army of the Rhine. In 1797, he accompanied Desaix to Egypt as *chef d'escadron*, and remained under his command as long as that general lived. After the battle of Marengo (1800), Napoleon made him his aid-de-camp, and for several years employed him only in political affairs, for which he showed an admirable capacity. In 1803, he was made general of brigade; in 1804, as commandant of the troops stationed at Vincennes, he presided at the execution of the Duc d'Enghien, an event which he is believed to have unduly hastened; and in the Prusso-Russian Austrian wars of 1806—1808, he acquired high military reputation, his victory at Ostrolenka (February 16, 1807) being really a brilliant achievement. Created Duke of Rovigo in the beginning of the following year, he was sent to Spain by the emperor, and negotiated the perfidious arrangement by which the Spanish king and his son were kidnapped. In 1810, he replaced Fouché as Minister of Police. After the fall of Napoleon, to whom he had always been passionately, and, we may add, unscrupulously devoted, he wished to accompany him to St. Helena; but he was confined by the British government at Malta for seven months, when he succeeded in making his escape, and getting on board a ship, was landed at Smyrna.

After experiencing several vicissitudes, he returned to Paris in 1818, and was reinstated in his titles and honors. In 1823, he removed to Rome; but at the close of 1831, he was appointed commander-in-chief of the army of Africa, and during his brief administration of affairs in Algeria, exhibited a splendid energy and generalship. But ill-health forced him to withdraw to France in March 1833, and on the 2d of June following, he died at Paris. S.'s *Mémoires* (Par. 8 vols. 1828) are among the most curious and instructive documents relating to the period of the Empire.

SAVE, a river of the south of Austria, and an important affluent of the Danube, is formed by two upper waters, which rise in the extreme north-west of Carniola, and unite at Radmannsdorf 1560 feet above sea-level. The river then flows south-east through Carniola, passing Laibach (at which point it becomes navigable), and forming in part the boundary between Carniola and Styria, after which it enters and traverses Croatia; and at its confluence with the Unna, first touches the Turkish dominions, the northern boundary of which it continues to form throughout the remainder of its course to its junction with the Danube at Belgrade. Estimated length, 500 miles. Its principal affluents are the Laibach (200 miles long), Kulpa, Unna, Bosna, and Drina.

SA'VELOY, a kind of sausage common in the London shops; it only differs from pork sausages in being made of young *salted* pork, highly seasoned, and having a little saltpetre added to give the contents a red color.

SAVIGLIA'NO, a fortified town of N. Italy, province of Cuneo, 9 miles east of Saluzzo. It is situated on the Maira and the Grana, and is a handsome and clean town. Cloth and silk are extensively manufactured, and the country in the vicinity is productive in wines and grain. Cattle are reared in great numbers, and silk-worms are bred largely. Pop. of town (1871), 9544; of commune, 16,150.

SAVIGNY, FRIEDRICH KARL VON, an illustrious writer on Roman jurisprudence, descended from a French Calvinistic family, that had emigrated to Germany in 1622, to avoid religious persecution, was born at Frankfurt on the 21st February 1779. He studied at Marburg, and took his degree in 1800, after which he commenced a series of lectures on juridical subjects, which were attended by a numerous auditory. Struck, in his exposition of the Digest, with the divergence existing between the text and the commentaries on the theory of possession, he composed in 1803 his masterly treatise, *Das Recht des Besitzes*, in which the Roman law is disengaged from the extraneous elements introduced into it by Germanic law, common usage, and the misapprehensions of commentators. Its merit was quickly recognized, and S. received the most advantageous offers from different universities, which, however, he declined, in order to prosecute researches in the libraries of France and Germany, with a view to a historical development of the glosses of commentators. He was assisted in this laborious undertaking by his pupil, Jakob Grimm, and his young wife, a daughter of the poet Clem. Brentano, and Bettina von Arnim. Appointed Professor of Law at Landshut in 1808, he was called, two years afterwards, to Berlin, on the reorganization of the university, and there he continued to lecture with unbroken success for a period of 32 years, in the course of which he filled various important offices in the university and the state, and died 25th October 1861, at the age of 82.

S. is the virtual founder of the new historical school of writers upon jurisprudence, although it is but fair to admit that Hugo and Schlosser had preceded him in the same direction. The essential idea of this school is, that 'law' or 'right' is not an abstract and absolute rule, manifesting itself under the same forms in all countries, but that it is one of the forces of society, with which it changes, according to fixed laws of development that are beyond the caprices of the day. This idea, when worked out historically, has produced the most important and original results, and may even be said without exaggeration to have regenerated the science of jurisprudence. S.'s principal writings are: *Vom Berufe unserer Zeit für Gesetzgebung und Rechtswissenschaft* (Heidelb. 1815); *Geschichte des Römischen Rechts im Mittelalter* (6 vols. Heidelb. (1826—1831); *System des heutigen Römischen Rechts* 8 vols. Berl. 1840—1848); *Das Obligationenrecht* (1851—1853), and *Vermischte Schriften* (5 vols. Berl. 1850), a collection of essays which had originally appeared in the *Zeitschrift für Historische Rechtswissenschaft*, and elsewhere.

SA'VINE (*Juniperus Sabina*, see JUNIPER), a low, much-branched, and very widely-spreading shrub, with very small, imbricated, evergreen leaves, which grows on mountains in the south of Europe and the east. It bears small black berries, covered with a pale blue bloom. Its foliage has a strong, fetid, aromatic, penetrating odor, particularly when rubbed. Its exhalations cause headache. The part of the plant used in medicine is the tops of the branches, collected in spring, and dried. Their odor is strong, peculiar, and unpleasant, and their taste acrid, bitter, resinous, and disagreeable. The therapeutic properties of S. are due to the volatile oil which it contains. Two pounds of the tops yield about five ounces of this oil, which is limpid and nearly colorless, having the odor of the plant, and a hot acrid taste. Its composition is $C_{10}H_8$, being isomeric with oil of turpentine.

S. exerts a stimulating effect on the uterine organs, and is employed with much benefit in cases of amenorrhœa and chlorosis, depending upon want of tone in those parts. It is best given in the form of the oil, one or two minims of which may be prescribed in a pill, to be taken twice a day. This drug is often employed by the lower classes for the purpose of procuring abortion; but it ought to be generally known that if it is given in a sufficiently large dose to produce the desired effect, the life of the mother is placed in the greatest possible peril. If a poisonous dose has been given for this or any other object, emetics should first be employed to remove any of the drug that may remain in the stomach, after which opiates and demulcents should be prescribed, and a general cooling and lowering treatment adopted. S. in the form of ointment is much used as an external application, with the view of keeping up the discharge from a blistered surface. The ointment cannot, however, be kept long without losing its properties.

SAVINGS-BANKS. The application of the banking-system to the middle and humbler classes of society was commenced by individual exertions long before the legislature took cognizance of the matter. In 1799, the Rev. J. Smith, rector of Wendover in Bucks, as a means of inducing habits of prudence and frugality among his parishioners, offered, with two other inhabitants, to receive weekly any sum not less than twopence; and if the amount were not touched before the next following Christmas, to add one-third to it as a bonus or encouragement. In 1810, the Rev. H. Duncan established a Parish Bank Friendly Society at Ruthwell (Scotland), more resembling a modern savings-bank. A minute account of its organization and mode of operation drew so much attention to it, that, by the year 1817, there were 78 establishments resembling it in the United Kingdom.

The first savings-banks acts were passed in 1817, one for England and Wales, and one for Ireland. A fund, called the Fund for the Banks for Savings, was opened with the National Debt Commissioners; and into this fund were to be placed all savings-banks deposits as soon as they reached £50. On these sums the National Debt Commissioners gave £4, 11*s*. 3*d*. per cent. interest (3*d*. per cent. per diem). The managers of the savings-banks in most cases allowed the depositors 4 per cent., the difference being applied to the working expenses.

This, the fundamental statute on the subject, has been modified and extended in many ways since. In 1824, as it was found that the benefits of the savings-banks system were reaped by persons for whom it was not intended, an act was passed declaring that the deposits in the first year should not exceed £50; that those in subsequent years should not exceed £30; that no interest would be allowed on any excess beyond £200; and that no person would be allowed to make deposits at more than one savings-bank. In

1828, an act was passed to give greater security to the depositors. The rules drawn up by the trustees and managers of all savings-banks were to be submitted to a barrister appointed by the National Debt Commissioners, and without his approval no savings-bank could commence or continue operations. The justices of the peace had also a veto in the matter; and the clerk of the peace was to keep a certified copy of the approved rules and regulations. The trustees were to receive £3, 16*s.* 0½*d.* per cent. interest (2½*d.* per cent. per diem), and were to pay the depositors not exceeding £3, 8*s.* 5½*d.* interest (2½*d.* per cent. per diem). No depositor was to deposit more than £150; but compound interest might accumulate until the total reached £200. Friendly societies and charitable institutions were, however, permitted to invest to the amount of £300.

In 1833, an act was passed to enable savings-banks to manage the granting of small deferred annuities, to be paid for by weekly, monthly, quarterly, or yearly instalments. In 1835, another act extended the operation of the statutes of 1828 and 1833 to Scotland, and enabled existing savings-banks to conform to the stipulations without a necessity for reorganization.

In 1844, a new act made extensive changes in the savings-banks system, the chief items of which may thus be summarized: Interest allowed by the commissioners to trustees to be reduced to £3, 5*s.* 0*d.* per cent., and to depositors to £3, 0*s.* 10*d.* per cent. (2*d.* per diem); every depositor's book to be sent once a year to his savings-bank for examination; the extent of the liability of trustees, managers, actuaries, and cashiers exactly defined; arrangements for making deposits in trust for other persons; annuities under the act of 1833 not to exceed £30 for any one person, but separate annuities to that amount may be granted to a husband and wife; deposits made by a married woman may be returned to her, unless the husband give notice to the contrary; rules laid down concerning the inheritance of the deposits of intestate and illegitimate persons; payments to the relations of intestate depositors to be made to the next of kin according to the law of Scotland, if in that country. An act passed in 1848 placed a limit on the liability of trustees of savings-banks in Ireland. In 1853, an act placed the maximum and minimum of savings-banks annuities at £30 and £4 respectively; and allowed a husband and wife to purchase a joint annuity, although one of them may have already had an annuity of the full amount. Another act in 1860 authorized the National Debt Commissioners to invest the moneys received by them from savings-banks in any kind of stock, debenture, or other security that has received parliamentary sanction; and required them to make an annual return to parliament of all such transactions. The act of 1861, establishing Post-office savings-banks, contained provisions for the transfer of deposits from the one kind of savings-banks to the other. By another statute passed in 1863, the arrangements for deposits in the name of a minor are defined; the order of proceedings is settled whereby any savings-bank may be wound up and closed, and the claims of the depositors transferred to the Post-office savings-banks. Two more recent statutes will be noticed in the concluding paragraphs of this article.

From time to time, as the above-named statutes came into operation, the National Debt Commissioners have laid down rules for giving them practical effect, and the registrar of savings-banks has exercised the necessary supervision. The rules on the important subject of savings-banks annuities may be thus briefly noticed: The nominee's age must not be under 15; no annuity below £4, and the aggregate of annuities to any one person not to exceed £30; by purchasing two half-annuities instead of a whole one, the annuitant may receive his money in four quarterly sums; on the death of the annuitant, a sum equal to one-fourth part of the annuity will be paid to his or her next representative, if claimed within two years; if the purchaser of an annuity is unable to continue his instalment of payments, he may either receive back the whole of his money without interest, or may have an immediate or deferred annuity equivalent in amount to the moneys which he has paid; if the purchaser of a deferred life-annuity die before the annuity becomes due, the whole amount of his payments, but without interest, is paid to his family; an annuity is not transferable, except by a bankrupt to his creditors, from whom it will be purchased by the National Debt Commissioners at its proper value.

These institutions have wrought vast benefit, by inducing habits of economy among the working-classes. Let us compare two years thirty years apart, 1833 and 1863. On November 20, 1833, there were 484 savings-banks, holding balances belonging to 475,155 depositors; the sum in hand was £15,715,111, giving an average of more than £33 due and belonging to each depositor; these totals applied to England, Wales, and Ireland, but did not include Scotland. On November 20, 1863, there were savings-banks in the United Kingdom holding balances belonging to 1,555,089 individual depositors, charitable institutions, and friendly societies; the sum in hand (including interest) was £43,278,656, giving an average of about £28 due and belonging to each depositor. The charitable institutions and friendly societies which had accounts open with savings-banks were so large in number as 28,334, having deposits of about £100 each on an average. About 300,000 depositors had accounts open of less than £5 each. There were 6627 savings-banks annuities then in force, for an aggregate sum of £135,748 per annum; in other words, the annuities were more than £20 each on an average.

Just before the new Post-office savings-banks came into operation, there were 1,609,103 depositors in the old savings-banks; this number increased to 1,887,510 by March 31, 1864—showing that the new system has been a positive benefit to the old. In subsequent years, many of the old or trustee banks arranged for a transfer to the Postmaster-general. The report issued in 1879 tells us of 1,506,714 accounts open with the old banks, on which was due to depositors the aggregate sum of £43,797,804; the number of savings-banks under trustees at that date was 449. The different sections of the United Kingdom had contributed to the aggregate amount in the following proportions in 1878:

England and Wales	£35.324,689
Scotland	6.178.534
Ireland	2,219,596
Channel Islands	533.069
	£44,255,890

It would appear that the Post-office savings-banks are suitable for smaller deposits than the others, judging from the sums deposited since the two systems have been in operation together. That the changes have been in the increase of the Post-office banks, rather than in the decline of the trustee banks, is satisfactorily shown by a comparison of the deposits in each in 1864 with those in 1874.

	1864.	1874.	Increase.
Post-office banks..	£4,993,124	£23,157,469	£18,164,345
Trustee banks....	35.145.567	41,505.949	6,360,382
	£40,138,691	£64,663,418	£24,524,727

a total increase of £24,524,727 in ten years.

POST-OFFICE SAVINGS-BANKS.—Mr. Sikes, of the Huddersfield Banking Company, in a paper read before the Congress on Social Science, held at Bradford in 1859, advocated the establishment of savings-banks in connection with the money-order department of the General Post-office. The subject had more or less occupied the attention of public men since 1806, when Mr. Whitbread made a proposition relating to it; but Mr. Sikes's plan was so clear and detailed, that the postmaster-general took the matter up. An act of parliament was obtained in 1861. The Postmaster-general is to act in concurrence with the Treasury and the National Debt Commissioners. Deposits not less than one shilling in amount may be made at any of the money-order offices or at such offices as the Postmaster-general may appoint. Each depositor is provided with a deposit-book; each deposit is entered in this book, and is attested by the receiving-officer, and by the dated stamp of his office. The amount received is reported on the same day to the Postmaster-general. An acknowledgment of each deposit is transmitted to the depositor, and this is to be conclusive evidence of his claim to repayment with interest. The depositor is entitled to repayment of the whole or any part of the deposit, on making a demand in a prescribed form at *any* of the offices (not necessarily the one at which he made his deposits) within ten days at furthest after sending in the demand. The names of the depositors, and the amounts paid in and returned, are not to be disclosed except to the officials immediately concerned. All the moneys are paid into and received back from the National Debt Office, on the authority of the Postmaster-general. Interest at 2½ per cent. is allowed on all deposits as soon as they amount to £1, but none on fractional parts of £1. Facilities are supplied by means of certificates for transferring deposit accounts from ordinary savings-banks to Post-office savings-banks, or *vice versâ*. All expenses are refunded to the Post-office out of the deposit fund; and if there should be any deficiency, the Consolidated Fund is to bear it.

A detailed account of the proceedings is to be presented annually to parliament. The maximum sum deposited by any one person in one year is limited to £30. By the act promoted by Mr. Henry Fawcett, Postmaster-general in 1880, the business done by these banks has been vastly increased. Deposits of one shilling in the shape of twelve penny stamps on an official form are now received. The rate of interest is £2, 10*s.* per cent. per annum. Investments in Government stock and the purchase of annuities are transacted in the same way as in the trustee banks. See *The Post-office* and *Aids to Trift*, by H. Fawcett, to be had gratis at any post-office.

This new system commenced on September 16, 1861; and at the end of 1875 the total sum deposited, with interest, was £81,397,000, and the sum withdrawn, £56,210,000. At the end of 1879 the number of P. O. savings-banks in the United Kingdom was

6016, and the amount of deposits for that year was £9,887,109, making an average of £2, 19*s*. 1*d*. per deposit. The number of withdrawals was 1,418,543, amounting to £9,030,174; average of each withdrawal, £6, 7*s*. 4*d*. The interest amounted to £743,636, and the charges of management to £192,280, being 12*s*. per cent. on the capital. The total amount at the credit of depositors at the end of the year was £32,689,001. The total amount at the end of 1878 was £30,411,563; the number of banks, 5831. The average amount at the credit of each depositor was £16, 1*s*. 4*d*. The proportion of depositors to population in 1878 was 1 to 17, thus distributed: 1 to 14 in England, 1 to 70 in Scotland, and 1 to 79 in Ireland. Large numbers of provident and charitable societies, &c., deposit their funds in the Post-office savings-banks.

MILITARY AND NAVAL SAVINGS-BANKS.—In 1842, an act was passed for establishing military savings-banks in connection with the regimental pay departments. Another act was passed in 1859, affording greater facilities to the frugal soldier. The proceedings of these banks in the following years, present the following figures:

	Deposits in Year.	Withdrawals in Year.
1859	£70.736	£64.497
1860	163,491	116,393
1861	167,136	149,090
1879–80	224,814	238,302

The figures have fluctuated through causes not stated in the parliamentary returns, being about the same in 1871 as in 1861, after being much lower in some of the intervening years, and much higher in 1866. The number of accounts open in the latest years was 17,054, including those of many army charitable funds.

Concerning seamen's savings-banks, they mainly depend for their provisions on an act passed in 1856, which recognized the shipping-offices for seamen as branch savings-banks; and authorized the Board of Trade to lay down rules with respect to the persons entitled to become depositors, the making and withdrawal of deposits, &c. The operations of the seamen's savings-banks are far less extensive in amount than those of the military savings-banks. The deposits in the year 1879–80 were £96,052, and the withdrawals £116,669; number of accounts open, 10.979; the total investment is steadily growing, and with it the total interest receivable.

A few changes have been made by the legislature, some of which have tended to widen the area of their operations. An act was passed in 1866 (29 Vict. c. 5), authorizing the investment of a stated amount of savings-banks money in terminable annuities. It applied alike to trustee savings-banks and to Post-office savings-banks; and was supplemented by another act in 1869 (32 and 33 Vict. c. 59). By the act of 1880 (43 and 44 Vict. c. 36), while the rate of interest was reduced to £2, 15*s* per cent. per annum, facilities were given for the purchase of Government stock at current rates; the smallest amount for one investment being £10, and the largest not more than £100, per annum. It need hardly be said that this new feature has been largely taken advantage of.

AMERICAN SAVINGS-BANKS.—In the report for 1879–80, the Comptroller of the United States Currency states the total deposits in United States savings-banks at over £163,000,000, owned by 2,335,582 depositors; while the number of banks was about 660.

SAVO'NA, a maritime city of Northern Italy, in the province of Genoa, and 25 miles south-west of the city of that name. It is situated on a plain near the sea, and has numerous manufactures, including extensive potteries. The neighborhood produces olives, fruits, grain, wood, and wines. It carries on a brisk trade with Marseille. The harbor, one of the safest in the Mediterranean, was 25 to 30 feet deep, till the Genoese in the 16th c. filled it with stones; but since the opening of the Mont Cenis tunnel, which promises to increase the commerce of S., steps have been taken to have it cleared out. Pop. (1872) 19,664. The city is the third in importance on the Riviera. It is a very ancient city, and in the time of the Romans was called Sava, founded, according to tradition, by Janus. It flourished under the Roman empire, was destroyed by Rotharis (639), was rebuilt by Ludovic the Pious (981), and was afterwards laid waste by the Saracens.

SAVONAROLA, JEROME, the celebrated preacher and political as well as religious reformer of Florence, was born of a noble family at Ferrara, September 21, 1452. He was educated at home, and, at a very early age, became deeply versed both in the philosophy of the schools and in the old Greek philosophy, which at that time had become popular in Italy; but his disposition from the first was strongly tinged with religious asceticism, and, in 1474, he formally withdrew from secular affairs, and entered the Dominican order at Bologna. Having completed his novitiate, and the studies of the order, his first public appearance as a preacher seems to have been in 1482, at Florence, where he had entered the celebrated convent of his order, San Marco, and where he preached the Lent in that year. His first trial, however, was a signal failure. His voice was harsh and unmusical, and he so utterly failed to interest his hearers, that, after a time, the course of lectures was entirely deserted. Some time afterwards, S. was sent to a convent of his order at Brescia, where, by degrees, his earnestness and zeal began to attract notice, and eventually, the disadvantages of manner and address, which had told against the effect of his early efforts, either were overcome through practice, or ceased to be felt under the influence of his sterling genius and irresistible enthusiasm. In 1489, he was once more recalled to the convent of San Marco at Florence. His second appearance in the pulpit of San Marco was a complete success. The great subject of his declamation was the sinfulness and apostacy of the time; and in his denunciation of the vices and crimes of his age, he took as his theme what has been the topic of enthusiasts in almost every age, the mystical visions of the Apocalypse, which he applied with terrible directness to the actual evils with which, as with a moral deluge, the age was inundated; and in these half-expositions, half-prophetical outpourings, his followers claimed for him the character of an inspired prophet.

Under the rule of the great founder of the family of the Medici, Lorenzo the Magnificent, art, literature, and philosophy had all followed the common direction of that elegant but semi-pagan revival, which the scholars of the 15th c. had inaugurated; and the whole spirit of the social as well as intellectual movement of which Florence, under the Medici, was the center, was utterly at variance with the lofty Christian spirituality and severe asceticism in which S. placed the very first conditions of the restoration of true religion and morality. His preaching, therefore, in its spirit, as well as in its direct allusions, was no less antagonistic to the established system of the government, than to the worldly and irreligious manners of the age; the visions and predictions ascribed to him had quite as much of political applicability as of religious significance; and thus, to the aristocratic adherents of the Medici, S. early became an object of suspicion, if not of antipathy and dread. It is said by Pico de Mirandola, that he refused to grant absolution to Lorenzo, when the latter lay dying in 1492; but the statement does not accord with Poliziano's account of his patron's death. Through all this time, however, S.'s relations with the church were, if not of harmony, at least not of antagonism; and when, in the year 1493, a reform of the Dominican order in Tuscany was proposed under his auspices, it was approved by the pope, and S. was named the first general vicar. About this time, however, his preaching had assumed a directly political character, and the predictions and denunciations which formed the staple of his discourses, pointed plainly to a political revolution in Florence and in Italy, as the divinely ordained means for the regeneration of religion and morality. In one of his discourses, he pointed plainly to the advent of the French under Charles VIII.; and when this prediction was fulfilled by the triumphant appearance of the French expedition, S. was one of a deputation of Florentines to welcome Charles VIII. as the savior of Italy, and to invite him to Florence.

Very soon, however, the French were compelled to leave Florence, and a republic was established, of which S. became, although without political functions, the guiding and animating spirit, his party, who were popularly called *Piagnoni*, or 'Weepers,' from the penitential character which they professed, being completely in the ascendant. It was during this brief tenure of influence that S. displayed to the fullest extent, both the extraordinary powers of his genius, and the full extravagance of the theories to which his enthusiastic asceticism impelled him. The republic of Florence was to be the model of a Christian commonwealth, of which God Himself was the chief ruler, and His Gospel the sovereign law; and thus the most stringent enactments were made for the repression of vice, and of all the sinful follies by which it is fomented and maintained. All the haunts of debauchery were suppressed; gambling in all its forms was prohibited; the vanities of dress were restrained by sumptuary enactments; and, under the impulse of the popular enthusiasm which the enthusiasm of the prophet engendered, women flocked in troops to the public square to fling down their costliest ornaments; and gay gallants and grave scholars destroyed, in one common *auto da fé* before the gates of the cathedral, whole hecatombs of the amatory poetry or licentious fiction of the day, in conjunction with the elegant paganism or unconcealed immorality of the classic period. Meanwhile, the extremes of his rigorism; the violence of his denunciations, which did not spare even the pope himself; the assumption by him, or attribution to him, of a supernatural gift of prophecy; and the extravagant interpretation of the Scripture, and especially of the Apocalypse, by which he sought to maintain his views, drew upon him the displeasure of Rome. He was cited, in the year 1495, to answer a charge of heresy at Rome; and on his failing to appear, he was forbidden to preach; the brief by which the Florentine branch of his order had been made independent, was revoked; and he was again summoned to Rome. Once again

S. disregarded this order. But his domestic difficulties now began to deepen. The measures of the new republic proved impracticable.

The party of the Medici, called 'Arrabbiati' (Enraged), began to recover ground. A conspiracy for the recall of the exiled House was formed; and although, for the time, it failed of success, and six of the conspirators were condemned and executed, yet this very rigor served to hasten the reaction. The execution of these conspirators was a direct violation of one of S.'s own laws, and it tended to direct the popular sympathy in their favor. At the critical point of the struggle of parties came, in 1497, a sentence of excommunication from Rome against Savonarola. S. openly declared the censure invalid, because unjust, and refused to hold himself bound by it. In the following year, however, 1498, when the new elections took place, the party opposed to S., the Arrabbiati, came into power. He was ordered to desist from preaching; and the struggle was brought to a crisis by the counter denunciations of a preacher of the Franciscan order, long an antagonist of S., Francesco da Puglia. In the excited state of the popular mind thus produced, an appeal was made by both of the contending parties to the interposition of divine providence by the ordeal of fire. But at the moment when the trial was to have come off, difficulties were originated by the party of S., and nothing was actually done. The result of this was to destroy, with the populace, the prestige of S.'s reputation, and to produce a complete revulsion of public feeling. In the midst of this reaction, he was cited before the council, and brought to trial for misleading the people by false prophecies. He denied the charge; but being threatened with torture, he is said to have made a confession, which, however, his friends say was garbled, if not utterly falsified. He was declared guilty of heresy and of seditious teaching. The acts of the trial were sent to Rome, where the sentence was confirmed; and he, with two others of his order, were given up to the secular power.

An effort was made to procure a remission of the capital sentence which was passed upon them, but in vain; and on May 23, 1498, this extraordinary man, with his two companions, F. Domenico da Pescia and Silvestro Maruffi, were executed and their bodies burned by the executioner. They died professing their adherence to the Catholic Church, and humbly accepting the last absolution from the papal commissary; and it is still a question among Catholics, whether S. is to be regarded in the light of a confessor of the truth, or of a fanatical forerunner of the movement which so soon reached its full development in the Reformation. The works of S. are very numerous. They were all written either in Latin or in Italian, but have for the most part been translated into French, German, Spanish, and other languages. His works in Latin are: (1.) *On the Simplicity of the Human Soul;* (2.) *The Triumph of the Cross;* (3.) *A Dialogue of the Spirit and the Soul;* (4.) *A Fourfold Exposition of the Lord's Prayer;* (5.) *On the Perfection of the Spiritual Life.* Most of them were translated contemporaneously into Italian, and some even by S. himself. His principal Italian works are: *A Treatise on Humility, On the Love of Jesus Christ, On the State of Widowhood, Two Treatises on Prayer, Rules of Christian Living* (together with a work of a title almost the same which he wrote while in prison, and at the desire of his jailor), *On the Mysteries of the Mass,* and several other doctrinal and ascetical treatises. No collected edition of his sermons has been published, and his correspondence also has, for the most part, disappeared; but the works which survive sufficiently illustrate the peculiarities of his genius, and the stern and almost fierce enthusiasm which was the secret of his influence on that corrupted but yet cultivated age.—See Madden's *Life of Savonarola* (2 vols. 8vo, 1854); Abbé Carle's *Historie de S.* (Paris, 1842); and especially Villari's *Storia di S.* (Flor. 1859—1861). See also Mrs. Oliphant's *Makers of Florence* (1877).

SAVONE'TTES, soap of fine quality, perfumed and made into balls or other shapes, for use at the toilet.

SA'VORY (*Satureja*), a genus of plants of the natural order *Labiatæ*, nearly allied to Thyme (*Thymus*), and differing from it in the regularly 5-toothed or 5-cleft calyx, and the stamens bent together into an arch under the upper lip of the corolla. The species are herbaceous and half-shrubby plants, all natives of the South of Europe and the East. They have narrow, linear-lanceolate, entire leaves, with resinous dots, and short, axillary, little corycombs. The COMMON S., or SUMMER S. (*S. hortensis*), is commonly cultivated in kitchen-gardens for flavoring dishes. It is an annual plant, ½—1 foot high, with leaves not prickly pointed, and lilac or white flowers; has a strong and agreeable aromatic smell, and an aromatic pungent taste, and is in common use both fresh and dried for flavoring dishes, and especially for flavoring beans. It is stomachic and tonic.—WINTER S. (*S. montana*) is used exactly in the same way. It is a half shrubby plant, with thickly-pointed leaves and larger flowers. Its taste is pungently aromatic.—Summer S. is propagated by seed; winter S. by slips and cuttings.

SAVOY, a cultivated variety of CABBAGE (q. v.), forming a large close head like the true cabbages, but having wrinkled leaves. A number of sub-varieties are in cultivation. The mode of cultivation and the uses are the same as those of cabbage. Savoys are much cultivated for winter use; they require a light rich soil.

SAVOY, formerly a duchy belonging to the kingdom of Sardinia (q. v.), now incorporated with France, is bounded on the N. and E. by Switzerland, E. and S. by Piedmont, and W. by the French departments of Isère and Ain. While an Italian duchy, it was politically divided into seven provinces, a division which exhibited the successive steps of its acquisition by the House of Savoy; but since its annexation to France, this division has been modified, though the change has been little more than nominal. It is now separated into two departments: first, SAVOIE, or CHAMBÉRY, the southern part of S., with an area of 2220 sq. m., and a pop. of (1876) 268,361, which is divided into four arrondissements—Chambéry (old province of *Chambéry*), Albertville (*Alta-Savoia*), Moutiers (*Tarantasia*), and Saint Jean de Maurienne (*Maurienne*)—and has Chambéry for its capital; secondly, HAUTE-SAVOIE, or CONFLANS, the northern part of S., which has an area of 1660 sq. m., with a pop. of 273,801, and is divided into four arrondissements—Bonneville (*Fossigni* or *Faucigny*), Thonon (*Ciablese* or *Chablais*), Annecy and St. Julien (*Genevese*)—Annecy being the capital. The two departments resemble each other so much in all respects, that they may be described together.

S. is the most elevated tract in Europe, and is mostly covered with mountains, which break up the country into a number of valleys, each watered by its own snow-fed torrent or stream. The highest elevation of S. is the summit of Mont Blanc (q. v.), and the lowest is the bank of the Rhone at Saint-Genix d'Aosta, 670 feet above sea-level. The Graian Alps run along the eastern boundary of S., and form a natural barrier between it and Piedmont, several breaks or gorges affording means of communication between the two countries; from this range, the mountains gradually decrease in height towards the valley of the Rhone, which is on the western boundary.

S. (especially Haute-Savoie) is extremely picturesque, and within a comparatively limited space, exhibits at once the curious, the beautiful, the grand, and the wild and forbidding phases of natural scenery. There we have the lakes of Geneva, Annecy (9 miles by 1½), Aiguebellette, each perfect in its own style of beauty; the subterranean lakes of Bauge, the cascades of Sallanches and Bout-du-monde, the intermittent springs of Pigros and Haute-Combe, the grottoes of Balme, Bauge, and Sallanches, the hot springs of Aix-le-bains (near Chamberry), of Saint Gervais, Bride, Echaillon, and others; the smiling valleys of Chamberry, Faverage, Maglan, and Albertville; the glaciers of Chamounix, Buet, and Upper Tarantasia; the wooded mountain-sides of Ciablese, the bare rugged peaks which surround Mont Blanc, the frowning gorge of Challes, and the wild and savage glens and dells of Maurienne. Tourists consequently flock in great numbers to S., the robust to gratify their love of sight-seeing, and the invalids to benefit by the thermal springs, which are much esteemed.

The whole of the country is drained by streams which flow either into Lake Leman (the northern boundary) or the Rhone. Chief of the former is the Drance, which traverses Chablais; among the latter are the Arve, which drains the Chamounix valley, the Usses, the Fier, the Laisse, the Guier, and the Isère. The geology of S. is marked by the presence of three distinct ranges, exhibiting respectively the primary, transition, and secondary series of rocks with great completeness; and the depth of the crevasses, the height of the mountains, inversions of strata, débris on the mountain-sides, afford excellent opportunities for a thorough study of the constitution and elements of the earth's crust.

The whole of S. is broken up into a multitude of small estates, and the country is, as a consequence, most carefully cultivated, some of the fertile valleys resembling a continuous garden abounding in flowers and fruits. The ground suitable for cultivation being very limited, the enterprising natives have made extraordinary efforts to increase it by constructing line above line of parapets along the steep mountain-sides, and by filling in earth behind, forming long and narrow terraces, on which, if they can succeed in growing two rows of vines, they consider themselves well rewarded for their labor. These terraces are most common in the hilly districts of Tarantasia and Maurienne.

The climate of S. is in general cold, the winters are long and severe, and the summers frequently follow without an intermediate spring. Yet S. can boast of the vegetation of warm countries, as well as of that of higher latitudes; the vine is found growing almost to the edges of the glaciers, and cereals and fruits of various sorts are produced in great perfection. The pasturage is rich and abundant, and mulberry trees are largely planted. Although it is essentially an agricultural country, the industrial arts

are not unrepresented; fabrics of cotton, printed calico and gauze, stockings, felt-hats, woollen cloth, are manufactured in various localities; and tanneries, breweries, distilleries, glass-works, potteries, &c., are occasionally met with. The chief occupation, however, is the breeding of cattle, horses, and mules, all of which are much esteemed, and fetch good prices; and bees and silk-worms are tended as a source both of amusement and profit.

S. is rich in minerals—silver, iron, copper, antimony, manganese, lead, zinc, asphalt, marble, granite, gypsum, sulphur, and salt. The principal mines are the spathic iron-mine of Saint Georges d'Hurtieres, and the lead-mine of Macot. Coal is found in Maurienne.

The exports consist of the surplusage of these products, and also of cheese, hemp, silk both raw and spun, and wood of various sorts. S. is, with the exception of Bavaria, the only country of Europe in which advanced education is given gratuitously, there being within the country 14 colleges for this purpose. Ordinary education is also well provided for, as more than 1200 schools exist, nearly the whole of which are supported on old foundations.

The Savoyards are honest, intelligent, religious, hospitable, and enthusiastically patriotic, even to a greater extent than the Swiss. More than 20,000 of them expatriate themselves annually for the purpose of pursuing various callings, but the greater portion return early in summer, while others wait till they have amassed wealth sufficient for the rest of their lives.

SAVOY, HOUSE OF. The small territory of Savoy, formed a part of ancient Gaul, and after the decline of the Roman power, was seized by the Burgundians (407 A.D.), and along with Burgundy, passed under the Franks (534). On the breaking up of the Frankish empire, Savoy was joined to *Transjurane Burgundy*, and along with that kingdom was united to *Cisjurane Burgundy*, or Arles. On the accession of the last king of Arles to the imperial throne as Conrad II., the great lords of North-western Italy, such as the lords of Suza, Chablais, Maurienne, and Turin, became vassals direct of the empire. The counts of Maurienne, the ancestors of the House of S., are generally believed by most historians who have investigated their genealogy to have descended directly in the male line from a son of Wittekind the Great, the last independent king of the Saxons; and COUNT HUMBERT, *the White-handed*, was the first of the family who, by the addition of Chablais and Valais (grants from the Emperor Conrad the Salic) to his hereditary lordship of Maurienne, rose to high position among the princes of Northern Italy. One of his descendants, HUMBERT II. (1078—1103), succeeded to the marquisate of Suza (which included the greater part of Piedmont), and further increased his little territory by the conquest of Tarantasia. The family now commenced to form alliances with the royal Houses of France, Portugal England, Naples, Spain, and Germany, which added greatly to its political importance.

AMADEUS III. (1103—1149) received from the Emperor Henry V. the title of COUNT OF SAVOY (1111), and his grandson, THOMAS I. (1188—1233), obtained important accessions in Chambery, Turin, the country of Vaud, and many other lordships. Count Thomas was the initiator of the policy so long and successfully adopted by his successors, 'of preserving armed neutrality in all contests between France and the Empire, and of vigorously supporting the Empire against the papacy.' From this time, the counts of Savoy became the arbiters of all quarrels in North, and occasionally in South Italy, and their bravery in the field, and keen political sagacity,* increased at once their political influence and their territorial jurisdiction. After the death of Count Boniface in 1263, without heirs, his uncle PIETRO, the Earl of Richmond and lord of Essex, usurped the crown; but in 1285, the rightful heir, AMADEUS V. (1285—1323), the grandson of Pietro's elder brother, obtained the succession; and his grant to his brother THOMAS of the principality of Piedmont as a hereditary fief, founded the two lines of Savoy and Piedmont, which continued to rule over their respective territories till, on the latter becoming extinct in 1418, Piedmont reverted to the elder line. (See AMADEUS V., VI., and VIII.). Amadeus VIII. was the first DUKE OF SAVOY, being so created by the Emperor Sigismond in 1416. CHARLES I. (1482—1489) obtained from Charlotte of Lusignan, queen of Cyprus, the transference of her rights, and from this date (1485) the dukes of Savoy also claimed to be kings of Cyprus and Jerusalem.

The elder male line becoming extinct in 1496, the next collateral heirs were PHILIBERT II. (1496—1504) and Charles III. (1504—1553); but the latter, having sided with Charles V. against Francis I. of France, was deprived of the duchy of Savoy in 1533, the countries of Valais and Geneva placed themselves under the protection of Switzerland, and in 1536 the country of Vaud was seized by the people of Bern. But his son, PHILIBERT EMMANUEL, who was the Spanish governor in the Netherlands, succeeded, at the peace of Cateau-Cambresis (1559), in obtaining repossession of Savoy. It was this duke who attempted to convert the Vaudois (q. v.), and who founded the now important silk-production in Piedmont, besides, to the utmost of his power, encouraging the prosecution and development of other branches of industry. He re-annexed (1576) the principality of Oneille, and conquered the county of Tende. His successor, CHARLES EMMANUEL I. 1580—1630, was celebrated as a scholar, statesman, and warrior, but he was cursed with an inordinate ambition, which involved him in unfortunate contests with Geneva (a former town of Savoy, of which he wished to regain possession), with the French, who in revenge took possession of his dominions, and with the Spaniards. His two sons, VICTOR AMADEUS I. (q. v.) (1630—1637) and Thomas, were the respective founders of the two lines of Savoy and Savoy-Carignan. Victor Amadeus speedily regained the dominions which his father had lost; and with the consent of France, added to them Montferrat, Alba, and some other places, relinquishing Pignerol, La Perouse, Angrone, and Lucerne to the French. As generalissimo of the French army in Italy, he gained two victories over the Spaniards, but died soon after. His grandson, VICTOR AMADEUS II. (1675—1730), was one of the claimants for the Spanish throne on the extinction of the Spanish-Hapsburg dynasty (see SUCCESSION, WAR OF THE SPANISH); and by his adroit policy in the contest between the Hapsburgs and Bourbons for the possession of this crown, he succeeded in obtaining extensive additions to his little territory, the chief of these being Alessandria, Val-di-Sesia, and other portions of the Milanese, the island of Sicily in 1713, and along with this latter the title of king. He and his descendants were also recognized as the legitimate heirs of the Spanish throne, should the Bourbon dynasty ever become extinct. But in 1720 he was compelled to surrender Sicily to Austria, in exchange for the island of Sardinia, which, along with Savoy, Piedmont, and his other continental possessions, was then erected into the KINGDOM OF SARDINIA (q. v.).

SAVOY CONFERENCE, the name given to an ecclesiastical conference held in 1661 at the Savoy Palace (so called because built in 1245 by Peter, Earl of Savoy and Richmond [see AMADEUS]; burned by Wat Tyler in 1381, it was rebuilt and endowed in 1505 as an hospital for poor persons) between the Episcopalian and Presbyterian divines, with the view of ascertaining what concessions would satisfy the latter, and thereby lead to 'a perfect and entire unity and uniformity throughout the nation.' During the rule of the Protector Cromwell, the Church of England had been in a very anomalous condition. Most of the clergy who held office during the early period of the Civil Wars were strong royalists, and either were ejected or fled, when the cause of the parliament triumphed. Their places had been supplied in many cases by zealous Presbyterians—a rather numerous body in England at that time, and thus it happened at the restoration of Charles II. that a considerable section of the ministers *within the church* were hostile to the re-introduction of Episcopalian order and practice. Aware of this feeling, yet desirous of not adopting severe measures, if such could possibly be avoided, the king issued letters-patent dated 25th March appointing twelve bishops with nine clergymen as assistants on the side of the Episcopal Church, with an equal number of Presbyterian divines, 'to advise upon and review the *Book of Common Prayer*.' Among the Episcopalian commissioners were Frewen, Archbishop of York, Sheldon, Bishop of London, Gauden of Exeter, Reynolds of Norwich, &c.: among their assistants, Dr. Peter Heylin, Dr. John Pearson, and Dr. Thomas Pierce. The most notable representatives of the Presbyterian party were Richard Baxter, Dr. John Wallis (then Savilian Professor of Geometry at Oxford), Edmund Calamy, William Spurstow, and Matthew Newcomen. The Conference (which lasted four months) was opened on the 13th of April.

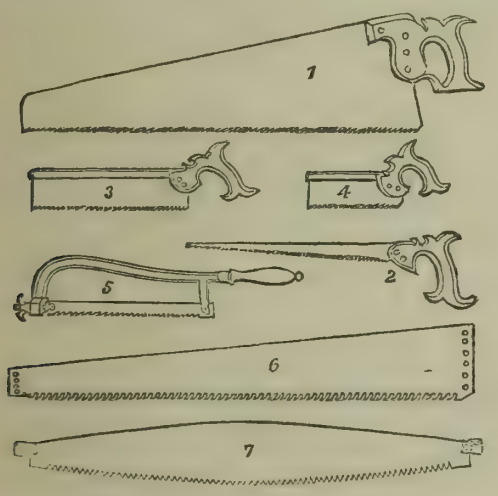
The Presbyterians (according to Burnett) demanded that Archbishop Usher's scheme of a 'reduced episcopacy,' in which the elements of the Scotch system of presbyteries, synods, and general assemblies were combined with distinctions of ecclesiastical ranks, should be made the basis to begin with; that responses should be given up; that the prayers in the Litany should be combined into one; that no lessons should be taken out of the Apocrypha; that the psalms read in the daily service should be according to the new translation; that the term regeneration (among others) should be struck out of the baptismal service; and that the use of the surplice, of the cross in baptism, of godfathers as sponsors, and of the holy days, should be abolished. They were told in reply that the commission had no authority to discuss questions affecting the government of the church, such as were contained in Archbishop Usher's scheme; whereupon they proceeded to consider the minor points, such as the alterations of the Liturgy. Baxter, with the consent of his party, drew up a 'Reformed Liturgy' which the Episcopalian commissioners would not look at, considering the wholesale rejection of the older one *ultra vires* on their part. Finally, the parties separated without

* It is a remarkable fact, in connection with the history of this family, that they have numbered among them more great warriors and politicians than any other royal House of Europe.

arriving at any conclusion; and this fruitless attempt at 'comprehension' was followed in 1662 by the famous 'Act of Uniformity,' the result of which was that 2000 clergymen were forced to abandon their livings in the Church of England.

SAVU' ISLANDS, The, lie in the Indian Ocean. Pop. 35,000. They are small, except Savu, in 121° 45′—122° 7′ E. long., and 10° 25′—10° 36′ S. lat.; area, 237 sq. miles. It is healthy, and moderately fertile, the thermometer ranging from 76° to 88° F. by day, and 68° to 70° by night. The products are those of the Archipelago, including tobacco and horses, but ships from Timor no longer call for horses. The five rajahs have relations with the Dutch Indian government, whose post-holder resides at Seba, the rajah of which possesses much influence, is a Christian, and has a missionary on the island. There is good anchorage at Seba. The Savunese are of Malay race—brave, and feared by their neighbors. Their religion is a traditionary heathenism, in which the offering of sacrifices of dogs is frequently practised.

SAW, one of the most important tools used in working timber. It usually consists of a long strip of thin steel, with one edge cut into a continuous series of sharp teeth. Notwithstanding the great simplicity of the principle upon which the saw is made, it admits of great variation, and modern carpentry has brought into use a great many kinds of saws adapted to different purposes. The most common is the *Hand-saw* (fig. 1), in general use. For this the blade is broader at one end than the other, and a wooden handle is fixed to the broader end, without which it could not be used. This kind of saw is varied by the manner in which the teeth are cut and set, and in the shape and width of the blade, as in *Compass* or *Key Saws* for cutting small holes (fig. 2). Other kinds of hand-



saws, such as the *Back-saw* (fig. 3) and the *Tenon-saw* (fig. 4), have straight blades, and the back is guarded and strengthened by a piece of brass or iron bent over it. The *Bow-saw* (fig. 5) is used for a variety of purposes; the blade, which is always thin, is stretched like a bowstring to an iron frame. The *Frame-saw* (fig. 6), chiefly used in sawpits and mills for cutting timber longitudinally, is similar in shape to the ordinary hand-saw, but much larger, with holes at each end, for fixing it in the frame by which it is moved up and down. For cutting timber transversely, the *Cross-cut-saw* (fig. 7) is used; this differs not only in shape, but in

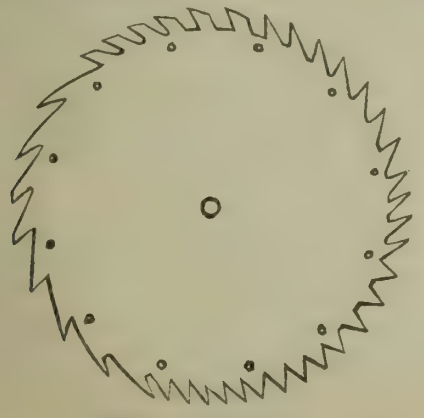


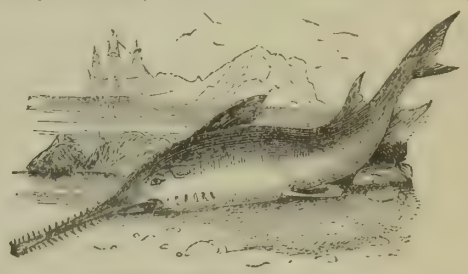
Fig. 8.—Circular-saw.

the set of the teeth from other saws. Within the present century, the *Circular-saw* (fig. 8) has come into universal use wherever machinery can be had for working it. It is generally so fitted as to be worked under a flat bench, a part only of the blade projecting through a narrow slit cut in the top of the bench. It is made to revolve with great rapidity, and the wood resting on the bench is pushed against the saw in the direction it is intended to be cut. The rapidity with which wood is cut by the circular-saw is truly marvelous. To save space, several forms of teeth are shown in the figure, but each saw has but one kind. The *Ribbon-saw* is comparatively a new invention. It consists of a very long band—or web, as it is called—of steel, usually very narrow, and with finely-cut teeth. The two ends are joined together so as to form an endless band, which is passed over two revolving drums, one above, and the other below the working-bench, through holes in which the saw passes. With this work, the finest patterns in open work may be cut out with great ease and rapidity. Numerous other kinds of saws are in use, but these are the chief.

SAWDUST. The waste made by sawing timber, formerly of little or no use, has now become a material of some value in localities where it can be applied. Its most interesting application is one very recently patented by Messrs. Dale & Co., of Manchester, whereby it is converted into oxalic acid, and with so much success as to have nearly or altogether displaced every other method of making that chemical. The process is very simple. The sawdust is first saturated with a concentrated solution of soda and potash in the proportion of two of the former to one of the latter; it is then placed in shallow iron pans, under which flues run from a furnace, whereby the iron pans are made hot, and the saturated sawdust runs into a semi-fluid, pasty state. It is stirred about actively with rakes, so as to bring it all in contact with the heated surface of the iron, and to granulate it for the succeeding operations. It is next placed in similar pans, only slightly heated, by which it is dried. In this state it is oxalate of soda mixed with potash. It is then placed on the bed of a filter, and a solution of soda is allowed to percolate through it, which carries with it all the potash, leaving it tolerably pure oxalate of soda. It is then transferred to a tank, in which it is mingled with a thin milk of lime, by which it is decomposed, the lime combining with the acid to form oxalate of lime, and the soda being set free. Lastly, the oxalate of lime is put into a leaden cistern, and sulphuric acid is poured in; this takes up the lime, and sets free the oxalic acid, which readily crystallizes on the sides of the leaden cistern, or on pieces of wood placed on purpose. So rapid and cheap is this method, compared with that formerly in use, that several extensive manufactories for making oxalic acid in the old manner have been shut up, being unable to compete with the patent process.

Another interesting use of the sawdust of hard woods, such as rosewood, ebony, &c., is that recently made known in France under the name of *Boisdurci*. The various kinds of sawdust used are reduced to fine powder, and mixed with blood into a paste; other materials are doubtless added, for when pressed into moulds it is jet black, and receives the most beautiful impressions. Messrs. Latry, Senior, & Co. of Paris produce some very beautiful medallions and other small articles in this material.

SAWFISH (*Pristis*), a genus of cartilaginous fishes, constituting the family *Pristidæ*, which is ranked with the Rays (q. v.)



Sawfish (*Pristis antiquorum*).

although the elongated form of the body agrees rather with that of the sharks. In a number of anatomical characters, however, the sawfishes differ from sharks, and agree with rays, and conspicuously in the position of the gill-openings, which are not on the sides, as in sharks, but on the under-surface, as in rays. The mouth is on the under surface of the head, and is furnished with pavement-like teeth, adapted for crushing. But the S. is particularly remarkable for the elongation of the snout into a flat bony sword, armed on each edge with about twenty large bony spines or teeth; a most formidable weapon, of which it seems to make use for killing prey, rushing amongst shoals of fishes, and slaying them right and left. Whales are said to be sometimes killed by sawfishes, and the saw has been sometimes driven into the hull of a ship. There are six or seven known species of S., and they are distributed over the whole world. The Common S. (*P. antiquorum*) was known to the ancients, being found in the Mediter-

ranean. It is a very widely distributed fish, being found both in polar and tropical seas. It sometimes attains the length of eighteen feet, including the saw. Sawfishes are seldom seen near the shore, and no species is reckoned among British fishes.

SAWFLY (*Tenthredo*), a Linnæan genus of insects of the order *Hymenoptera*, now divided into many genera, and constituting a family of which the species are very numerous. They derive the name S. from the ovipositor of the females, which is, scaly, serrated, pointed, and enclosed in a sheath of two concave plates. By means of this instrument, the female S. perforates the stalks or other parts of plants, laying an egg in each hole. The hole soon becomes filled with a frothy liquid, and sometimes a gall-like swelling is formed, within which the larva resides.

Turnip Sawfly (*Athalia spinarum*), in its various stages of Transformation.

The larvæ of many sawflies, however, live in no such nests, but feed on foliage, like caterpillars, which they very much resemble. One of the most common species of gooseberry 'caterpillar' is the larva of a S. (*Nematus ribesii*). Sawflies have the abdomen cylindrical, and so united to the thorax that the distinction is not easily perceived. They vary much in the antennæ. Both pairs of wings are divided by nervures into numerous cells. Among the more notable species is the CORN S. (*Cephus pygmæus*), which, in its perfect state, abounds on umbelliferous flowers, a shining black insect, marked with yellow, the abdomen elongated. The larva consumes the inside of the straw of corn, and descending to the base of the straw, cuts it down level with the ground.—Another important species is the TURNIP S. (*Athalia spinarum*), reddish, spotted with black; the larva nearly black, and known by the names of *Black Jack* and *Nigger*. The Turnip S. is sometimes very troublesome and destructive for a year or two, and then almost completely disappears for a number of years. It has sometimes been very destructive to the turnip-crops of Britain.—The S. of the Pine (*Lophyrus pini*) is a common British species, and sometimes, although not very often, strips pine and fir trees of their leaves.

SAW-MILL. Within the present century, the art of working saws by machinery has been invented, and large mills for cutting up timber by means of large saws worked by machinery, are to be found in most civilized countries. They are worked both by steam and water-power, and in Holland, wind-mills are made to work sawing machinery. The arrangements of a saw-mill are very simple: they consist of a fixed horizontal frame, with rollers at short intervals, upon which the tree or log of timber is laid; at the end of this, another frame is placed in a vertical position; it contains as many saws placed side by side as it is proposed to cut planks out of the log, and they are set as far apart as the desired thickness of the planks or boards. A rapid up-and-down motion is given to these saws by the machinery, and at the same time the log is pulled forward on the rollers by the same power, so as to be kept constantly up to the saws. In this way, a large tree or log of wood may be cut into twenty planks in much less time than was formerly required by laborious hand-labor to cut one single thickness.

The circular-saw is also much used in mills for cutting planks and boards into pieces of almost any form.

SAXE, HERMANN MAURICE, COUNT OF, one of the greatest warriors of the 18th c., was the natural son of Augustus II. (q. v.), Elector of Saxony and king of Poland, and the Countess Aurora von Königsmark, and was born at Goslar, 28th October 1696. When only twelve years of age, he ran off from home, made his way to Flanders, joined the army of Marlborough, and took part in the capture of Lille and the siege of Tournay. With a boyish love of change, he joined the Russo-Polish army before Stralsund (1711), and after the taking of Riga, returned to Dresden, where his mother induced him, in 1714, to espouse a young and amiable German heiress. In the two following years, he took part in the civil war then raging in Poland; but having quarrelled with his father's favorite minister, he returned to Dresden, where the well-grounded jealousy of his wife made his life sufficiently disagreeable.

Obtaining the annulment of his marriage, and a pension from his father, he came to Paris in 1720, where he devoted himself for some years to the study of military tactics, and originated and developed an entirely novel system of manœuvres, which was highly spoken of by the Chevalier Folard, the celebrated military engineer. In 1726, he was elected Duke of Courland, and for a time maintained himself in his new possession against both Russians and Poles, but was compelled to retire to France in the following year. Joining the army on the Rhine, under the Duke of Berwick, he signalized himself at the siege of Philipsburg (1734), and decided the battle of Ettingen by a desperate charge at the head of a division of grenadiers. For these services, he was made a lieutenant-general in 1736; and on the breaking out of the war of the Austrian Succession, he obtained the command of the left wing of the army which was appointed to invade Bohemia, and took the strongly-fortified town of Prague by storm with marvelous celerity. The capture of Egra was similarly effected a few days afterwards, and the rest of the campaign showed that his abilities in the field were not inferior to his skill against fortifications. In 1744, he was made a marshal of France, and appointed to command the French army in Flanders, and on this occasion he gave decisive proofs of the soundness and superiority of his new system of tactics, by reducing to inaction an enemy much superior in number, and taking from him, almost before his face, various important fortresses. The following year was for him more glorious still; his army was reinforced, and though so ill with dropsy that he had to submit to tapping (15th April), he laid siege to Tournay on the 22d, and on the advance of the Duke of Cumberland to its relief, took up a position at Fontenoy, and awaited attack. He was assailed on the 11th May, and the desperate valor of the English for a time bore down everything before them; but S. sped about in his litter, encouraging his troops, and when the critical moment came, the fire of his artillery disorganized the English, and a charge of the French completed the victory.

Four months afterwards, every one of the numerous strong fortresses of Belgium was in his hands. In 1746, S., by a series of able manœuvres, threw back the allies on the right bank of the Maese, and gained (11th October) the brilliant victory of Raucoux, for which he was rewarded with the title of marshal-general, an honor which only Turenne had previously obtained. For the third time, at Laufeldt (2d July 1747), the victor of Culloden suffered complete defeat at the hands of S., whose favorite system of tactics was again brought into full play; and the brilliant capture of Bergen-opzoom brought the allies to think of peace.

The Dutch, however, were still disposed to hold out, till the capture of Maestricht (1748) destroyed their hopes, and the peace of Aix-la-Chapelle followed. S. had previously carried on a correspondence with the great Frederick of Prussia, and he now took occasion to visit him at Berlin, experiencing the most brilliant reception. In the following year, Frederick wrote to Voltaire: 'I have seen the hero of France, the Turenne of Louis XV.'s time. I have received much instruction from his discourse on the art of war. This general could teach all the generals in Europe.' S. lived at his estate of Chambord for some time afterwards, and died there of dropsy, 30th November 1750. His work on the art of war, entitled *Mes Rêveries*, was published at Paris in 1757.

S. was probably the greatest captain of his time, and a gallant and enterprising leader, but he was a mere soldier, and the offer of membership made to him by the Académie Française is sufficiently ridiculous. S. had, however, the good sense to decline the proffered honor, and he did so in a sentence, the extraordinary orthography of which accidentally rebuked, more than the most cutting sarcasm could have done, the mean sycophancy of the Académie. He wrote: 'Ils *veule* me *fere* de *la cademie; sela* m'*iret come* une *bage* a un *chais*.'

Many biographies of S. have been written, but few of them are to be much depended upon.—See *Moritz von Sachsen* (Dresden, 1863), by Karl von Weber; and the *Nouvelle Biographie Générale* (art. 'Saxe'). His character and genius are also well, though not flatteringly, portrayed in Carlyle's *Life of Frederick the Great*.

SAXE-A'LTENBURG, the smallest of the minor Saxon states, is a duchy bounded by Saxe-Weimar, Prussian Saxony, the kingdom of Saxony, Saxe-Meiningen, and Schwarzburg-Rudolstadt, and separated into two nearly equal parts by the interposed principality of Reuss-Gera. The eastern portion, or *circle of Altenburg*, from its being watered by the Pleisse, was formerly called *Pleissengau*. It contains 254 English sq. m., with a pop. (1871) of 94,502. The western part, or *circle of Saal-Eisenberg*, is watered by the Saale, with the Orla and Rode, and contains 256 English sq. m.; pop. (1871) 47,620. Total area, 510 sq. m., pop. (1871) 142,122; (1880) 155,036, nearly half of whom are inhabitants of towns. The vast bulk of the population (999 in 1000) are Prot-

estants, there being in 1872 only 193 Catholics, 16 Christian sectaries, and 10 Jews. The eastern portion is open, undulating, and very fertile, and agriculture has here attained considerable perfection, and is diligently pursued by a large proportion of the population, so that much more corn is produced than is necessary for home-consumption. The peasants in this circle, though speaking the Thuringian dialect, exhibit in their dress, manners, and customs a family resemblance to the Wendish-speaking Serbs of Lusatia; and numerous names of places, especially those ending in *itz*, indicate their Slavic origin. They are celebrated throughout Germany for their skill as agriculturists, and their superior intelligence, knowledge, and comparative wealth. The budget estimate of revenue for 1878–80 was £113,717; and the expenditure, including the duke's civil list of £22,900, to the same sum. The troops are, of course, under the command of the emperor of Germany.

S. is a limited monarchy, in accordance with the constitution of 29th April 1831, modified somewhat by the events of 1848—1849. By the law of 1870, the single chamber consists of 30 members, 9 representing the towns, 12 the country, and 9 the persons who pay most taxes. The government is in the hands of a ministry of three. As a member of the empire, S.-A. has one vote in the council, and one representative in the diet. Altenburg (q. v.) is the seat of government. See GERMANY.

SAXE-CO'BURG-GO'THA (in German, SACHSEN-KOBURG-GOTHA), the third in point of size and population of the minor Saxon states, is a duchy comprising the duchy of *Gotha*, lying between Prussia, Schwarzburg, Meiningen, and Weimar, and containing 542 English sq. m.; pop. (1871) 122,630; and the duchy of *Coburg*, 18 miles south of Gotha, lying between Meiningen and Bavaria, and containing 215 English sq. m.; pop. (1871) 51,709. Total area, 757 English sq. m.; pop. (1871) 174,339; (1880) 194,716. In 1871 there were 172,786 Protestants; 1263 Roman Catholics, and 210 Jews. Gotha lies on the north side of the Thuringer-wald, which extends along and within its southern frontier; but the rest of this duchy consists of low, undulating, and very fertile land, and is watered by the Werra, an affluent of the Weser, the Unstrut, a tributary of the Saale, and several smaller streams. Coburg lies on the southern slope of the same range, is watered by the Itz and Rodach, affluents of the Main, and has extensive forests, and many beautiful valleys between the spurs of the Thuringer-wald. Of the surface of the whole duchy, $\frac{5}{8}$ths is arable, $\frac{2}{8}$ths is wood, $\frac{1}{14}$th waste land, and the rest pasture and gardens. In the plains and valleys, the climate is mild and salubrious, but in the mountainous parts of Gotha it assumes a more inclement character. Agriculture is the principal occupation of the people, and is pursued with energy and skill; corn and flax being produced in abundance, as also potatoes, and various leguminous plants. The breeding of horses, cattle, and sheep is also successfully conducted. The mineral wealth includes coal (chiefly in Gotha), iron, cobalt, manganese; also marble, porcelain-earth, mill-stones, and salt. The manufactures are not of much importance, and are chiefly confined to Gotha. There is a large beet-sugar-factory at Gotha. The extensive forests of the duchy employ a large proportion of the population in the production of pitch, tar, and potash.

The duchy is a limited monarchy, in accordance with the fundamental law of 3d May 1852. Coburg and Gotha have each a *landtag*, or diet; that of the former consisting of 11, and of the latter of 19 deputies; besides which there is a common landtag for the whole state, composed of 7 of the Coburg, and 14 of the Gotha representatives, who are elected by their several diets. The particular diets for the two duchies are elected by the people at large. There are two ministers for carrying on the government—one for Coburg, and another for Gotha. As a member of the empire, S.-C.-G. has one vote in the federal council, and has the right to choose two deputies to the imperial diet. As in other German states, the troops are under the command of the emperor of Germany. Education is well diffused; and the higher education is cultivated by the several gymnasia and academies.

The finances of the two portions of the duchy are separately administered. For the period 1877–81, the estimated annual revenue of Coburg (both revenue from the crown domains and state revenue) was close on £66,000, the expenditure being £58-500. Of Gotha, the total annual revenue is given at £227.000, and the expenditure at £185,000. The joint debt of both in 1878 was £545,000, of which, however, a large portion is 'active capital.' The present ducal family is distinguished for the spirited and liberal character of its members, as well as for physical and mental gifts. It is allied with several of the royal families of Europe, the present duke's younger brother having been the late Prince Albert of Great Britain, and his uncle, Leopold I., the late king of the Belgians. The heir-apparent to the duchy is Alfred, Duke of Edinburgh, the second son of Queen Victoria of Great Britain. All the Saxon ruling families are descended from the Counts of Wettin, a place near Magdeburg. See GERMANY.

SAXE-MEI'NINGEN (also called SAXE-MEININGEN-HILDBURGHAUSEN), the second in size and population of the minor Saxon states, is a duchy, consisting of one large crescent-shaped territory, which lies immediately north of Bavaria and Coburg, with the horns of the crescent pointing northwards, and contains 862 English sq. m., and two small isolated territories, Kranichfeld and Kamburg. The area of the whole is 955 square miles, with a pop. in 1871 of 187,884; (1880) 207,075. In 1866, when other administrative changes and reforms were introduced, the territory, which till then had been divided into 11 administrative districts, was distributed into 4. Of the total population, 181,964 were, in 1871, Protestants; 1564 were Roman Catholics; 1625 were Jews; and 165 Christian sectaries of various kinds. The crescent is composed of the old duchy of Meiningen, the old duchy of Hildburghausen, and the principality of Saalfeld (both of which, along with Kamburg, were annexed to Meiningen in 1826). S. forms the south-west of Thuringia (q. v.), and is traversed in the east and north by the Thuringer-wald, offshoots from which also cover the west, while the Rhön-gebirge enters the country at the south-west. Its surface is thus necessarily hilly, in some places even mountainous, Kieferle in the Thuringer-wald being 2700 feet, and Geha-berg in the Rhön-gebirge, 2308 feet above sea-level; but between the mountain ridges are numerous fruitful valleys, and that of the Werra in particular is one of the most fertile and picturesque in Germany. The Werra, Saale, Milz, Steinach, Itz, &c., water the country. Two-fifths of the country is arable land; a nearly equal extent is under wood; and the rest is meadow, garden and vineyard, and waste. In the lower lands, agriculture is in an advanced condition, and is prosecuted with such vigor, that corn enough is produced for home-consumption; potatoes, hemp, flax, and tobacco are the other chief crops.

The mining industry of the east and north is considerable, employing recently about 550 men; and the important mineral products are iron, copper, cobalt, coal, porcelain-clay, sulphur, and salt from the works of Salzungen, Neusulza, and Friedrichshall. S.-M. is also an active manufacturing district, chiefly in woollen, cotton, and linen fabrics, and paper; and brewing, distilling, the making of glass and porcelain, and various other branches of industry, are prosecuted. The fabrication of wooden toys in the district around Sonneburg employs 2092 men, and the produce is bought up by the Sonneburg dealers for export. A rape-sugar factory is maintained. S.-M. is a limited monarchy in accordance with the fundamental law of 1829, and the laws of 1871 and 1873. The diet consists of 24 representatives—4 representing the more extensive landowners, 4 the persons who pay most taxes, and 16 being the deputies of the rest of the inhabitants. As a member of the empire, S.-M. has one vote in the federal council, and sends 2 deputies to the diet of the empire. The troops of S.-M. form part of the imperial army. The government is carried on by four ministers, each of whom heads a separate department. The budget for 1880—1882 gives as receipts £232,028 (of which £100.000 come from the domains); as expenditure, £206,155. In 1880 the net public debt amounted to £34.000. The late duke, Bernard-Erich-Freund, who reigned for 63 years spontaneously gave his subjects a liberal representative constitution in 1824. S.-M. had for some time the distinction of being the best-governed state in Germany. See GERMANY.

SAXE-WEI'MAR-EI'SENACH, the largest of the minor Saxon states, is a grand duchy, consisting of *Weimar*, which lies between Prussia, Altenburg, and Schwarzburg-Rudolstadt, and contains (inclusive of Allstädt, on the Unstrut, within Prussia, 45 English sq. m., and Ilmenau, in the south-east of Gotha, 32 English sq. m.) 683 English sq. m., with a pop. (1871) of 151,379; *Eisenach*, the western portion, which lies to the north of Meiningen and Bavaria, and contains (inclusive of Ostheim, in the Rhön-gebirge, in Bavaria, 23 English sq. m.) 471 English sq. m., with a pop. (1871) of 84,298; and *Neustadt*, which lies on the western boundary of the kingdom of Saxony, and contains 239 English sq. m., pop. (1871) 50,506; total area, 1403 English sq. m.; pop. 286,183, of whom 275,492 are Protestants, 9404 Roman Catholics, 53 Greek Catholics, 1120 Jews; the Jews and Catholics being chiefly in Eisenach. Pop (1880) 309,577. The Eisenach portion is traversed in the N. by the Thuringer-wald, and in the S. by the Rhön-gebirge, the intermediate districts being also hilly and undulating, and watered by the Werra and its feeders, the Fulda, Ulster, Suhl and Orsel. The Neustadt division is traversed from south-east to north-west by several offshoots of the Erz-gebirge, but most of the surface belongs to the plain of the Saale, and is watered by the Elster and Orla, affluents of that river. The Weimar portion is also partly hilly and uneven, and partly belongs to the plain of the Saale, which, with its tributary, the Ilm, traverses it. The highest peak in the grand duchy is Hinkelhahn (2694 feet), in the detached territory of Ilmenau. The climate is somewhat inclement in the high lands, more temperate in the plains, and particularly pleasant along the valley of the Saale. Of the whole surface, about $\frac{3}{5}$ths is arable, $\frac{3}{11}$ths is forest, and

the rest is meadow-lands, gardens, and vineyards. Agriculture is in an advanced condition, and is diligently prosecuted, there being frequently a surplus of grain over and above that required for home-consumption, in spite of the occasional infertility of the soil; and potatoes, pulse, hemp, flax, hops, and (on the banks of the Saale) vines are also cultivated.

Horse and cattle breeding is a common pursuit in Neustadt and Eisenach, and sheep-breeding in Weimar, the sheep having the usual good reputation of the Saxon breed. The mineral wealth comprises coal, iron, copper, cobalt, and marble. Eisenach is the chief seat of the manufacturing industry, with the exception of the woollen manufactures, which are principally carried on in Neustadt. The form of government is, according to the revised fundamental law of 15th October 1850, a limited monarchy; the diet, or landtag, is composed of 31 deputies, 1 representing the landed nobility, 4 chosen by landed proprietors with incomes under 1000 thalers, 5 by those who possess the same income from other sources, and 21 by universal suffrage. The government is administered by three heads of departments. As a member of the empire, S. has one voice in the federal council, and elects three deputies to the imperial diet. The troops of S. form part of one of the Thuringian regiments in the 11th *corps d'armée* of the empire. The budget for the financial period 1878—1880 shows annual receipts amounting to £338,340, and an annual expenditure of £536,884, leaving a small balance in favor of the exchequer. The public debt amounted in 1879 to a total of £368,600. The Grand-duke of Weimar is the chief of the Ernestine branch of the House of Saxony. The most celebrated of the Weimar family was Duke Karl-August, the Mæcenas of the art, literature, and science of Germany, who took the reins of government in 1775, and displayed extreme anxiety to favor the development of public prosperity and the progress of education. Under his fostering care, the university of Jena became a focus of intellect and knowledge to Germany; and the presence of Herder, Goethe, Schiller, and others at his court, well entitled it to be denominated the abode of the muses. He also elevated the theatre of Weimar to its present position as the chief German school of dramatic art. In 1806, he joined the Confederation of the Rhine with the title of duke, and received from the Congress of Vienna an accession of territory, and the title of grand duke. In 1816, he granted a liberal representative constitution to his subjects, expressly guaranteeing the liberty of the press, and died 14th June 1828. His successors have followed in his footsteps. See GERMANY.

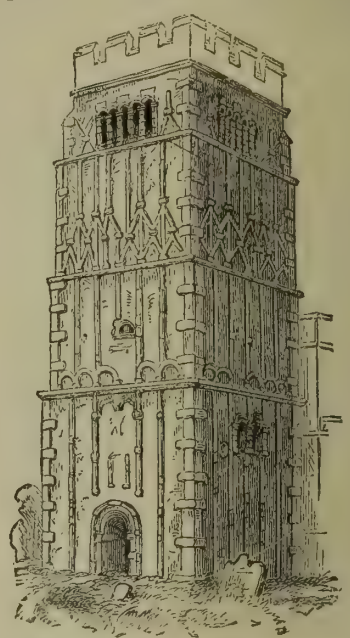
SA'XIFRAGE (*Saxifraga*), a genus of plants of the natural order *Saxifrageæ* or *Saxifragaceæ*. This order has a calyx, usually, of five sepals more or less cohering at the base; a corolla usually of five perigynous petals, alternate with the sepals, rarely

Saxifrage (*S. stellaris*).

wanting; perigynous stamens; a hypogynous or perigynous disc; an ovary, usually of two carpels, cohering more or less by their face, but diverging at the apex; fruit generally a 1—2-celled capsule, the cells opening at the ventral suture, and often divaricating when ripe; the seeds usually minute and numerous. The order *Saxifrageæ* is sometimes regarded as including above 900 species divided into several suborders, which are elevated by some botanists into distinct orders—leaving, however, more than 300 species to the reduced order SAXIFRAGEÆ, which contains herbaceous plants, often growing in patches, with entire or divided alternate exstipulate leaves, natives chiefly of mountainous tracts in the northern hemisphere, and often found up to the limits of perpetual snow, some of them forming there a rich and beautiful turf, and adorning it with their very pleasing flowers. A considerable number are natives of Britain. Some of the genus *Saxifraga* are well known in gardens and are employed to cover rock-works, &c. *S. umbrosa*, London Pride, or None-so-pretty, is familiar in all cottage gardens. It is a native of the hills of Spain, and of the south and west of Ireland.

SAXO-GRAMMATICUS (i. e., Saxo the 'Grammarian' or 'Scholar'), the most celebrated of the early Danish chroniclers, flourished in the 12th c., and was secretary to Archbishop Absalom. He is said to have died at Koeskilde in 1204. S. undoubtedly formed his style on that of the later Roman historians, particularly Valerius Maximus, yet in his whole mode of representation, he belongs to the school of medieval chroniclers, although ranking first in that school. Erasmus half wondered at his elegance. Moreover, it adds mightily to our respect for S., that although a cleric, he did not in the very least degree allow himself to be swayed in his historical conceptions by the prejudices incident to his profession. His work is entitled *Historia Danica*, and consists of 16 books. The earlier portions are of course not very critical, but in regard to times near his own, S. is a most invaluable authority. According to his own statement, he derived his knowledge of the remoter period of Danish history—the 'Heroic Age' of the North—from old songs, Runic inscriptions, and the historical notices and traditions of the Icelanders; but he is not sharply critical in his treatment of the Danish sagas, although a rudimentary critical tendency is occasionally visible. The best edition of the *Historia Danica* is that undertaken by P. E. Müller, and finished by J. M. Velschov (Copen. 1839.) It is furnished with a complete critical apparatus. There are good translations from the original Latin into Danish.

SAXON ARCHITECTURE, the style of building used in England before the introduction of the Norman architecture at the Conquest. There are few specimens remaining which can be depended upon as genuine. The Saxons built chiefly in wood, and



Tower of Earl's Barton, Northamptonshire.
(From Parker's *Glossary of Architecture.*)

all their wooden edifices are now lost. It seems probable that a rude and simple style, not unlike Early Norman, was that used by the Saxons. There are several buildings in England which Mr. Rickman considers entitled to rank as Saxon. Amongst these, the Tower of Earl's Barton, Northamptonshire, is one of the best examples. The peculiar 'long and short' work of the quoins, the projecting fillets running up the face of the walls, and interlacing like wood-work, and the baluster-like shafts between the openings of the upper windows, are all characteristic of the style.

SA'XON LAND. See TRANSYLVANIA.

SAXON STATES, MINOR. The capitulation of Wittenberg, which followed the rout of Muhlberg (see SAXONY), and deprived John Frederick the Magnanimous of the electorate of Saxony, at the same time despoiled him of a large portion of the hereditary possessions of the Ernestine branch. The remainder, amounting —after the acquisition of Coburg, Altenburg, Eisenberg, &c., in 1554—to little more than one-fifth of the whole Saxon territory, was divided into two portions, *Saxe-Gotha* and *Saxe-Weimar*, the former falling to John Frederick II., and the latter to John William, the two sons of the deposed elector. Each of these portions was afterwards subdivided, the former into *Saxe-Coburg* and *Saxe-Eisenach*, and the latter (1573) into *Saxe-Weimar* and *Saxe Alten-*

burg. It would only bewilder the reader to attempt to follow the endless subdivisions and reunions that followed. Suffice it to say, that the gradual adoption of the law of primogeniture during the 18th c., and the extinction of various cadet branches, has left the four states of Saxe-Altenburg, Saxe-Coburg-Gotha, Saxe-Meiningen, and Saxe-Weimar-Eisenach, as described under their several names. Should the Albertine or Saxon-royal line become extinct, the Duke of Weimar succeeds to the throne; and failing his family, the lines of Saxe-Meiningen, Saxe-Altenburg, and Saxe-Coburg-Gotha obtain in this order the right of succession.

SAXON SWITZERLAND. See SAXONY.

SAXONS (Lat. *Saxones*, Ger. *Sachsen*), a German people, whose name is usually derived from an old German word *sahs*, meaning a 'knife,' are first mentioned by Ptolemy, who makes them inhabit a district south of the Cimbrian Peninsula. Towards the end of the 3d c., a 'Saxon League' or 'Confederation' makes its appearance in North-western Germany, to which belonged, besides S. proper, the Cherusci, the Angrivarii, and the largest part of the Chauci. In the times of the emperors Julian and Valentinian, S. and Franks invaded the Roman territory; but their piratical descents on the coasts of Britain and Gaul are far more famous. At what period these commenced, it is impossible to tell, but it is believed to have been much earlier than is commonly supposed. Recent investigations seem to prove that S. had established themselves in England long before the time of the mythical Hengist and Horsa (see ANGLO-SAXONS); and we know that as early as 287 A.D., Carausius, a Belgic admiral in the Roman service, made himself 'Augustus' in Britain by their help. They had firmly rooted themselves, at the beginning of the 5th c., in the present Normandy, where a tract of land was named after them, the *Limes Saxonicus*. They fought against Attila (q. v.) in the Catalaunian Plain, 451 A.D. They also obtained a footing at the mouth of the Loire; but all the S. who settled in France 'disappeared' before the Franks, i. e., were probably incorporated with their more powerful kinsmen of Southern Germany. At home, the S. (called *Alt Sachsen*, or 'Old Saxons,' to distinguish them from the emigrant hordes who found their way to England and France) enlarged, by conquest, their territory north and northwest as far as the North Sea, the Yssel, and the Rhine; south, as far as the Sieg, and nearly to the Eder; eastward, to the Weser and Werra, the Southern Harz, the Elbe, and the Lower Saale. Along with the Franks, they destroyed the kingdom of the Thuringians in 531, and obtained possession of the land between the Harz and the Unstrut; but this district was in turn forced to acknowledge the Frankish sovereignty. From 719, wars between the S. and the Franks became constant; but the latter, after 772, were generally successful, in spite of the vigorous resistance offered by Wittekind; and in 804, the S. were finally subjugated by the arms of Charlemagne. Wittekind was the last Saxon king, and the first Saxon duke of the German empire. A collection of the old national laws and usages of the S., under the title of *Lex Saxonum*, was made during the reign of Charlemagne.

During 1830—1840, A. Schmeller published (from two manuscripts, one preserved at Munich, and the other in the British Museum) an 'Old Saxon' poem of the 9th c., called *Hêliand*, i. e., the 'Healer,' or 'Saviour,' which narrates in alliterative verse the 'History of Christ' according to the Gospels, whence it is also called the 'Old Saxon Gospel Harmony.' It is probably a part of a more comprehensive work, embracing a poetical treatment of the history of the Old and New Testament, which Ludvig the Pious intrusted to some celebrated Saxon singer. This unknown poet lived, as his language leads us to conjecture, somewhere between Münster, Essen, and Kleve. His work is not only the almost sole monument of the old Saxon tongue left us, but is also of high poetical value, through its warmth of feeling, and the strength and splendor of its diction—worthy, indeed, to take its place alongside the contemporary Anglo-Saxon and old Norse poetry.—See Vilmar's *Deutsche Alterthümer im Hêliand* (Marb. 1845).

SA'XONY (Ger. *Sachs n*), KINGDOM OF, the second in importance and population of the minor German states, though inferior to three of them in extent, is bounded on the N. by Prussia, S. by Austria, and W. by Bavaria and the Saxon duchies. Population in 1881, 2,972,805. In 1875 it was distributed over the four districts of the kingdom as follows:

	English Sq. Miles.	Pop. in 1875.
Dresden	1680	749,503
Leipzig	1370	639,731
Zwickau	1790	1,031,905
Bautzen	950	339,203
Total	5790	2,760,342

The kingdom is somewhat of the form of a right-angled triangle, with the right angle in the north-west and the longer side lying along the foot of the Erz-gebirge range, which sends its spurs northward over the southern half of the country, giving to that portion a somewhat mountainous character, while the northern half remains a flat or undulating plain. The whole country, with the exception of a small portion in the extreme east, which belongs to the Oder basin, and is watered by the Neisse, is drained by the Elbe (which is wholly navigable in S.) and its tributaries the Muglitz, Wilde-Weisseritz, Trubsch, Mulde, and White Elster, on the west; and the Wessnitz, Black Elster, and Spree on the east. From the point where the Elbe bursts through the Erz-gebirge chain to within about 8 miles of Dresden, it traverses a district rich in picturesque scenery, to which the somewhat inappropriate name of *Saxon Switzerland* has been given. This district, which averages about 24 miles long by 23 broad, is an elevated plateau of coarse crumbling sandstone (much resembling the English green-sand); and though destitute of the perpetually snow-clad mountains, glaciers, serrated ridges, and escarped peaks which give a character of lofty grandeur to its namesake, it can boast of features equally peculiar and strikingly romantic. From the soft nature of the rock, it has yielded freely to the action of the mountain rills, which rise from the hills on its east and west borders, and converge to the Elbe, and is cut up in all directions by deep narrow gorges (so symmetrical in their formation as to resemble artificial lanes), the constantly deepening beds of these mountain torrents, which here form cascades, there sullenly glide through deep vales bordered by rocks of the most fantastic forms, or by steep rugged slopes thickly clad with trees. High above the level of the plateau rise towering rocks, some of them pyramidal or conical, others pillar-like, while a few taper almost to a point, and then bulge out at the top; all clearly testifying to the agency by which they have been produced. The medieval knights took advantage of these curious results of nature's so-called freaks, to erect castles upon the summits of some of them; several of these castles still exist, and one of them, Königstein, is almost the only virgin fortress in Europe.

The most remarkable of these peaks are Königstein (864 feet), Lilienstein (1254 feet), the Bastei (600 feet), Nonnenstein, Jungfernsprung, and seven others, each of which possesses its group of traditionary gnomes and kobolds. The lakes of S. are unimportant, and the only canals are those constructed between the mines and ore-mills.

Climate, Soil, Products, &c.—The climate is healthy, and on the whole temperate, though occasionally severe in the south-western districts. Of the whole surface, more than one-half is arable, nearly one-third is in forest, about one-ninth in meadow, while the rest is occupied by gardens and vineyards, coarse pasture and waste land, or quarries and mines. The arable land has long been in a high state of cultivation, as is the case with the whole of Upper S. (see *History*), yet notwithstanding this, and its extreme fertility, the produce is hardly sufficient to supply the wants of the dense population (441 to the English sq. mile). The agricultural products consist of the usual cereals and leguminous plants, with rape, buck-wheat, hops, flax, and potatoes, and all kinds of fruits suited to the climate. The forests, the largest of which are in the Voigt-land (the south-west corner of Zwickau), and along the northern slopes of the Erz-gebirge, supply timber of excellent quality, and in such abundance as to render them one of the great sources of wealth and industry. The rearing of cattle is an important employment in the mountainous districts of the south-west. Sheep, for which S. was formerly so famous, have been less generally attended to of late years, though, from the introduction of merinos, and increased care in breeding and rearing, the quality of the wool has much improved, and at the present day it occupies a high position in the markets of the world. Minerals are another great source of national wealth, the ore being both rich and abundant, and the processes of excavation and smelting in a high state of perfection. Most of the mines belong to the crown; they are situated in Zwickau and Dresden, and mostly on or near the northern slope of the Erz-gebirge. The mineral wealth includes silver, tin, iron, cobalt, bismuth, zinc, lead, nickel, arsenic, antimony, and other metals, besides coal, marble, porcelain-earth, vitriol, and various gems. In 1870, there were in operation 548 mines; 10,045 men were employed in the iron-mines, and 18,377 in coal-mines. The products raised in that year had a value of 12,929,360 thalers (£1,939,404).

Manufactures, Commerce, &c.—Manufacturing industry has also been greatly developed, and several branches have been carried to a high degree of perfection. This species of labor employs nearly three-fifths of the whole population. The oldest manufacture is that of linen, which at present employs more than 16,000 looms; but it is now eclipsed by the cotton-spinning and weaving, which is the most important branch of Saxon industry, has its chief seats at Chemnitz, Frankenberg, Zschoppau, Folkland, and Lausitz, and gives work to upwards of 150 spinning-mills. The woollen manufactures are also extensive. Broad-cloth, thread, merinos, silks, mixed silk and woollen wares, &c., are also produced in considerable quantity, and of excellent quality; the muslin de laines being still preferred by many to those of

England and France, while the laces and embroideries preserve their ancient well-won reputation. Saxon pottery and porcelain have long been famous. The chief centers of manufacturing industry are in Bautzen and in the mountainous country to the north of the Erz-gebirge. Owing to this extension of manufacturing industry, combined with a deficiency in the supply of home-grown articles of consumption, an extensive foreign commerce is rendered necessary, and this is chiefly carried on through the medium of the great fairs of Leipzig (q. v.). The chief imports are corn, wine, salt (not found in S., though common enough in Prussian Saxony), cotton, silk, flax, hemp, wool, coffee, tea, &c. The country is well provided with roads, railways, and lines of telegraph.

Government, Religion, Education, Revenue, &c.—The government of this very interesting country—the reading of the history of which leaves on one's mind a firm sense of both past ages and present activity—is a limited monarchy, hereditary in the Albertine line, and is carried on according to the constitution of September 4, 1831, modified by changes in 1849, 1851, 1860, 1861, 1868, and 1874. By the electoral law passed in the year 1868, the first of the two chambers which constitute the legislature consists of the princes of the royal family, certain nobles, representatives of the Lutheran and Roman Catholic churches, the chief proprietors, representatives of the universities, and the burgomasters of the eight principal towns. The second chamber comprises 35 deputies from the towns, and 45 from the rural communes. The supreme administration is managed by six ministers (of Justice, Finance, the Interior, War, Religion and Education, and Foreign Affairs). The established religion is the Lutheran, though the reigning family, since the time of Fr. Augustus I., have been Roman Catholic. The church department must, so long as the reigning family remains Roman Catholic, be administered by a member of the Established church. In 1871, there were 2,484,075 Lutherans; 9347 Reformed; 53,642 Roman Catholics. The population of S. is by no means purely German; in 1875 there still were upwards of 50,000 who spoke Wendish. S. has upwards of 2000 elementary schools, 11 gymnasia, and 12 *real-schulen;* the university is at Leipzig. The budget for 1880 and 1881 showed annual receipts to the amount of £3,187,980; and the expenditure was a little less. The public debt of S. at the beginning of 1880 amounted to £33,775,000 (a great part of which was incurred for railways). The Saxon troops form the twelfth *corps d'armée* of the German empire. S. has a war ministry of its own; but after the war of 1866, S. paid the penalty of her opposition to Prussia by being compelled to make over to the king of Prussia the supreme military command of the Saxon army, the right to garrison the fortress of Königstein the management of the postal, railway, and telegraphic systems, and the charge of the diplomatic representation of S. abroad. As a member of the German empire, S. has four voices in the federal council, and has a right to send 23 deputies to the diet.

History of the Great Duchy of Lower Saxony and of the Ascanian Electorate of Upper Saxony.—After the final conquest of the Saxons by Charlemagne, they became one of the components of the German empire; but their country by no means corresponded to what is now known as Saxony. It included the most of the country between the Elbe, the Harz Mountains, the Rhine, and Friesland; and, in 850, was erected into a dukedom, with Lubeck for its capital, and ruled by hereditary princes. Ludolf, the first duke, is said to have been the great-grandson of Wittekind, but nothing is certainly known of his ancestry. His second son, Otho the illustrious (880—912), was the most distinguished of the German princes; he fought valiantly against the Normans, and, on the extinction of the Carlovingian dynasty (911), refused the crown of Germany which was unanimously offered him by the electors. His son Duke Henry (912—936), surnamed 'the Fowler,' obtained the throne (919), and commenced the Saxon line of German sovereigns, which was continued by Otho I. (q. v.), Otho II. (q. v.), Otho III. (q. v.), and Henry II., and ended in 1024. Otho I., handed over the great duchy of S. to Hermann Billung in 960, on condition of military service; and this family held it till 1106. Under the Billung dynasty, the prosperity of the country greatly increased, and Meissen, Thuringia, East S., in Lusatia, S. in the Northern Mark, Anhalt, Saltzwedel, and Siesvig, were all dependent on the Saxon duke. A portion of S. had, however, been reserved by the emperor, Otho I., for his nephew Bruno, who founded a lordship of Saxony-Brunswick; and, in the middle of the 11th c., a duchy of 'Saxony on the Weser' was also founded; but both of these (united by marriage in 1090 or 1096) came (1113) by marriage to Count Lothar of Supplinburg, who was also invested (1106) with the great duchy of S., which was now more extensive than ever, stretching from the Unstrut, in Gotha, to the Eider, and from the Rhine to Pomerania.

After Lothar's accession to the imperial throne in 1125, he handed over (1127) the duchy to his son-in-law, Henry the Proud, the Guelphic Duke of Bavaria, who was thus the ruler of more than half of Germany; but this overgrown dominion did not long exist, for under his son, Henry the Lion (q. v.), it was wrested (1180) from the House of Guelph, Bavaria being given to the House of Wittelsbach; East Saxony created an electorate, and given to Bernhard of Ascania; Brunswick and Luneburg mostly restored to Henry's son; while the numerous and powerful bishops of Northern Germany divided among themselves Westphalia, Oldenburg, and many portions of Luneburg and Brunswick; Mecklenburg and Holstein became independent, and the Saxon palatinate in Thuringia went to the Landgraf Ludwig. S., now shorn of its former greatness, consisted chiefly of what is now Prussian S., a few districts separated from Brandenburg, and Saxe-Lauenburg, the last being the only portion of the great duchy of S., or *Lower Saxony*, as it is called, which retained the name. Wittenberg was the capital of the new duchy. S. was diminished in 1211 by the separation of Anhalt as a separate principality; and in 1260 it was permanently divided into two portions, *Saxe-Lauenburg* and *Saxe-Wittenberg*, to the latter of which the electoral dignity remained, and to which, on subsequent dispute between the two branches, it was confirmed by the celebrated Golden Bull (1356). The Ascanian line became extinct in 1422 with Duke Albert III., and the duchy then passed to Frederick the Warlike, Markgraf of Misnia, and Landgraf of Thuringia, who was invested with it by the Emperor Sigismund in 1423. His possessions consisted of Thuringia, the present kingdom of S., Prussian S., in fact, the whole of *Upper Saxony*, with the exception of Anhalt.

History of the Country now known as Saxony.—The earliest inhabitants of Upper S., since the Christian era, were the Hermunduri (see THURINGIA); and on the destruction of the great Thuringian kingdom in the beginning of the 6th c., their settlements were taken possession of by the Sorbs, a Slavic race, who practised agriculture and cattle-breeding. The Carlovingian rulers, dissatisfied with the ingress of those non-German tribes, erected 'marks' to bar their progress; and Duke Otho the Illustrious of S., and his celebrated son, Henry the Fowler, warred against them, the latter—subduing the Heveller, the Daleminzer, and the Miltzer—founded in their country the marks of Brandenburg (q. v.), Misnia (Meissen), and Lusatia (Lausitz), and planted colonies of Germans among the Sorbs. In 1090, the mark was bestowed on the House of Wettin (a supposed off-shoot of the race of Witte-kind), and was confirmed as a hereditary possession to that family in 1127; and the markgraf, Henry the Illustrious (1221—1288), whose mother was heiress to the landgrafdom of Thuringia, with its appendages, combined the whole into a powerful state. Business, commerce, and mining industry now flourished; great roads for commercial purposes were constructed throughout the country, and the Leipzig fairs were established; and, in spite of much internal discord, and frequent partitions of S., its prosperity increased. At last, FREDERICK THE WARLIKE (1381—1428) succeeded in uniting the severed portions of S., to which were added, by purchase and marriage, various districts in Franconia; and in 1423, the electorate of S. (see above). The Saxon elector was now one of the most powerful princes of Germany; but unfortunately the fatal practice of subdividing the father's territories among his sons still continued, and during the reign of the Elector FREDERICK THE MILD (1428—1464), whose brother William had obtained Thuringia, a civil war broke out, and was carried on for years. ERNEST (1464—1486) and ALBERT (1464—1500), the sons of Frederick, in accordance with the will of their father, reigned conjointly over the hereditary domains of the family (the duchy of S., with the electoral dignity, being reserved always to the eldest) till the death of their uncle (1485), when Ernest obtained Thuringia, and Albert Meissen, while Osterland was equally divided between them.

Ernest, the founder of the *Ernestine*, which was also the *elder* or *electoral line*, was succeeded by his son, FREDERICK THE WISE (1486—1525), who favored the reformation, and firmly supported and protected Luther against the overwhelming power of the Catholic party, which he was enabled to do, from his personal influence with the Emperors Maximilian and Charles V. His brother and successor, JOHN THE CONSTANT (1525—1532), was still more a partisan of the new doctrines, as was also his son and successor, JOHN FREDERICK THE MAGNANIMOUS (1532—1547); but the latter, by the defeat of Muhlberg (q. v.) (see SCHMALKALD), was forced to resign both his electoral dignity and his states. Albert, the founder of the *younger, ducal*, or *Albertine line*, was succeeded by his sons, GEORGE THE BEARDED (q. v.) (1500—1539), a rabid Catholic, and HENRY THE PIOUS (1539—1541), a no less zealous Protestant; after whom came the celebrated MAURICE (1541—1547), who was a professed Protestant, but joined the Catholic party against the league of Schmalkald, obliged the Protestant army to retreat from the Danube, and took possession of the estates of the Elector John Frederick, who, however, speedily drove him out, and took possession of ducal S. in his turn. After the rout of the Protestants at Muhlberg, Maurice received the electoral title (1547—1553), and the greater portion of the estates of his vanquished cousin. But the arbitrary political measures and religious severities which were

either instituted or promoted by the emperor, induced Maurice to join the Protestants, and by a sudden march on Innspruck, he forced the emperor to agree to the peace of Passau. New tyrannical measures of the emperor caused him to look to an alliance with France, but the scheme was frustrated by his death, July 11, 1553, near Sievershausen, where two days before he had totally defeated the Markgraf Albert of Kulmbach, a secret agent of the emperor's. His brother, AUGUST I. (q. v.) (1553—1586), the first economist of the age, has left a memory dear to S., from the numerous excellent institutions which he established; he considerably increased his territories by purchase and otherwise, and restored Altenburg to the Ernestine line.

CHRISTIAN I. (1586—1591), a weak prince, surrendered the reins of government to his chancellor, Crell, who was sacrificed, in the succeeding reign of CHRISTIAN II. (1591—1611), to the revenge of the offended nobility. Christian II. weakly neglected to assert his claims to Juliers, on the death of its last duke, and allowed it to become a prey to Brandenburg and the palatine House of Neuburg; but his brother JOHN GEORGE I. (1611—1656), in revenge for this spoliation, allied himself to Austria, and conquered Upper and Lower Lusatia and Silesia. Subsequently, the good understanding between these powers was destroyed, and the elector allied himself with Gustavus Adolphus (1631), and took part in the Thirty Years' War. But on the death of Gustavus, the elector separated from the Swedes, and made a separate peace (1635) with Austria, by which he obtained Upper and Lower Lusatia, acquisitions confirmed by the general treaty of Westphalia (1648). This was the period of the electorate's greatest power. His sons, JOHN GEORGE II. (1656—1680), August, Christian, and Maurice, divided the estates, the three latter founding cadet lines, all of which became extinct before 1750. The reigns of his successors, JOHN GEORGE III. (1680—1691) and JOHN GEORGE IV. (1691—1694), are unimportant, but that of FREDERICK AUGUST I. (q. v.) (1694—1733) well-nigh ruined the hitherto prosperous electorate. Frederick August had been chosen king of Poland; and his attempt, in company with the czar and the king of Denmark, to dismember Sweden, brought down upon him and his two states the vengeance of the northern 'fire-king.' Poland was utterly devastated, and S. exhausted of money and troops. Besides, the king's habits were most extravagant, and to maintain his lavish magnificene, he was forced to sell many important portions of territory. FREDERICK AUGUSTUS II. (q. v.) (1733—1763), also king of Poland took part in the war of the Austrian Succession (q. v.) against Maria Theresa, but finding the treaty of Berlin (1742) not so satisfactory for himself as he expected, he joined the empress in 1745. The country was atrociously ravaged during the Seven Years' War (q. v.), and a long time elapsed before it recovered its previous peaceful and prosperous state.

FREDERICK CHRISTIAN (1763—1763) and FREDERICK AUGUST I. (1763—1827), labored zealously for the good of their subjects; and under the reign of the latter, agricultural, manufacturing, and industrial enterprise progressed with rapid strides. In spite of his love for peace, the elector was led into the quarrel respecting the Bavarian Succession (q. v.); but he refused the crown of Poland in 1791, and declined to take part in the convention of Pilnitz, though he joined the Prussian confederation of German princes, and had an army of 22,000 Saxons at the battle of Jena. But the pressure of the French compelled him to join the Confederation of the Rhine in 1806, and from this time his army fought side by side with the French. He obtained the union to S. of the duchy of Warsaw (see POLAND), but fearing that the disasters of the French, in 1812, would be fatal to their supremacy, and to the interests of S., he withdrew to Bavaria, and thence to Prague, renounced the duchy of Warsaw, and made every attempt to come to amicable terms with the allies. But he was again compelled to join the French, between the battle of Lutzen (May 2, 1813), and that of Leipzig (October 16—19, 1813), after which he became the prisoner of the allies, and his army was joined to theirs. For his support of Napoleon, he was deprived of the greater portion of S., which was handed over to Prussia, but he retained the title of king, which had been conferred upon him in 1806. The rest of his reign was occupied with internal reforms. ANTONY (1827—1836) reformed the entire legislation of the country, and granted a liberal constitution, being urged thereto by a popular outbreak in the autumn of 1831. The constitution was proclaimed September 4, 1831, and the state's representatives first assembled, January 27, 1833. FREDERICK AUGUST II. (1836—1854), his nephew, who had been regent for several years, now succeeded, and though favorable to constitutionalism, he was unable to obtain the smooth and harmonious working of the new system. In 1843, violent contests commenced, accompanied by occasional riots in the principal towns, on the subject of the liberty of the press, and the publicity of legal proceedings. Sometimes the constitutionalists, and sometimes their opponents, gained the supremacy, and for a long time the efforts of the two parties counteracted each other. Towards the close of the king's reign, he was a mere tool in the hands of the reactionary party, headed by his brother JOHN, who succeeded in 1854. John, however, supported constitutionalism, and established courts of justice throughout the kingdom. For the hostile attitude assumed by S. towards Prussia before 1866, and its subsequent history, see GERMANY.

SAXONY, PRUSSIAN, the most westerly undetached province of Prussia, bounded on the E. and N.-E. by the province of Brandenburg. Area, 9730 sq. miles; pop. (1880) 2,312,007. The west districts are occupied by the Harz Mountains, and the peak of the Brocken (3738 feet high) is the chief elevation. The greater portion of the surface, however, is level, and slopes towards the north, in which direction flow the principal rivers—the Elbe, with its tributaries, the Saale and Mulde. The climate is mild and healthy, and the soil is exceedingly fertile and well cultivated. More than the half of the area is under crop, and nearly $\frac{2}{5}$ths are uncultivated, and in water and wood. The *Goldene Aue*, in the south-west, is especially famous for its abundant fertility. Manufacturing industry is most actively carried on, and there are spinning, weaving, and oil-mills in great numbers. The capital is Magdeburg (q. v.). The larger portion of Prussian S. (7911 sq. m.) was detached from the kingdom of Saxony, and ceded to Prussia, by decree of the Congress of Vienna, 1815. See SAXONY.

SAY, JEAN BAPTISTE, an eminent French economist, was born at Lyons, 5th January 1767. Being destined by his father for a commercial career, he passed a part of his youth in England; and on his return to France, obtained a situation in a Life Insurance Company, about which time he made his first acquaintance with the works of Adam Smith. During the Revolution, he was for some time secretary to Clavière, the Minister of Finance; and from 1794 to 1800 edited a journal called *La Décade*, in which he expounded with great effect the views of Smith. Already S. had acquired a distinguished reputation as a thinker by his *Traité d'Economie Politique, ou Simple Exposé de la Manière dont se forment, se distribuent et se consomment les Richesses* (Paris, 1803), and other works. Called to the tribunate in November 1799, he was not slow to express his disapprobation of the arbitrary tendencies of the new consular government, and in 1804 he ceased to be a member of a body that had become a mere tool in the hands of Bonaparte.

Under the despotism of the Empire, S. was forced into private life, and betook himself to industrial pursuits, establishing (along with his son) at Auchy a large spinning-mill, which soon employed not less than 500 workmen; and when Bonaparte fell, S. found himself at the head of the economical and commercial movement that marked the epoch. In 1814, the second edition of his now celebrated *Traité* appeared, dedicated to the Emperor Alexander, who had long called himself his 'pupil;' and in the same year the French government sent him to England to study the economical condition of that country. In 1819, a new chair, that of *Economie Industrielle*, was created for him at the *Conservatoire des Arts et Métiers;* and S. added both to his influence and his popularity by the lucidity, grace, and intensity of conviction displayed in his lectures. In 1831, he was appointed Professor of Political Economy at the *Collége de France*, but died 15th November 1832. Although strictly a follower of Adam Smith, S. is an independent, sagacious, and penetrative thinker. Ricardo speaks of his works as containing 'several accurate, original, and profound discussions.' He was the first to teach Frenchmen to consider rationally such questions as customs-duties, the currency, public credit, the colonies, and taxation; and though the brilliant socialistic theorizers say that he is not an *economiste spiritualiste*, many will consider that defect a merit. Besides his *chef-d'œuvre* already mentioned, S. wrote (among other works) *De l'Angleterre et des Anglais* (Par. 1812), *Catéchisme d'Economie Politique* (Par. 1815), *Lettres à Malthus* (Par. 1820), *Cours Complet d'Economie Politique* (Par. 1828—1830), and *Mélanges et Correspondance* (Par. 1833). His principal writings form vols. 9—12 in Guillaumin's *Collection des Economistes.*

SCAB, in Sheep, like itch in man, or mange in horses or dogs, depends upon the irritation of a minute acarus, which burrows in the skin, especially if dirty and scurfy, causing much itching, roughness, and baldness. The parasite readily adheres to hurdles, trees, or other objects against which the affected sheep happen to rub themselves, and hence is apt to be transferred to the skins of sound sheep. Chief amongst the approved remedies are diluted mercurial ointments, tobacco-water, turpentine and oil, and arsenical solutions, such as are used for sheep-dipping. One of the best and simplest applications consists of a pound each of common salt and coarse tobacco, boiled for half an hour, in about a gallon of water; to this are added two drachms of corrosive sublimate; and the mixture diluted until it measures three gallons. For each sheep, a pint of this mixture should be carefully applied, from a narrow-necked bottle, along the back, and to any other scurfy itchy parts. A second dressing, after an interval of a week, will generally effect a perfect cure.

SCA'BBARD is the sheath for a sword or bayonet, at once to render the weapon harmless and to protect it from damp. It is usually made of black leather, tipped, mouthed, and ringed with metal; but the British cavalry wear scabbards of steel. These better sustain the friction against the horse's accoutrements, but are objectionable from their noisiness, and the consequent impossibility of surprising an enemy. The sword-scabbard is suspended to the belt by two rings; the bayonet-scabbard hooks into a frog in connection with the waist-belt.

SCABE'LLUM, a kind of pedestal to support busts.

SCA'BIES. See ITCH.

SCA'BIOUS (*Scabiosa*), an extensive genus of herbaceous plants, exclusively natives of the eastern hemisphere, of the natural order *Dipsacaceæ*. See TEASEL. The flowers are collected in terminal heads, surrounded by a many-leaved involucre, so as to resemble those of the order *Compositæ*. The DEVIL'S-BIT S. (*S. succisa*) is a very common autumnal flower in British pastures. The plant possesses great astringency, but no important medicinal virtues; although it was formerly supposed to be of great efficacy in all scaly eruptions, and hence the name S., from Lat. *scabies*, leprosy. The end of the root appears as if abruptly bitten off, and the superstition of the middle ages regarded it as bitten off by the devil, out of envy, because of its usefulness to mankind! The SWEET S. (*S. atropurpurea*) is a well-known fragrant garden-flower. It is supposed to be a native of India.

SCAD (*Caranx trachurus* or *Trachurus vulgaris*), a fish of the family *Scomberidæ*, sometimes called the *Horse Mackerel*, because of its resemblance to the mackerel, and its comparative coarseness. It is from 12 to 16 inches long, of a dusky olive color, changing

Scad (*Caranx trachurus*).

to a resplendent green, waved with a bluish gloss, the head and lower parts silvery, the throat black. There are two small free spines in front of the anal fin. The species of *Caranx* are very numerous, and it is sometimes divided into several genera; but the S. is the only one found on the British coasts. It is common on the south-western coasts of England, but comparatively rare to the north. It sometimes appears in immense shoals, pursuing the fry of herring or similar prey, and the multitudes have sometimes been so great and so crowded together, that they could be lifted out of the sea by buckets, and overloaded nets have been torn to pieces. The S. has something of the mackerel flavor. Although not much cared for when fresh, it is often salted, and in that state is esteemed as an article of food.

SCA'FELL, a double-peaked mountain in Cumberland, on the Westmoreland border, 13 miles south-south-west of Keswick, is a chief feature in the scenery of the Lake Country, in the heart and center of which it stands. Of its two peaks, the higher is 3229 feet, the other 3092 feet in height.

SCAGLIO'LA, a composition made to imitate the more costly kinds of marble, and other ornamental stones; and so successfully is it done, that it is often difficult to distinguish between the artificial and the real stone. It consists of finely ground plaster of Paris mixed with a thin solution of fine glue, and colored with any of the earthy colors, such as ochres, umber, Sienna earth, Armenian bole, and sometimes chemical colors, such as the chrome yellows, &c. This is spread over the surface intended to represent marble; and whilst still soft, pieces of fibrous gypsum, marble, alabaster, and other soft but ornamental stones, are pressed into it, and made level with the surface. When the composition is set hard, it is rubbed down, and polished with the ordinary stone-polishing materials, which give it a very fine gloss. This kind of work is only adapted for interiors, because scagliola will not bear exposure to damp for any length of time; but its lightness, and the extreme ease with which it may be applied to walls, pillars, plasters, and even cornices, render it very useful for the decoration of the better class of dwellings and public buildings.

SCA'LA NO'VA, a seaport of Asiatic Turkey, stands on an eminence at the head of a gulf of the same name, 40 miles south of Smyrna. The ruins of the ancient city of Ephesus (q. v.) are in the vicinity. An important export trade is carried on. Pop. stated at 20,000. The Gulf of S. N., confined on the south by the island of Samos, is 40 miles long, and about 20 miles broad.

SCALD-HEAD (a corruption probably of *Scaled Head*) is the popular name of a fungous parasitic disease of the scalp (and occasionally of the face and other parts), known in medical phraseology as *Favus*, *Tinea favosa*, and *Porrigo scutulata*. The primary seat of the parasite is in the lowest portion of the hair-follicles, outside the layer of epithelium which covers the root of the hair. The plant is, however, often found in cup-shaped depressions on the surface of the scalp, forming the yellow honeycomb-like masses which suggested the specific name *Favus* (honeycomb) for the disease. The honeycomb crust continues to increase, preserving its circular form and depressed center, till it occasionally reaches a diameter of nearly half an inch. These crusts commonly appear in crops, and may be either distinct or confluent. 'At a more advanced stage,' says Dr. Aitken, 'the epidermis disappears, and a viscid fluid is secreted in such abundance as to form one entire incrustation over the entire head; hence the *Porrigo larvalis*—mask or visor-like scald-head. The smell of the scab is peculiar, and has been compared to that of the urine of a cat, or of a cage in which mice have been kept. It is probably due to a species of alcoholic fermentation in connection with the vegetable growth.' The scab sometimes resembles a lupine, or a minute shield, rather than the cell of the honeycomb, and hence the varieties of scald-head which have been described under the name of *Porrigo lupinosa* and *Porrigo scutulata*.

Scald-head:
A, A, chains of sporules projecting beyond the edges of the hair; B, sporules between the fibres of the hair; C, D, broken-up root end of the hair, with masses of sporules between the laminæ.

The great point to be aimed at in the treatment of this affection is to destroy the cryptogamic parasite, and to eradicate its germ. For this purpose, the head should be shaved, and poultices then applied till the scabs are removed. Tar-ointment should then be applied, night and morning, the old ointment being washed off with soft soap and water before the fresh dose is laid on. Dr. Aitken states, that in the early stage of the disease, in place of the preceding treatment, it is sometimes sufficient to cut the hair close, and to wash the affected parts, night and morning, with oil of turpentine. If the disease does not yield to these applications, the same treatment as that recommended for RINGWORM must be tried.

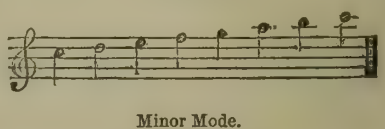
SCALDS. See BURNS.

SCALE-ARMOR consisted of small plates of steel riveted together in a manner resembling the scales of a fish. From the small size of the plates, it possessed considerable pliability, and was therefore a favorite protection for the neck, in the form of a curtain hanging from the helmet. Scale-armor is now obsolete, except, perhaps, among some eastern potentates.

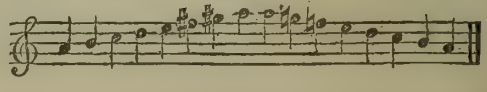
SCALE INSECT. See COCCUS.

SCALE, MUSICAL, a succession of notes arranged in the order of pitch, and comprising those sounds which may occur in a piece of music written in a given key. The ultimate criterion of what should constitute a musical scale, is doubtless what gives most pleasure to a cultivated ear; but the sounds that please the ear are also found to be those that stand in certain simple mathematical relations to each other. Among the ancient Greeks, various different scales or *modes* were in use, of which six were generally enumerated—the Dorian, Phrygian, Lydian, Mixo-Lydian, Ionic, and Æolian. Excepting in the music of the Greek Church and

Major Mode.



Minor Mode.



of the Ambrosian Chant, modern musical feeling has rejected all of these but two, the Ionic and the Æolian, the former of which is now known as the Major, and the latter the Minor Mode. In both modes, the scale consists of a series of seven steps leading from a given note fixed on as the tonic or key-note to its octave,

which may be extended indefinitely up or down, so long as the sounds continue to be musical.

For an explanation of the principles on which these scales are founded, and of their derivation from the harmonic triad, see MUSIC. The major scale is derived from much simpler proportions than the minor. The minor scale requires to be modified by occasionally sharpening its sixth and seventh.

SCALES OF FISHES. They are divided by Agassiz, whose classification is generally adopted, into the *placoid*, *ganoid*, *ctenoid*, and *cycloid* forms. *Placoid* scales (from the Gr. *plax*, a broad plate) lie side by side without overlapping or imbricating. They are often elevated at the center so as to form a strong projecting point. All the cartilaginous fishes, except the sturgeon, have placoid scales. *Ganoid* scales (from the Gr. *ganos*, splendor) are covered with a fine enamel, and generally of a rhomboidal form and imbricated. The sturgeon and the bony pike (*Lepidosteus*)

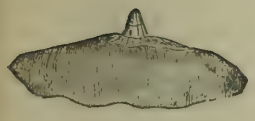


Fig. 1.—Placoid Scale.

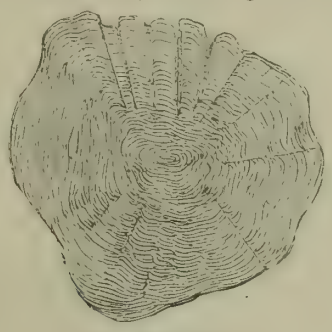


Fig. 2.—Cycloid Scale.

have scales of this nature, but the finest examples of these scales are found in fossil fishes. *Ctenoid* scales (from *kteis*, a comb) are generally of a rounded or oval form, with teeth or projections on their posterior margin. They are devoid of enamel, and present an imbricated arrangement. The perch and many osseous fishes possess these scales. *Cycloid* scales (from the Gr. *kyklos*, a circle) consist of concentric layers of horn or bone, without spinous margins, and not covered by enamel. They are soft and flexible, present a variety of linear markings on their upper surface, and usually exhibit an imbricated arrangement. The carp, herring, salmon, &c., possess these scales. In many cases, two kinds of scales occur in the same fish, while in other cases the different species of a single genus exhibit different kinds of scales.

For anatomical details regarding the structure and mode of development of scales, the reader is referred to Professor Huxley's article 'Tegumentary Organs' in the *Cyclopædia of Anatomy and Physiology*, and to Professor Williamson's Memoirs in the *Philosophical Transactions*, 1849—1852. In their chemical composition, the scales of fishes approximate to the bones, except that they contain more organic matter. The brilliancy of tint exhibited by many fishes is due apparently to the phenomena of optical interference, rather than to the presence of coloring matter. Figures of Ctenoid and Ganoid Scales are given in the articles CTENOID FISHES and GANOID FISHES.

SCALES OF NOTATION are the various 'radices' which determine, as explained under NOTATION (q. v.), the form and digits of the number expressing any numerical quantity. Thus, the number 289, in the decimal or common system whose radix is 10, signifies 9 units, 8 tens, and 2 hundreds, or $2 \times 10^2 + 8 \times 10 + 9$. To express the same number in the quinary scale, for instance, we must group the 289 units into multiples and powers of 5; an operation which may be performed in either of two ways, as follows:

5)289	289	2124 (quinary)
5)57-4	10	5
5)11-2-4	103 (taking in 8, and	11 (carrying by 10)
2-1-2-4	10 carrying by 5)	5
	2124	57
		5
		289

or 2124 (i. e., $2 \times 5^3 + 1 \times 5^2 + 2 \times 5 + 4$) in the quinary scale represents the same numerical quantity as 289 in the decimal scale. The following list shows the same numerical quantity according to the scales having for their radices the first 11 numbers after unity, and will partly indicate the advantages and disadvantages of each scale:

In the *binary*	(*radix* 2) scale	.....	100,100,001
" ternary	(" 3) "	.....	101.201
" quaternary	(" 4) "	.....	10.201
" quinary	(" 5) "	.....	2,124
" senary	(" 6) "	.....	1,201
In the septenary	(*radix* 7) scale	.....	562
" octary	(" 8) "	.....	441
" nonary	(" 9) "	.....	351
" decimal	(" 10) "	.....	289
" undenary	(" 11) "	.....	243
" duodecimal	(" 12) "	.....	201

It will be observed that the binary scale possesses only two symbols, 0 and 1, the ternary has 3, while the undenary would require a symbol in addition to the 9 digits and zero to express 10, which is a digit in that scale, and the duodecimal scale two additional symbols for 10 and 11. A glance at the above table shows at once that if the binary scale had been in ordinary use, great facility in the 'performance' of arithmetical operations would have been obtained at the cost of largely increasing their 'extent,' and that both the advantage and disadvantage diminish as we raise the scale. The selection of 'ten' as the ordinary scale is very prevalent, and was evidently suggested by the number of fingers; but the scales of two, three, four, five, six, and twenty, have at various times been made use of by a few nations or tribes. The scale of 12 has long been generally employed in business among northern European nations, as is instanced by such terms as 'gross,' signifying 12 times 12, and 'double gross,' denoting 12 times 12 times 12; and it has also been largely introduced into the standard measurements of quantity, as inches, pence, ounces, troy, &c., causing a considerable amount of complexity in calculation, as all abstract numerical calculation follows the decimal system. To remedy this acknowledged evil, it has been proposed to introduce the decimal system *in toto*, as has been done in France, Italy, Russia, &c., or else to do the same with the duodecimal system. Those who hold to the first proposal have the argument of conformity in their favor; those who support the latter do so on the ground, that 12 has in proportion far more aliquot parts than 10 has, and that on this account the number of fractions, and the size of each numerator and denominator, would be diminished; while both parties can bring overpowering arguments against the continuance of the present method, or rather want of method. See DECIMAL SYSTEM.

SCALIGER, JULIUS CÆSAR, one of the most famous men of letters that have appeared since their revival, was born in 1484. In after-life, he created for himself a noble pedigree, and made out that he was descended from a princely family of the Scalas of Verona, and that his birthplace was the castle of Riva, on the banks of the Lago di Guarda. According to his own account, he was educated first under the famous Fra Giocondo; was afterwards attached as a page to the Emperor Maximilian, whom he attended for 17 years in peace and war; was next made a pensioner of the Duke of Ferrara; thereafter studied at Bologna; commanded a troop of cavalry at Turin under the French viceroy; prosecuted his studies there in philology, philosophy, and medicine; and in 1525 went to Agen, in France, with the bishop of that diocese, a member of the Rovere family, to whose household he became physician. Tiraboschi's account, however, which is the more probable, represents him as having been born at Padua, the son of Benedict Bordoni, who was a geographer and miniature-painter of that city, and who either from the sign of his shop or the name of the street he lived in, assumed the surname Della Scala. Up to his 42d year, young Giulio Bordoni resided chiefly in Venice or Padua, engaging in the study and practice of medicine, and appearing under his true name as an author. In 1525, he withdrew to Agen, either from some advantageous offer, or with a view to promote his fortune, and there fixed his abode. He became physician to the bishop of the diocese, and in that capacity sought in marriage Andietta de Roques-Lobejac, a young lady only 16 years of age, and of noble and rich parentage. An obstacle was thrown in the way of this alliance; and probably with the purpose of improving his position, and lessening the disparity in station between himself and the object of his affections, he procured, in 1528, letters of naturalization as a French subject under the name of Jules-César de Lescalle de Bordonis. This was probably the occasion when he added Cæsar to his baptismal name of Julius. The marriage took place in 1529, and was both happy and fruitful. He died in 1558, leaving behind him a mass of publications on various subjects, and a reputation for extent and depth of learning, which, considering the ripe age at which he made the majority of his acquirements, redounds to the credit of his vigorous understanding and extraordinary memory.

As a thinker, he was more independent that sound; and as a man, was of violently irritable temper and excessive vanity. His best known publications are *Commentarii in Hippocratis Librum de Insomniis* (Commentaries on the Hippocratic Treatise on Dreams); *De Causis Linguæ Latinæ Libri XVIII.*, celebrated as the first considerable work written in the Latin language in modern times, and not without value even yet; his Latin translation of Aristotle's *History of Animals;* his *Exercitationum Exotericarum liber quintus decimus de Subtilitate ad Hieronym. Cardanum;*

his seven books of *Poetics* (also in Latin, and on the whole his best work); his *Commentaries on Aristotle and Theophrastus;* his two orations against Erasmus; his Latin poems, &c.

SCALIGER, JOSEPH JUSTUS, the tenth son of J. C. Scaliger and Andietta de Roques-Lobejac, and much his father's superior in learning, was born in 1540 at Agen, whence, at the age of 11, he was sent, along with two of his brothers, to the college of Bordeaux, where for three years he studied Latin. A pestilence breaking out in the town, he was recalled by his father, who supplemented the scanty knowledge which his son brought home with him by making him write a Latin declamation every day upon any subject he chose. Under this training, he soon attained great proficiency as a Latinist; and in his 19th year, on the death of his father, he went to Paris, where he studied Greek under the famous Turnebus. He was less indebted, however, to any master than to himself; and finding that his progress was slow under his great preceptor, he closeted himself alone with Homer, and in 21 days read him through, with the aid of a Latin translation, and committed him to memory. In less than four months, he had mastered all the Greek poets. Next, Hebrew, Syriac, Persian, and the most of the modern European languages succumbed in rapid succession to his industry, while at the same time he was assiduous in his composition of verses both in Latin and Greek. About this time, he boasted that he could speak 13 languages, ancient and modern; and such was his ardor in study, that he allowed himself only a few hours' sleep at night, and would frequently pass whole days without rising from his books even for meals.

His proficiency in literature, especially in the history, chronology, and antiquities of Greece and Rome, secured him, in 1583, an honorable engagement from Louis de la Roche Pozay, at that time French ambassador at the pontifical court. The year, before, however, he had become a Protestant, which rendered it difficult for him to retain an appointment in France. Except that he traveled a good deal, at the generous instance of his patron, and visited the chief universities of France and Germany, and even found his way to Scotland, we know little of his life between 1565 and 1593. He is conjectured to have traveled in Italy, and to have gone as far as Naples. Certain it is, however, that in the year last named he complied with an invitation of the Dutch government, and went to fill the chair of Literature, vacated by Lipsius in Leyden University, where he spent the residue of his days. His labor now consisted chiefly in interpreting and illustrating the classical authors. He died of dropsy on the 21st January 1609, and was never married. We have said that he far excelled his father in learning; but it should be added that he was not a whit less irritable, arrogant, or vain; that he fully shared the paternal pride of pedigree, spurious as he probably knew his own to be; and that he endeavored to support his father's genealogical fictions in his well-known letter to Dousa on the splendor of the Scaliger family. His writings abound with expressions of hatred and contempt towards his opponents, and he has enriched the vocabulary of learned abuse to an extent well nigh proverbial. He was, however, a man of immense vigor of understanding, and must be credited with having been the first to lay down, in his treatise *De Emendatione Temporum* (Paris, 1583), a complete system of chronology formed upon fixed principles. It was this most learned achievement, and his invention of the Julian period, that secured for him the title of the Father of Chronological Science. It was subjected to much emendatory criticism by censors like Petavius, and also by himself, its errors having been partly corrected by him in his later work, the *Thesaurus Temporum, complectens Eusebii Pamphili Chronicon cum Isagogicis Chronologiæ Canonibus* (Amst, 1658, 2 vols. fol.).

Among the classical authors whom he criticised and annotated are Theocritus, Seneca (the tragedies), Varro, Ausonius, Catullus, Tibullus, Propertius, Manilius, and Festus. His other works are *De Tribus Sectis Judæorum; Dissertations on Subjects of Antiquity; Poemata; Epistolæ;* a translation into Latin of two centuries of Arabian proverbs, &c. He numbered among his friends the most illustrious scholars of the time, such as Lipsius, Casaubon, Grotius, Heinsius, the Dupuys, Saumaise, Vossius, Velser, P. Pithou; and interesting notices of him are preserved in such works as the *Huetiana*, and above all, in the two vols. of *Scaligerana*, which embody his conversations, and which were collected and published after his death.

SCA'LLOP, more commonly ESCALOP (q. v.), in Heraldry, a species of shell. It has been considered the badge of a pilgrim, and a symbol of the apostle St. James the Greater, who is usually represented in the garb of a pilgrim.

SCALLOP-SHELL. See PECTEN.

SCALP, THE, is the term employed to designate the outer covering of the skull or brain-case. Except in the fact, that hair in both sexes grows more luxuriantly on the scalp than elsewhere, the skin of the scalp differs so slightly from ordinary skin that it is unnecessary to enter into any details on this point. But besides the skin, the scalp is composed of the expanded tendon of the occipito-frontal muscle, and of intermediate cellular tissue and blood-vessels. Injuries of the scalp, however slight, must be watched with great caution, 'for they may be followed by erysipelas, or by inflammation and suppuration under the occipito-frontal muscle, or within the cranium, or by suppuration of the veins of the cranial bones, and general pyæmia that may easily prove fatal.'—Druitt's *Surgeon's Vade Mecum*, 8th edition, p. 332. In the treatment of a wound of this region, no part of the scalp, however injured it may be, should be cut or torn away; and, if possible, the use of stitches should be avoided, as plasters and bandages will generally suffice to keep the separated parts in apposition. The chance of suppuration may be prevented by coagulating the blood externally, by dressing the wound with lint, saturated with *Friars' Balsam* (*Tinctura Benzoin Comp.*), so as to seal up the injured part from the access of air. The patient should be confined to the house (and in severe cases to bed), should be moderately purged, and fed upon non-stimulating, but not too low diet.

Burns of the scalp are very liable to be followed by erysipelas and diffuse inflammation, but the brain is comparatively seldom affected in these cases.

Tumors of the scalp are not uncommon, the most frequent being the cutaneous cysts popularly known as *Wens* (q. v.), and vascular tumors.

SCAMA'NDER, the ancient name of a river in the Troad (see TROY), which, according to Homer, was also called Xanthus (Gr. yellow) by the gods, and as a divinity took an important part in the Trojan war, its destructive floods doing serious injury to one party, and thus materially assisting the other. The S. rose in Mount Ida (q. v.), and, flowing west and north-west, discharged itself into the Hellespont, after being joined by the Simois, about two miles from its mouth: the two rivers, however, since the 1st c. A.D., have had separate courses. There has been much controversy as to what modern river corresponds to the ancient S.; Mr. C. Maclaren, in his *Plains of Troy*, has clearly identified it with the Mendere.

SCAMI'LLUS, a small plinth below the bases of Ionic, Corinthian, and other columns.

SCA'MMONY is a gum-resin of an ashy-gray color, and rough externally, and having a resinous, splintering fracture. Few drugs are so uniformly adulterated as scammony, which, when pure, contains from 81 to 83 per cent. of resin (which is the active purgative ingredient), 6 or 8 of gum, with a little starch, sand, fibre, and water. The ordinary adulterations are chalk, flour, guaiacum, resin, and gum tragacanth.

Scammony, when pure, is an excellent and trustworthy cathartic of the drastic kind, well adapted for cases of habitual constipation, and as an active purgative for children. The resin of scammony, which is extracted from the crude drug by rectified spirit, possesses the advantage of being always of a nearly uniform strength, and of being almost tasteless. The *Scammony Mixture*, composed of four grains of resin of scammony, triturated with two ounces of milk, until a uniform emulsion is obtained, forms an admirable purgative for young children in doses of half an ounce or more. According to Christison, 'between 7 and 14 grains of resin, in the form of this emulsion, constitute a safe and effectual purgative' for adults. Another popular form for the administration of scammony is the *Compound Powder of Scammony*, composed of scammony, jalap, and ginger, the dose for a child being from 2 to 5 grains, and for an adult from 6 to 12 grains. Scammony is frequently given surreptitiously in the form of biscuit to children troubled with thread-worms.

The plant which produces this valuable drug is *Convolvulus Scammonia* (see CONVOLVULUS), a native of the Levant. It is a perennial, with a thick fleshy tapering root, 3—4 feet long, and 3—4 inches in diameter, which sends up several smooth slender twining stems, with arrow-head-shaped leaves on long stalks. The root is full of an acrid milky juice, which indeed pervades the whole plant. The scammony plant is not cultivated, but the drug is collected from it where it grows wild. The ordinary mode of collecting scammony is by laying bare the upper part of the root, making incisions, and placing shells or small vessels to receive the juice as it flows, which soon dries and hardens in the air.

The name *French* or *Monpelier Scammony* is given to a substance which is prepared in the south of France, chiefly from the juice of *Cynanchum Monspeliacum*, a plant of the natural order *Asclepiaceæ*. It is a violent purgative.

SCA'NDALUM MAGNA'TUM. This offence was committed in speaking words in derogation of a peer, judge, or great officer of the realm, and a special action was brought for such words, the punishment being damages and imprisonment. But now this proceeding, though not expressly abolished, is superseded by the ample remedies of Criminal Information (q. v.), indictment, or

action. A somewhat similar offence in Scotland is called Leasing-making (q. v.).

SCANDERBEG (properly, *Iskander-beg*, 'the Prince Alexander,' the name given him by the Turks), the famous patriot chief of Epirus, was born in that country in 1414. His real name was George Castriota, and his father, John Castriota, was one of the great lords of Epirus, his mother, Voisava, being a Servian princess. In 1423, he was given as one of the hostages for the obedience of the Albanian chiefs, and his physical beauty and intelligence so pleased Amurath II., that he was lodged in the royal palace, and subsequently circumcised and brought up in Islamism, being also put under the tuition of skilful masters in the Turkish, Arabic, Slav, and Italian languages. In 1433, he greatly distinguished himself in Asia as a Turkish pasha (of one tail); but being offended at the confiscation of his paternal domains, and being solicited by some Epirote friends to return to his native country to aid in the restoration of its independence, he watched an opportunity of withdrawing from the Turkish army. He had not long to wait, for the generous and unsuspicious sultan, who had caused him to be brought up as if he had been his own son, gave him the command of a large division of the army which was destined to act against the Hungarian invaders. S., having concerted his plans with 300 of his fellow-countrymen in the Turkish army, deserted during the confusion of the first battle (1443), and having previously compelled Amurath's secretary (whom he afterwards murdered to avoid detection) to prepare an order investing him with the government of Croia (now *Ak-hissar*), the capital of Epirus, he and his companions fled thither with all possible speed. The unsuspecting governor at once resigned the town into his hands, and was massacred along with the garrison.

At the news of S.'s success, the whole country rose in insurrection, and in 30 days he had driven every Turk, except the garrison of Sfetigrad, out of the country. In order to strengthen himself in his new position, he invited a number of the neighboring princes and Albanian chiefs to a conference, at which it was unanimously agreed to make no terms with the Turks, and to obey S. implicitly as their leader. S. then raised an army of 15,000 men, with which he completely scattered (1444) the 40,000 Turks whom the indignant sultan had sent against him, killing an immense number of them, and taking a few prisoners. Three other Turkish armies shared the same fate, and the 'animus' with which the contest was carried on may be imagined, when we consider that the number of prisoners taken in the last (1448) of these three battles amounted to *seventy-two*. Amurath himself in 1449 took the field, and stormed many of the principal fortresses, but being then ill of his fatal malady, he retired from before Croia, to die at Adrianople (1450). S.'s splendid successes brought in congratulations from the pope and the sovereigns of Italy and Aragon, but many of the Epirote chiefs were becoming wearied of the continual strife, and fell off from him, some of them even joining the Turks. S.'s career was now, in consequence, of a more chequered character, but in spite of occasional defeats, he stoutly refused all the liberal and fair proposals of the sultan, Mohammed II., who had a profound admiration for him, and sheltered by the montainous nature of the country, carried on an unceasing warfare. At last an armed convention was agreed to in 1461, and S. profited by this leisure to pay off his debt to the pope and the king of Aragon (both of whom had supplied him with material assistance during his greatest need), and crossing over to Italy, he routed the partisans of Anjou, and restored the kingdom of Naples to the latter of his benefactors, returning home laden with honors and benedictions.

At the instigation of the pope, who had tried in vain to raise the other Christian princes of Europe against the Turks, S. broke the armed truce in 1464, and repeatedly defeated the Turks; but Mohammed becoming furious at these unprovoked aggressions, equipped two mighty armies, the first of which invested Croia, and the second, under his own leadership, advanced more leisurely. The first army was, after a desperate contest, defeated by S. in 1466; but the restless and indomitable chief, worn out with the incessant toil of 24 years, died at Alessio, 17th January 1467. The war continued to rage some time longer, but the great mainstay of the country was now wanting, and before the end of 1478, the Turkish standard floated undisturbed over Epirus. Barlesio, a fellow-countryman of S., who has written his biography (*De Vita et Moribus ac rebus gestis Geo. Castrioti*, Rome, 1537), remarks his sobriety, the purity of his manners, and the strictness of his religious belief. He had vanquished the Turks in 22 pitched battles.

SCANDINA'VIA, a large peninsula in the north of Europe, bounded on the N. by the Arctic Ocean; on the W. by the Atlantic, North Sea, Skager Rack, Cattegat, and Sound; and on the S. and E. by the Baltic Sea, Gulf of Bothnia and Finland, with which it is connected on the north-east by an isthmus 325 miles wide. This peninsula comprises the two kingdoms, Norway (q. v.) and Sweden (q. v.); is 1240 miles long, from 230 to 460 miles broad, area 300,000 sq. miles. The ridge of mountains which traverses the peninsula in the direction of its length gives character to the whole conformation. The western division of the Scandinavian peninsula is covered with mountains; the eastern half, Sweden, consists principally of low-lying country. The mountains of S. extend from Waranger Fiord, in the extreme north-east, to the promontory of the Naze, in the extreme south-west, with an average breadth of 180 miles. They consist principally of gneiss and micaceous schist, sometimes, but rarely, of porphyry, syenite, granite, and chalk; salt is not found; silver, copper, and iron abound.

The Scandinavian Mountains, though forming in reality one great range, are considered as forming four sections—the Lapland Mountains, in the north, from 1000 to 2060 feet high; the Kjolen Mountains, from 1500 to 2575 feet high; the Dovre Fjelde, from 2500 to 3600 feet high; and lastly, the Southern Fjelde, 4000 to 5150 feet high. Though of inconsiderable height, yet the numerous glaciers and snow-fields of the mountains of S. impart to this range almost an Alpine character. The climate of S. is much milder on the west than on the east side, a fact to be ascribed probably to the influence of the Gulf Stream. The character of the country, its physical features, industries, &c., are given under the articles NORWAY and SWEDEN.

The ancient *Scandia*, or S., included Northern Denmark, as well as the peninsula that still retains the name. It is first mentioned by Pliny, who, unaware that the peninsula was attached to Finland on the north, considered S. as an island.

SCANDINAVIAN LANGUAGE AND LITERATURE. The language which was spoken during the heathen ages in all the northern or Scandinavian lands, and which, in accordance with traditionary belief, had been introduced by Odin and his companions, when the Gothic tribes supplanted the more ancient races of the Finns and Lapps, is always referred to by the oldest authorities either as the *Dönsk túnga*, 'Danish tongue,' or as the *Norræna*, 'Norse.' We never hear of the 'Swedish' or 'Gothic tongue,' and although different dialects no doubt existed from a very early period, among the Scandinavian people, it is certain that substantially the same language was spoken by the Northmen generally till the 11th century.

According to recent inquirers, the race of the Northmen, before their settlement in Sweden and Norway, was divided into an eastern and western branch, the former of which is supposed to have used the old language of Norway and Iceland, and the latter the Swedish and Danish dialects. These two divisions of the race had entered Scandinavia by different routes, the eastern having passed along the Gulf of Bothnia, through the country of the Finns and Lapps, while the western branch had crossed from Russia to the Aland Islands, and spread from thence southward and westward; and it seems natural to infer that in their respective lines of migration they may have incorporated into their own speech some of the special characteristics that belonged to the language of the peoples with whom they came in contact. But the differences thus introduced could not have been important, for we find the same language employed in the several most ancient laws of the different people of Scandinavia, while the two Eddas (q. v.)—the oldest monuments of Scandinavian speech—which were compiled in Iceland, whither the Northmen had carried their language on their settlement in the island in the 9th c., give evidence of an almost complete identity of local and personal names. This unity of language is further proved by the agreement which is found to exist in all runic inscriptions, from Slesvig to the northern parts of Sweden, and from Zealand to the western shores of Iceland. All monuments of this old Northern tongue would, however, have been lost to us, had not the Norræna or Norwegian form of it been carefully preserved and cultivated in Iceland through the short songs (*hlvod* or *quida*) relating to the deeds of the gods and heroes of the north, which had existed as early probably as the 7th c., and had passed with the religion and usages of Norway to the new colony.

After the introduction of Christianity into Iceland in the year 1000, schools were founded there, classic literature was cultivated and Roman characters were adopted for the writing of the national tongue, but this did not interfere with the zeal with which the national laws and poems were collected and studied by native scholars. This literary activity continued unabated till the 13th c., when the republic of Iceland, after having long been distracted by the dissensions of the rival aristocratic families of the island, was conquered by Hakon VI., king of Norway. Since 1380, Iceland has formed part of the Danish dominions, and although since that period the colonists have partly succumbed to the cramping influences of the subordinate and dependent conditions in which they have been placed; the distance from the mother-country, and the tenacity with which the people cling to all memorials of their former history, have enabled them to preserve their language so unchanged, that the Icelander of the present day can read the sagas of a thousand years since, and still writes in the same phraseology that his forefathers used ages ago. But while the old Scandinavian tongue was thus preserved in the

far distant colony, it had undergone great changes in Norway; and when, by the union of Calmar in 1380, the latter country was united to Denmark, the Danish form of speech, that had in the meanwhile been changing under the modifying influences due to the introduction of Latin and to contact with other nations, supplanted the Norwegian language, which thenceforth being banished from the pulpit, the law courts, and from literature, split up into numerous dialects peculiar to special valleys and fijords, but unknown in the larger towns.

When we come to examine the Icelandic or ancient Scandinavian, which is closely allied to its sister Teutonic languages, and like them betrays its eastern origin, we find that it differs from the latter in several important points. It has this striking peculiarity, that the definite article, instead of coming before the noun, is appended as a termination to the end of the word. The adjective, moreover, which in its indefinite form is subject to inflections, for all genders and cases, undergoes, when in its definite form, fewer and slighter changes. Again, while in the German tongues the verb in the infinitive ends in a consonant, in the old Scandinavian it invariably terminates in a vowel. The old Scandinavian language has a passive form of the verb unknown to its Gothic sister tongues; and while in German the third person of the present tense differs from the second person, such is not the case in Old Northern. In the latter, the vowel sounds are greatly modified by a very perfect system of combinations, indicated by dots or accents; and in addition to the consonants of the Gothic languages, it has an aspirated *d* and *t*. It possesses, moreover, a flexibility and richness of construction, which admit of favorable comparison with those of the ancient classical languages, while in regard to the number and comprehensiveness of its words, and its consequent independence of foreign derivates, it presents a character of regularity and unity which is wanting to the other Germanic languages. Its mode of construction is simple in prose, and in the earlier forms of poetry, although in the later periods of the Skalds (q. v.) it degenerated into a state of artificial complexity. The chief feature of the metrical system employed in Old Northern poetry was alliteration (q. v.). The alliterative method was continued after the introduction of terminal rhyme, but the simplicity of the ancient lay gave way in the 10th c. to the most artificial complexity of versification in the metres invented by the skalds. Besides these skaldic measures, of which 106 are enumerated in the *Hattalykli*, or Key of Metres, drawn up in the 13th c. by the Icelander, Snorri Sturlesson (q. v.), the skalds were required to know the *Kenningar*, or poetic synonyms, of which there were an enormous number; some words, as Odin, island, &c., having upwards of 100. The main feature of the system was that nothing must be called by its right name: thus a ship was a beast of the sea, a serpent of the waters, a dragon of the ocean, &c.; a woman was a graceful tree, a fair pearl, &c.; a wife was her husband's *Rune* (q. v.), or his confidential and intimate friend, &c.

The fragments of Old Northern poetry that have come down to us in the *Eddas*, belong for the most part to the 8th c., or even perhaps to the 7th c.; and consist of short songs (*hljod* or *quida*), which are either mystic, didactic, mythic, or mytho-historic in their character. See EDDA. It is supposed that some of these compositions, and several of the poems which celebrate the adventures of the gods, giants, and elves, were composed prior to the immigration into Scandinavia of Odin and his followers; while, on the other hand, the local coloring of others sufficiently prove their northern origin. In addition to the subjects belonging to the Odinic mythology, we have in the mytho-historic lays, known as the songs of the famous Smith Völundr, or the *Völundarquida*, a cyclus of heroic poems similar to the Old German epic the *Nibelungenlied* (q. v.); but much more ancient in form than that in which the latter has reached us. In the 9th and 10th centuries the ancient epic and the simple songs of the older poets gave place to the artificial poetry of the skalds, which, from its earliest development, manifested a realistic tendency, and made the real adventures of living men the subject of their compositions. Many of these compositions, as the *Eiriksmál*, or the Death and Apotheosis of King Eric Bloodaxe, who died in 952; the *Hakonarmal*, or Fall of Hakon the Good; and several poems by the famous Icelandic skald Egill Skalagrimson, while they afford valuable materials for the early history of the north, are among the latest of the skaldic productions that preceded the more degenerate periods of the art. To the 11th and 12th centuries belong the poems known as *Grongaldr* and *Solar-ljod*, which were composed in imitation of the ancient compositions, and consist of moral and didactic maxims, the former conceived from an assumed heathen, and the latter from a Christian point of view. In the 13th c., the skaldic art thoroughly declined, and gave place, in Iceland, to a puerile literature, based upon Biblical stories and saints' legends. In Scandinavia Proper, a more modern form of national literature was in the meanwhile being gradually developed by means of oral transmission, whence arose the folk-lore and popular songs of Norway and Sweden, and the noble Danish ballads known as the *Kæmpe viser*, whose composition in the Old Northern or Icelandic tongue may probably be referred to the 14th century.

The earliest Icelandic prose belongs to the beginning of the 12th c., when Ari 'hinns Frode,' or the Wise, composed a history of his native island and its population in the *Islendinga-bok* and *Landnáma-bok*, the latter of which was continued by others. He was the first northern writer who attempted to assign fixed dates to events by reference to a definite chronology, and his work is remarkable as the earliest historical composition written in the old Danish or Norse, as it still remains in the living language of Iceland. These works, which have since perished, entered largely into the composition of the annals of the early kings of Norway, compiled a century later by Snorri Sturlesson under the title of the *Heimskringla*. Throughout the middle ages the literature of Iceland was enriched with numerous national and other sagas, the materials of which were drawn from skaldic songs, folk-lore, local traditions and family histories; and in its later stages of development included among its subjects the mythic cycle of Arthur and his knights, Merlin, Alexander, Charlemange, &c. The compilation of the laws of the island attracted the attention of the Icelanders at an early period; and in 1118 a complete code, known as the Gragas, which had been derived from the ancient Norse law, was submitted to the Allthing or popular assembly, and a few years later the canons of the church, or the *Kristinrettr*, were settled and reduced to writing. A collection of those enactments in the ancient and subsequent codes, which are still in force in Iceland, has been made by Stephenson and Sigurdsson (Copen. 1853), under the title of *Lagasafn handa Islandi;* while the ancient Norse laws, beginning with the *Gula-things-lög* and the *Hirdskra* of Hakon the Good, which date from the 10th c., have been ably and critically edited in Norway under the title of *Norges gamle Love* (Christ. 1846—1849).

The study of the Old Northern language and literature, which was successfully inaugurated by the native scholars of Iceland in the 17th c., was soon prosecuted with equally happy results in Denmark and Sweden, and within the last 20 years in Norway, where the subject forms a necessary introduction to the investigation of the language and history of the country. Copenhagen, has, however, in recent times, been the principal seat of these inquires, the successful prosecution of which has been materially facilitated by the large number of important Icelandic MSS. contained in its libraries, and by the foundation of the Arne-Magnussen collection in 1772; and the different societies especially designed to promote the study of Icelandic and of northern antiquarian monuments. Among the Icelandic and Danish scholars who have gained pre-eminent distinction in these departments of research, we may instance Arne-Magnussen, Torfæus, Olavsen, Finn, Magnussen, Worm, Resenius, Bartholin, Thorlacius, Müller, Rask, Rafn, Keyser, Munch, Unger, Lange, &c. In the study of the grammar and comparative structure of the language, which excited an interest as early as the 13th c., as is proved by the grammatical treatises and rules of prosody incorporated in the younger *Edda*, no one has evinced a higher order of scientific acumen and critical learning than Rask (q. v.), who in his erudite work *Om det gamle Nordiske Sprogs Oprindelse* (Kjopenh. 1818) threw a flood of new and important light on the subject; while the labors of Jakob Grimm, Munch, and others, have tended materially to exhibit the affinities between the Old Northern and the Teutonic languages, and to assign to it its right position among the kindred Indo-Germanic tongues.

SCANDINAVIAN MYTHOLOGY. Our knowledge of Scandinavian mythology is mainly derived from the collections of ancient Northern sagas known as the Eddas (q. v.), which constitute the Odinic Bible, as it were, of heathen Scandinavia. The value and interest attaching to these records of the ancient faith of the Northmen are enhanced by the fact that there are strong grounds for assuming that the closest affinity, if not identity, of character existed between their religious doctrines and practices and those of the Germanic nations generally. Hence, in the absence of anything beyond the incidental notices of the Pagan religion of Germany, which are contained in the classic writers, the Eddaic exposition of northern mythology is of the highest importance to the student of the history of every nation of Teutonic origin. Owing to the remote situation of the Scandinavian lands, and the hold which the Odin religion had taken on the minds of the Northmen—whose natural tendencies inclined more to the Pagan merits of valor, courageous endurance of hardships, indomitable resolution, and unflinching fidelity in hate and love, than to the Christian virtues of submission, meekness, and forgiveness of injuries—Christianity took root slowly and insecurely in those lands, and only long after a national literature, based upon the superstitions and memorials of the ancient faith had been firmly established among the people. But although there is every reason to believe that all branches of the great Indo-Germanic family of nations had essentially the same system of belief and worship,

and venerated the same deities, minor differences were numerous. Thus, for instance, while Danes, Saxons, and Gothlanders worshiped Odin as their chief god, the Swedes generally paid supreme honors to Frey, the god of the year; some tribes of Northern Germany regarded Hlodyn, or the Earth, as their principal deity; and the Norwegians directed their worship to Odin's son, Thor; while in some parts of Norway even, as in Halgoland, the people worshiped deities not honored elsewhere in Scandinavia. Thus the chief objects of worship in the latter district were Thorgerd, Horgabrud, and Irpa, the daughters of Halogi, or high flame, from whom the name of the country was derived, and who was probably identical with Loki (Fire), who, after having, according to the myth, been beneficent in the beginning of time and united with the All-father, fell from his high estate, and, like some fallen angel, became crafty, evil, and destructive as a desolating flame. Halgoland appears from remains discovered there to have been a special seat of fire or sun worship, which seems to have been nearly universal at one period of the world's history.

Leaving for the present the discussion of the sources from whence the northern mythology derived some of the numerous complex elements which entered into its composition, we proceed to give a short summary of its cosmogony:—In the beginning of time a world existed in the north called Niflheim, in the middle of which was a well, Hvergelmeer, from which sprang twelve rivers. In the south was another world, Muspelheim, a light, warm, radiant world, the boundary of which was guarded by Surt with a flaming sword. Cold and heat contended together. From Niflheim flowed venomous, cold streams called Elivaager, which, hardening into ice, formed one icy layer upon the other within the abyss of abysses that faced the north, and was known as the Ginnunga-gap. From the south streamed forth the sparkling heat of Muspelheim; and as heat met cold, the melting ice-drops became instinct with life, and produced, through the power of him who had sent forth heat, a human being, Ymir, the progenitor of the frost-giants, by whom he was called Œrgelmer, or Chaos. He was not a god, but evil, both he and all his race. As yet there was neither heaven nor earth, neither land nor sea, but only the abyss Ginnunga-gap. Ymir drew his nourishment from the four milky streams which flowed from the udders of the cow Aedhumla, a creature formed from the melting frost. From Ymir there came forth offspring while he slept—a man and woman growing from under his left arm, and sons from his feet; and thus was generated the race of the frost-giants, or Hrimthursar, among whom the All-father dwelt in the beginning of time before the heavens and the earth were created.

In the meanwhile, as the cow Aedhumla licked the frost-covered stones, there came forth the first day a man's hair, the second day a head, and the third day an entire man. This man, *Buri*, or the Producing, had a son *Bör* (the Produced), who married Beltsa, one of the giant race, by whom he had three sons, Odin, Vili, and Ve.

These three brothers, who were gods, slew Ymir, and carrying his body into the middle of Ginnunga-gap, formed from it the earth and the heaven. Of his blood they made all seas and waters, taking the gore that flowed from his body to form the impassable ocean which encircles the earth; of his bones they made the mountains, using the broken splinters and his teeth for the stones and pebbles; of his skull they formed the heavens, at each of the four corners of which stood a dwarf, viz., Austri at the east, Vestri at the west, Northri at the north, and Suthri at the south. Of his brains they formed the heavy clouds, of his hair plants and herbs of every kind, and of his eyebrows they made a wall of defence against the giants round Midgard, the central garden or dwelling-place for the sons of men. Then the three brothers took the glowing sparks that were thrown out of the world Muspelheim, and casting them over the face of heaven, raised up the sun, moon, stars, and fiery meteors, and appointed to each its place and allotted course; and thus arose days, months, and years.

Night was of the race of the giants, and in turn married three husbands, by one of whom she had a daughter, Earth, and by another a son Day, who was bright and beautiful like the gods, or Œsir, to whose race his father Delling belonged. To this mother and son who were akin to the opposite races of the frost-giants and the gods, Allfader committed chariots and horses, and placed them in heaven, where Night rides first through her twenty-four hours' course round the earth with her horse Hrimfaxi, from whose bit fall the rime-drops that each morning bedew the face of the earth. Close after her comes her fair son Day, with his horse Skinfaxi, from whose shining mane light beams over heaven and earth. All the maidens of giant race were not dark like Night, for to Mundilfori were born a son and daughter of such beauty that their father gave to them the names of Mani or Moon, and Sol or Sun. The gods, incensed at this presumption, took them up to heaven, and ordained that they should direct the course of the sun and moon, which had been made to give light to the world, and thenceforth Sol drove the chariot of the Sun, which was drawn by two horses, Arvakur (the Watchful) and Alsvith (the Rapid), under whose shoulders the gods in pity placed an ice-cool breeze.

A shield named Svalin (the Cooling) was also by their care attached to the front of the car, to save sea and land from being set on fire. Mani directs the course of the moon, and he, like his sister, is followed by a wolf that seems about to devour him; and in the end of time this animal, which is of giant race, will with his kindred swallow up the moon, darken the brightness of the sun, let loose the howling winds, and sate himself with the blood of all dying men.

When heaven and earth were thus formed, and all things arranged in their due order, the chief gods or Œsir, of whom there were twelve, met in the middle of their city Asgard, which lay on the plain of Ida. These gods were Odin, or All-father, who has twelve names in Asgard besides many others on earth; Thor, Baldur, Tyr, Bragi, Heimdal, Hod, Vidar and Vali his sons, and Niord, Frey, Ull, and Forsetti. Here they raised for themselves a court with a high seat for All-fader; a lofty hall for the goddesses; and a smithy, in which they worked in metal, stone, and wood, but chiefly in gold, of which precious substance all the implements which they used were made, and hence this period of their existence was known as the Golden Age.

This age of peaceful labor lasted till three beautiful, but evil maidens made their way from the giants' world, Jotunheim, to Asgard, when confusion and ill-will arose in the world. Then the gods, taking counsel, determined to create new beings to people the universe, and first they gave human bodies and understanding to the dwarfs, who had been generated like maggots within the dead body of Ymir, but who now took up their abodes in the bowels of the earth, in rocks and stones, and in trees and flowers. Then Odin, with two companions, Hænir and Lodur, went forth on an excursion to the earth, where finding two trees, Ask and Embla, created a man and a woman of them, Odin giving them spirit or the breath of life, Hænir sense and motion, and Lodur blood and a fair color, with sight, speech, and hearing; and from this pair, whose dwelling was in Midgard, the human race has sprung.

A bridge of three colors, Bifrost, known to men as the rainbow, connects Midgard with Asgard, and over this the gods ride daily on their horses to the sacred fountain of Urd, where they sit in judgment. This fountain lies at one of the three roots of the ash, Yggdrasil, whose branches spread over the whole world and tower about the heavens. Under one of these roots is the abode of Hel (q. v.), the goddess of the dead, under another, that of the frost-giants, while under the third is the dwelling of human beings. Below the tree lies the serpent Nidhogg, who is constantly gnawing the roots, and striving with his numerous brood of lesser serpents to undermine Yggdrasil, whose branches are as constantly refreshed by water from the well of Urd, which is poured over them by the Norns. These are three maidens known as Urd, Verdandi, and Skulld (or Past, Present, and Future), who dwell in a fair hall below the ash-tree, where they grave on a shield the destiny which they determine for the children of men.

Besides gods, frost-giants, dwarfs, and men, there were other beings, as the Vanir, who dwelt in the world Vanaheim, lying between the abodes of the gods and of men, and the Light Elves and Dark Elves, the former of whom were friendly to mankind, and of great beauty, while the latter were of evil demoniacal natures, and blacker than pitch.

Now, after the three giant maidens came to Asaborg, dissensions soon broke out among these different races, and Odin, by casting a spear among mankind, created war and discord in the world. Then his maidens, the Valkyriur (or choosers of the doomed), surrounded by lightnings, rode forth with bloody corselets and radiant spears, to choose on every battle-field those who should fall, and to lead them into Valhal, where the chosen heroes known as Einheriar, daily go forth to fight and slay one another, but returning at early morn sound and fresh, recruit themselves for the next night's combats by drinking beer with the gods and eating the flesh of the sacred hog. It is, however, only men of rank, as jarls (or earls), who enter Odin's hall after death, for the base-born, or thralls, belong to Odin's powerful son, Thor (q. v.), who rules over Thrudheim, and drives through the world in a chariot drawn by he-gots, bearing with him his magic hammer Miolnir, the iron gloves which he requires to grasp the haft, and his belt of power.

Among the gods there reigned good-will and happiness even after the rest of the world had been disturbed by war, until Loki, or the impersonation of evil, who in infancy had been Odin's foster-brother, was admitted into Asaborg as their equal. By his treachery Baldur (q. v.), the purest, most beautiful, and best loved of Odin's sons, was slain. The gods, indeed, had power to inflict temporary punishment on Loki, and to chain him under a hot sulphur spring, where he lay for ages, but at length a time will come when Loki's evil progeny will prevail over the gods and the world. This terrible age of destruction, the Ragnarök

or twilight of the gods, will be marked by a three years' winter of hard frost, cutting winds, and sunless air uncheered by summer or spring-tide, when there will be bloodshed throughout the world, brothers will slay one another, parents and children will be at war. The wolf Fenrir will break loose, the sea will burst its bounds as the serpent Jormundgard, encircling Midgard, writhes in fierce rage, and struggles to reach the land. The wolf Sköll will swallow up the sun, and when the world is plunged in almost total darkness, his brother Hati will devour the moon, while the stars will vanish from heaven. As Midgard's serpent and the wolf Fenrir go forth, scattering venom through air and water, the heavens will be rent asunder; the ship Naglfar, which is made of dead men's nails, will be floated on the waters; the Œsir will ride forth across the bridge Bifrost, which will break away behind them; and all the friends of Hel, led on by Loki, will offer battle to the gods on Vigrid's plain. Then Odin, having taken counsel at Mimir's well, will advance armed with his spear Gungnir against the wolf Fenrir, while Thor encounters Midgard's serpent, and is killed by the venom which it exhales from its mouth. Although Fenrir, the wolf, will swallow Odin, and thus cause his death, he will himself be slain by the god Vidar, while Loki will fall beneath the hand of Heimdal, the watchman of the gods, and Surt, hurling fire from his hand, will burn up the whole world. After the conflagration of heaven and earth and the whole universe, there will still be dwellings for the evil and the good, the worst of which is Nastrond, a horrible habitation for perjurers and murderers, where serpent heads pouring forth venom line the walls, while in Gimli, Odin's best heaven, the good and virtuous will find a happy resting-place.

But from the great destruction of the universe another earth, verdant and fresh, will arise from the deep waters of the ocean, the unsown fields will bear fruits, and all evil will cease; Baldur and other gods will then return to Ida's plain, where Asgard once stood, and taking counsel together, will find the golden tablets which their race had possessed at the beginning of time, and remembering their deeds of old, will await the coming of the mighty All-father, the ruler of all things, who will pronounce judgments, and establish peace that shall endure to the end of time.

The above brief epitome of the Odin cosmogony serves as a framework for the numerous beautiful prose and poetic myths which make up the substance of northern mythology; and are contained in a rich mass of sagas, not all complete in themselves, but each capable of throwing some light on the others.

Many theories have been advanced to explain the origin and the fundamental ideas on which the northern myths have been based; and while some expositors have seen in them a mere re-clothing of Bible narratives, and a perversion of Christian truths, and have referred their composition to monks living in the middle ages, others, feeling that their title to antiquity could not be set aside, have gone to the other extreme, and tried to prove that they reflected the truths of Christianity, and represented under active and tangible forms the mysteries of Revelation; and that thus, for instance, in the narrative of Thor crushing the serpent we have a figurative delineation of Christ. Other interpreters, again, have attached very different meanings to these myths, regarding them as historic, psychical, physical, or even chemical; but against each of these assumed modes of explanation, taken in their full integrity, conclusive arguments might be adduced; and all that can be safely accepted is, that they are partly historical and partly an impersonation of the active forces of nature.

Like the northern languages, their original seat was in the south and east, where kindred mythologies existed among the ancient tribes of India and Persia; and it is probable that the more practical and energetic spirit of the northern myths, and the more warlike character of the gods of the north, when compared with the reflective and contemplative nature of their oriental prototypes, may be due to the gradual effect on the minds of a people who had passed from the soft enervating influences of a southern climate to the stern rigors of the north, where man lived in constant warfare with the elements and with his fellowmen. According to Snorri Sturlesson (q. v.), whose opinion seems to a certain extent to have been a mere re-echo of the traditional belief of his forefathers, Odin and his sons and companions were earthly kings and priests of a sacerdotal caste, who had migrated from Asia—perhaps, as some conjectured, from Troy—and who conquered and ruled over various parts of Scandinavia and Northern Germany, where after their death they were regarded by the people as deities. In conjunction with this mode of representation, the mythic tales of the warfare of the gods with giants, their intercourse with dwarfs, and spirits of the air and water, and their wanderings on earth, are interpreted as memorials of real war with pre-existing races, and of the spread of Odin's religion from its chief seat in Sweden over the neighboring countries. This theory explains only a few of the myths; while some, as we have already observed, may be referred to traces of an older faith, which lingered amongst the Finns and Lapps after the advance of the more civilized conquering races had driven those tribes from the southern districts of Scandinavia, which they originally occupied, to the barren recesses of the north.

The worship of the gods was celebrated either in spacious temples, of which there were many in different parts of Scandinavia, or on stone-heaps or altars, known as *horg*. These altars were always near some well, and close to a sacred grove, or a solitary tree, on which the votive offerings were suspended, after they had been washed at the neighboring spring by the attendant priestesses, known as *horgabrudar*. Human sacrifices, although never resorted to on ordinary occasions, were not uncommon in times of public calamity, arising from war, failure of crops, disease, &c.; and the horse, whose flesh was highly esteemed, was a frequent victim, while the fruits of the earth and spoils of war were the usual offerings. Three great festivals were held every year, the first of which was celebrated at the new year in the Yule month, when Thorablot, or the sacrifice of Thorri, an ancient god of the Finns and Lapps, was offered. On these occasions, offerings were made to Odin for success in war, and to Frey for a fruitful year, the chief victim being a hog, which was sacred to the latter god, on the assumption that swine first taught mankind to plough the earth. Feastings and Yule games occupied the whole of the month, whence it was also called the Merry Month. The second festival was in mid-winter, and the third in spring, when Odin was chiefly invoked for prosperity and victory on the Vikings, or sea-roving expeditions which were then entered upon. On the introduction of Christianity, the people were the more ready to conform to the great church festivals of Christmas and Easter, from the fact of their corresponding with the ancient national sacrificial feasts; and so deep-rooted was the adhesion to the faith of Odin in the north, that the early Christian teachers, unable to eradicate the old ideas, were driven to the expedient of trying to give them a coloring of Christianity. Thus the black elves, giants, evil subterranean sprites, and dwarfs, with which the Northmen peopled earth, air, and water, were declared by them to be fallen angels or devils, and under the latter character suffered to retain their old denominations. Belief in these imaginary beings survived the spread of the Reformation, and can scarcely be said to have died out in Scandinavian lands among the superstitious and ignorant, while among the more enlightened the myths connected with them are still related, and serve to give a poetic interest to special localities.

Our own association with the Scandinavian mythology is perpetuated in numerous superstitions and usages still lingering amongst us, and in the names of the days of the week. See WEEK.

The best northern authorities on Scandinavian mythology are N. M. Petersen, *Nordisk Mythologi* (2d ed. 1865); the Norwegian works of Munch and Keyser; Jacob Grimm, *Deutsche Mythologie;* Simrock's *Handbuch* (4th ed. 1874); Mannhardt, *Die Götterwelt;* Thorpe, *Northern Mythology*.

SCANSO'RÉS. See CLIMBERS.

SCA'NTLING, the sectional breadth and thickness of timbers for roofs, floors, &c. The term is also applied to quarterings or pieces of timber of about five inches in thickness and under.

SCA'PHOID BONE (Gr. *skaphe*, a boat), a term applied to two somewhat boat-like bones, of which one occurs in the carpus or wrist (see HAND), and the other in the tarsus of the Foot (q. v.)

SCAPPLE, a kind of work applied to masonry. To scapple a stone, is to work the surface even without making it smooth.

SCA'PULA, THE, or SHOULDER BLADE, is a flat triangular bone, which, when the arm hangs loosely down, extends posteriorly and laterally from the first to about the seventh rib. It presents for examination an outer convex and an inner, smooth, and concave surface, three borders (a superior, an inferior or axillary, and a posterior), three angles, and certain outstanding processes.

The figure represents an outer or posterior view of the scapula. It is divided into two unequal parts, the supra-spinous fossa (1), and the infra-spinous fossa (2), by the spine (10), a crest of bone commencing at a smooth triangular surface (11) on the posterior border, and running across towards the upper part of the neck of the scapula (8), after which it alters its direction, and projects forwards so as to form a lofty arch, known as the acromion process (12), which overhangs the glenoid cavity (6), or receptacle for the head of the humerus, or main bone of the arm. This acromion (so called from the Greek words *acros omos*, the summit of the shoulder) obviously serves to protect the shoulder joint, as well as to give great leverage to the deltoid muscle which raises the arm. It is this process which gives to the shoulder its natural roundness. From the upper part of the neck (8) there proceeds a remarkable curved projection termed the coracoid process, from its supposed resemblance to the beak of a raven (Gr. *korax*). It is about two inches long, and gives attachments to several muscles.

The upper border of the scapula presents a very remarkable notch (4), which in the recent state is bridged over with a ligament, and gives passage to the supra-scapular nerve. This bone articulates with the clavicle and humerus, and gives attachment

A Posterior View of the Left Scapula:

The parts designated by the figures 1, 2, 4, 6, 8, 10, 11, 12, are sufficiently described in the text; 3 is the superior border; 5, the anterior or axillary border; 7, the inferior angle; 9, the posterior border or base; 13, one of the nutritious foramina; 14, the coracoid process. (From Wilson's *Anatomist's Vade Mecum*).

to no less than 16 muscles, many of which, as the biceps, triceps, deltoid, serratus magnus, are very powerful and important.

The uses of this bone may be stated as follows: 1. It connects the upper extremity to the trunk, and participates in, and is subservient to many of the movements enjoyed by the arm; 2. By its extended flat surface it furnishes a lateral protection to the chest; and 3. It affords attachments to various muscles which modify the size of the thoracic cavity, and is thus concerned in the process of respiration.

SCA'PULAR, or SCAPULARY (Lat *scapula*, the shoulder), a portion of the monastic habit, so called from its being worn upon the shoulders. It consists of a long stripe of serge or stuff, the center of which passes over the head, one flap hanging down in front, the other upon the back. The scapular of the professed monks in most orders reaches to the feet, that of the lay brothers only to the knees. The color differs for different religious orders or congregations. Besides the scapular worn by the members of religious orders strictly so called, there exists also in the Roman Catholic Church a religious association or confraternity, the members of which, while living in the world and mixing in ordinary life, wear, although not conspicuously, a small religious emblem called a scapular. The chief duties of this confraternity consist in the recitation of certain prayers, or the observance of certain religious or ascetical exercises through devotion to the Blessed Virgin. The members may or may not bind themselves by a vow of chastity. This pious association was founded in the middle of the 13th c. by an English Carmelite friar named Simon Stock, and is said to have originated in a vision, which has been the subject of much controversy, as well with Protestants as among Catholics themselves.

SCARABÆ'IDÆ, a very numerous tribe of lamellicorn coleopterous insects (see LAMELLICORNES), of which more than 3000 species are known, the greater number inhabitants of tropical countries, although species are found in almost all parts of the world. Some of the tropical species are amongst the largest of beetles; those found in colder regions, as in Britain, are of comparatively small size. The tribe is divided into six sections: *Coprophagi* (dung-eaters), *Arenicoli* (dwellers in sand), *Xylophili* (delighting in wood), *Phyllophagi* (leaf-eaters), *Anthobii* (living on flowers), and *Melitophili* (delighting in honey), named according to prevalent and characteristic habits of the species belonging to them, although the names do not accurately denote the habits of all the species of each section. The sections are distinguished by differences in the organs of the mouth and the antennæ. To the section *Crotophagi* belong the greater number of the Dung Beetles (q. v.), or Scavenger Beetles, so useful in warm countries in removing offensive matter; amongst which is the Sacred *Scarabæus* of the ancient Egyptians (*Scarabæus*, or *Ateuchus sacer*). Some of the *Xylophili*, as the great Hercules Beetle (q. v.), have remarkable projections from the head or the thorax of the males. The Cockchafer (q. v.) is an example of the *Phyllophagi;* the Goliath Beetle (q. v.) is one of the *Melitophili*, to which section the Rose Beetle, common in Britain, also belongs. None of the *Anthobii* are British.

SCARABÆ'US, the name of a beetle held sacred by the Egyptians, commonly known in entomology as the *Scarabæus* or *Ateuchus sacer*. It was called *Heliocantharus* or *Cantharus*, by the Greeks, and S. by the Latins. Scarabæi were employed for rings, necklaces, and other purposes by the Egyptians, Phœnicians, and Etruscans (see GEMS). These are principally distinguished by the absence or presence of striated elytra and other marks. Entomologists have recognized four distinct species of the *Ateuchus* on the Egyptian monuments, viz., *A. semipunctatus*, *A. laticollis*, *A. morbillosus*, *A. puncticollis*. Several mystical ideas were attributed to the S.: the number of its toes, 30, symbolized the days of the month; the time it deposited its ball in which its eggs were deposited, was supposed to refer to the lunar month; the movement of the clay-ball referred to the action of the sun on the earth, and personified that luminary. The S. was supposed to be only of the male sex, hence it signified the self-existent, self-begotten, generation or metamorphosis, and the male or paternal principle of nature. In this sense it appears on the head of the pygmæan deity, Ptah-Socharis Osiris, the demiurgos, and in astronomical scenes and sepulchral formulas. In the hieroglyphs it is used for the syllable *khepru*, and expresses the verb 'to be, exist.' In connection with Egyptian notions, the Gnostics and some of the Fathers called Christ the scarabæus. The insect, during its life, was worshiped, and after death, embalmed.—*Horapollo*, i. c. 10; Ælian, *De Nat. Anim.* x. 15; Pettigrew, *History of Mummies*, p. 221; Wilkinson, *Man. and Cust.* v. p. 255.

Scarabæus.

SCA'RAMOUCH (Ital. *scaramuccia*, skirmish), a character in the old Italian comedy, originally derived from Spain, representing a military poltroon and braggadocio. He was dressed in a sort of Hispano-Neapolitan costume, including a black *toque* and mantle, and a mask open on the forehead, cheeks, and chin, and always received an inglorious drubbing at the hands of harlequin.

SCA'RBOROUGH (i. e., fortified rock), a seaport and municipal and parliamentary borough in Yorkshire, in the North Riding, 42 miles north-east of York, and about 20 miles north-west of Flamborough Head. It is built around a charming bay open to the south and south-west, and protected on the north-east by a promontory ending in a castle-crowned height, which looks out on the North Sea. From the sands the town has gradually climbed the rising ground behind in successive terraces and crescents. The chief buildings are churches, chapels, and benevolent and other institutions, with which the town is well furnished. A fine cast-iron bridge, 75 feet high, and stretching over a chasm 400 feet wide, connects the old and new towns, and leads to the spa, and a bridge was erected in 1865 over a picturesque ravine to connect the western part of the town with its large and fashionable southern suburb. The springs, which are saline and chalybeate, are on the margin of the sea, and are surrounded by walks and ornamental grounds. The harbor, composed of three piers, and furnished with a lighthouse, is the most important in this part of the east coast. Every accommodation is offered to visitors for sea-bathing; S. is reputed a most fashionable watering-place, and has about 200,000 visitors annually. The season lasts from June to the middle of October. In 1880, 382 vessels, of 25,711 tons, entered, and 351 of 23,302 tons, cleared the port. Pop. (1881) 30,484. The castle was erected about the year 1136. It was held against the barons by Piers Gaveston, who, however, surrendered, and it was twice besieged by the parliamentary forces. At present it is a barrack, and is fortified by batteries. New Spa buildings were opened in 1880.

SCA'RCEMENT, a plain set-off or projection in a wall; foundations have generally one or more scarcements.

SCARF, in Heraldry, a small ecclesiastical banner suspended from the top of a crozier.

SCARFING, the junction of two pieces of timber made to overlap, and united so as to appear as one piece.

SCARLATI'NA, or SCARLET FEVER, is one of the group of diseases called Exanthemata (q. v.). In addition to the characters common to the group, scarlatina is almost always attended by sore throat, and the rash or eruption, which is of bright scarlet color, commonly appears as early as the second day after the manifestation of the febrile symptoms, and ends in desquamation of the cuticle on the sixth or seventh day. Most writers on medicine make three varieties of this disease—viz., *S. simplex*, in which there are the fever and the rash, but scarcely any throat-affection; *S. anginosa*, in which, in addition to the fever and the rash, the throat-affection is the most prominent symptom; and *S. maligna*, a name which is applied to certain cases of extreme violence, in which the system is at once overwhelmed by the force of the disease, or in which the symptoms evince an extraordinary degree of weakness and want of vital power.

The disease begins with shivering, lassitude, headache, a fre-

quent pulse, a hot dry skin, a flushed face, thirst, loss of appetite, and a furred tongue. Shortly after the appearance of the febrile symptoms, the throat begins to feel irritable, and, on examination, is found to be red, and often more or less swollen. This redness becomes diffused over the interior of the mouth, and the tongue. The rash begins in the form of minute red points, which soon become so numerous that the surface appears of an almost uniform red. It first appears on the neck, face, and breast, whence it gradually spreads over the trunk and extremities. The reddened surface is smooth to the touch, and the color temporarily disappears on pressure of the finger. Along with the true rash, minute vesicles, known as *Sudamina* (q. v.), sometimes occur. The eruption, in ordinary cases, is persistent for three or four days, after which it gradually disappears, and is usually gone by the end of the seventh day. The cuticle then begins to scale off in small bran-like scurf, or in flakes of various sizes.

Specimens of an almost entire epidermic covering of the hand or foot, forming a natural glove or slipper, are of common occurrence in our pathological museums; but it is comparatively seldom that such perfect moulting takes place. The desquamative process is usually completed in a fortnight, or rather more, from the commencement of the disease. The fever does not abate on the appearance of the rash, but continues in a more or less decided degree through the progress of the case; it often presents exacerbations towards the evening, and is occasionally attended with delirium, or even with comatose symptoms. If the urine be examined, both chemically and microscopically, a few days after desquamation has set in, it will be found to contain albumen, and to exhibit a large amount of epithelium from the uriniferous ducts of the Kidneys (q. v.).

Malignant Scarlatina is so terrible a disease that its characteristic symptoms require a brief special notice. The rash comes out late and imperfectly, and sometimes is hardly perceptible; or, having appeared, it may suddenly recede; and sometimes it is intermixed with livid spots. The pulse is feeble, the skin is cold, and there is extreme prostration of strength. In such a case as this, death may occur (apparently from blood-poisoning) in a few hours. Other cases rapidly assume a typhus-like character. 'The pulse (says Dr. Watson) becomes frequent and feeble; the tongue dry, brown, and tremulous; the debility extreme; the breath offensive; the throat is livid, swollen, ulcerated, and gangrenous; and the respiration is impeded by viscid mucus, which collects about the fauces. Over this variety of the disease, medicine has comparatively little control.'

Even in *S. anginosa*, there is very considerable danger. The disease may prove fatal (1) from inflammation or effusion within the head, or (2) from the throat-affection, which too often proceeds to disorganization and sloughing of the adjacent parts. Moreover, in parturient women, even the mildest form of the disease is fraught with the greatest peril. Further, when the disease is apparently cured, the patient is exposed to great hazard from its consequences or *sequelæ*. Children who have suffered a severe attack of scarlet fever are liable (in the words of the eminent physician to whom we have already referred) 'to fall into a state of permanent bad health, and to become a prey to some of the many chronic forms of scrofula—boils, strumous ulcers, diseases of the scalp, sores behind the ear, scrofulous swellings of the cervical glands and of the upper lip, chronic inflammation of the eyes and eyelids. The above-named consequences not unfrequently follow small-pox and measles, but in addition to these, scarlatina is often followed by the form of dropsy known as *anasarca*, or serous infiltration of the subcutaneous cellular tissue, frequently accompanied with dropsy of the larger serous cavities. Strange as it may at first sight appear, this dropsy is much more common after a mild than after a severe form of the disease; but this apparent anomaly is probably due to the fact, that less caution is observed in the former than in the latter cases during the dangerous period of desquamation. If the patient (for example) is allowed to go out while new cuticle is still forming, the perspiratory power of the skin is checked by the cold, and the escape of the fever poison through the great cutaneous outlet is thus prevented. An excess of the poison is therefore driven to the kidneys, where it gives rise to the form of renal diease known as 'acute desquamative nephritis.'

Scarlatina is a disease that—like all the exanthemata—occurs in the epidemic form; and each epidemic presents its peculiar type, the disease being sometimes uniformly mild, and in others almost as uniformly severe. The treatment of this disease varies according to the preponderating symptoms. In *S. simplex*, nothing is required except confinement to the house, a non-stimulating diet, and the due regulation of the bowels, which are apt to be costive. In *S. anginosa*, cold or tepid sponging gives much relief if the skin is hot. If there is much fever, and especially if delirium supervene, a few leeches should be applied behind the ears, or if the patient were previously in robust health, blood might be cautiously taken from the arm. If, however, no bad head-symptoms are present, all that is necessary is to prescribe saline draughts, of which citrate of ammonia, with a slight excess of carbonate of ammonia, forms the best ingredient, and to keep the bowels open once or twice a day by gentle laxatives. In *S. maligna*, there are two main sources of danger, which were first recognized as distinct by Dr. Watson, who describes them as follows: 'The one arises from the primary impression of the contagious poison upon the body, and particularly upon the nervous system, which is overwhelmed by its influence. The patients sink often at a very early period, with but little affection either of the throat or skin. If we can save such patients at all, it must be by the liberal administration of wine and bark, to sustain the flagging powers until the deadly agency of the poison has in some measure passed away. But another source of danger arises from the gangrenous ulceration which is apt to ensue in the fauces, when the patient is not killed by the first violence of the contagion. The system is *re*-inoculated, I believe, with the poisonous matter from the throat. Now, under these circumstances also, quinia, or wine, and upon the whole, I should give the preference to wine, is to be diligently though watchfully given.' In addition to these remedies, a weak solution of chloride of soda, of nitrate of silver, or of Condy's disinfectant fluid, should be used as a gargle; or if, as is too often the case, the patient is incapable of gargling, the solution may be injected into the nostrils and against the fauces by means of a syringe or elastic bottle.

Three medicines have been so highly commended in scarlet fever generally, by trustworthy observers, that it is expedient to notice them. The first is chlorate of potash (KO,ClO_5) dissolved in water in the proportion of a drachm to a pint. A pint, or a pint and a half, may be taken daily. It was originally prescribed under the idea that it gave off its oxygen to the blood, and was eliminated from the system as chloride of potassium (KCl). Although this view is now known to be incorrect, there is no doubt that the salt is often prescribed with great benefit in this and some other diseases, as, for example, diphtheria and typhus fever. The second medicine is a very weak, watery solution of chlorine, of which a pint may be taken in the day; and the third is carbonate of ammonia in five-grain doses three times a day, given in beef-tea, wine, &c.

In the early stage, before the appearance of the rash, scarlatina may be readily mistaken for several other febrile diseases, after the appearance of the rash, the only disease for which it can be mistaken is measles, and we must refer to the article on that disease for a notice of the distinctive characters of the two affections.

There is no complaint in which the final result is more uncertain than this, and the physician should give a very guarded opinion as to how any special case may terminate.

Whether the disease is contagious throughout its course, or only at one particular period, is unknown; and if the physician is asked at what period the danger of imparting the disease on the one hand, or catching it on the other, is over, he should candidly declare that he does not know. That the contagion remains attached to furniture, clothing, &c., for a long period is undoubted. Dr. Watson gives a remarkable instance of a small piece of infected flannel communicating the disease after the interval of a year.

The popular delusion that *scarlatina* is a mild and diminutive form of *scarlet fever* should always be corrected, as the error, if uncorrected, may do much harm by leading to a disregard of those precautions which are always necessary in this disease.

SCARLATTI, ALESSANDRO, a musician of great eminence, born at Trapani in Sicily in 1659. He is said to have studied under Carissimi; if so, it must have been when very young. In 1680, S. visited Rome, and composed his first opera, *L'onestà nell' amore*, first performed at the court of Queen Christina of Sweden. His opera, *Pompeo*, was performed at Naples in 1684. In 1693, he composed the oratorio, *I Dolori di Maria sempre Vergine*, and the opera *Teodora*, in which orchestral accompaniments were first introduced to the recitatives, and a separate design given to the accompaniments to the airs. In the following eight years, during part of which time he held the office of *maestro di capella* at Naples, he produced various operas, the most remarkable being *Laodicea e Berenice*, composed in 1701. Between 1703—1709 he held the situation of *maestro di capella* at St. Maria Maggiore at Rome; he then returned to Naples; and in 1715, produced *Il Tigrane*. Alessandro S. died in 1721. His musical works comprise 117 operas, several oratorios and a great deal of church music, besides various madrigals and other chamber music. He was the founder of the Neapolitan school, in which were trained most of the great musicians of last century, and whose influence can be traced in the works of almost every composer who has flourished since. His invention was rich and bold, his learning great, and his style pure. His modulations, often unexpected, are never harsh, and never difficult for the voice.—His son, DOMENICO (born 1685, died 1757), was the first harpsichord player of his day. Among his compositions are a number of sonatas, remarkable for

invention, graceful melody, and skilful construction.—Domenico S. had a son, GIUSEPPE (born 1718, died 1796), who was also known as an eminent musician.

SCARLET COLORS. Cochineal furnishes the only scarlet color generally employed in dyeing, and for this purpose it is very extensively used; a solution of tin and cream of tartar is employed as the mordant to fix it. Scheffer, who produced the best formula for dyeing this color, also added starch, the proportions being as follow: Starch, 9 lbs.; cream of tartar, 9 lbs. 6 oz.; solution of tin, 9 lbs. 6 oz.; and cochineal, 12 lbs. 4 oz. These are the quantities required for 100 lbs. of wool or cloth.

SCARLET RUNNER. See KIDNEY BEAN.

SCARP. See ESCARP.

SCARPA, ANTONIO, a celebrated anatomist, was born on 13th June 1747, at Castello-Motta, a village in the Friuli. He was educated at Padua, where his ardor attracted the attention of the octogenarian Morgagni, who, having lost his sight shortly after the arrival of S. at the university, engaged the young enthusiast as his secretary, and dictated to him in Latin the answers which he made to letters soliciting his advice. The intervals between their medical studies were employed by Morgagni and S. in the perusal of the Latin authors, and it is to this practice that we must ascribe the elegance that distinguished the scientific style of S. in his subsequent publications. In 1772, he was appointed Professor of Anatomy in Modena. He afterwards visited France, Holland, and England; and while in London, was so enamored of John Hunter's Museum, that he did not rest until he had constructed a similar one at home. In 1783, he filled the anatomical chair at Pavia. He made, in the following year, a journey throughout the greater part of Germany, and in the course of it acquired the experience that made him one of the greatest clinical surgeons in Europe. On his return to Pavia, he published in rapid succession treatises on the anatomy of the Organs of Smell and Hearing; on the Nerves of the Heart, and on the minute anatomy of Bone. These, especially that on the innervation of the heart, which settled the question whether that viscus was supplied with nerves, gave S. a European reputation.

His work on the Diseases of the Eye, published in 1801, was followed in 1804 by his observations on the cure of Aneurism. But his greatest achievement was his work on Hernia, published in 1809. His reputation was now at its highest; but three years afterwards, he had to give up the work of public teaching, and entered, in 1814, on the office of Director of the Medical Faculty of Pavia. His next publication was some valuable observations on the operation for Stone. For the last years of his life, he suffered from almost total blindness, until, on the 30th of October 1832, he died at Pavia, of inflammation of the bladder. S.'s merits as an observer, a teacher, and a writer were very great. Industrious, scholarly, artistic, he appeared to great advantage in nearly every subject he undertook.

SCARPA'NTO (anc. *Carpathos*), an island in the Mediterranean, belonging to Turkey, midway between the islands of Rhodes and Crete. It is 32 miles long, and about 8 miles in extreme breadth, and its surface is covered with bare mountains, which reach the height of 4000 feet. The ruins of towns, which are found in several places, seem to indicate that formerly the island was well peopled. At present, the inhabitants are only about 5000 in number, and are mostly employed as carpenters and workers in wood, a trade of which they seem peculiarly fond, and in commerce.

SCARPE, in Heraldry, a diminutive of the bend sinister, being half the breadth of that ordinary.

SCARRON, PAUL, the creator of French burlesque, was born at Paris in 1610. His father, a counsellor of parliament, was a man of fortune and good family; but he having married again after the death of Paul's mother, discord broke out between the second wife and her step-children, the result of which was that Paul had to leave the house. About 1634, he visited Italy, where he made the acquaintance of Poussin the painter. On his return to Paris, he delivered himself over to a life of very gross pleasure, the consequence of which was that, in less than four years, he was seized with permanent paralysis of the limbs. What makes this incident in his career still interesting is the fact, that it undoubtedly exercised no inconsiderable influence on the development of his peculiar genius, which, as a French critic justly says, was 'the image of his body.' His love of burlesque, of malicious buffoonery, of profane gaiety, was simply a way of escape through the gates of mockery from the *tourmens vehemens* of his incurable ailment. His scramble for the means of living is excusable when we consider his hapless infirmity. He wrote verses, flattering dedications, begging-letters for pensions, &c.; and in 1643 he even managed to get a benefice at Mans, which he held for three years, when he returned to Paris, and lived in a sort of elegant Bohemian style. He had a pension from Mazarin of 500 crowns; but when the cardinal declined (probably from avarice) to allow the *Typhon* to be dedicated to him, S. got absurdly indignant, and joining the Frondeurs, lampooned Mazarin with spleenful virulence. However, when the war of the Fronde was at an end, and Mazarin had triumphed, S. was ready with an ode to

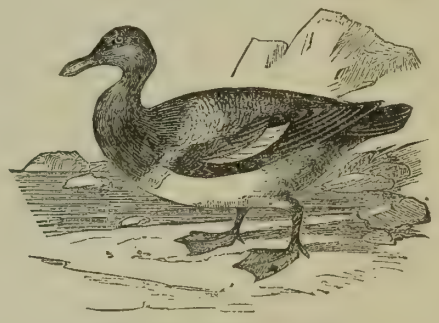
Jule, autrefois l'objet de l'injuste satire.

This baseness, however, did not win him back his pension, which the 'object of his unjust satire' had withdrawn; and it might have fared hard with the poet, had other friends not started up—for example, Fouquet, who granted him a pension of 1600 crowns—and had he himself not been the most consummate beggar that ever lived.

If he could not get a benefice or a purse of gold, or a lodge at court, he would take a load of firewood, or a carriage, pasties, capon, cheese, poodles, &c.—nothing came amiss; and his ample acknowledgments showed how thoroughly he had mastered the art of expressing gratitude. Doubtless his physical helplessness induced this bad habit, but his importunities were so pleasantly worded that they never estranged the friends on whom he fastened. In 1652, S. married Françoise d'Aubigné—a girl of 17, who subsequently became the mistress of Louis XIV., and is known as Madame Maintenon (q. v.). He died early in October 1660—the exact date is not known, but he was buried on the 7th. It is a proof of the charm of his company that his rooms were frequented by most of the men and women of his day who were distinguished either in literature or society. Among his works may be mentioned *Le Typhon*, *Virgile Travesti* (Par. 1648—1652), *La Mazarinade* (1649), *La Baronade Léandre et Héro*, *Ode Burlesque*, *La Relation du Combat des Purques et des Poëtes sur la Mort de Voiture*, *Poésies Diverses* (Par. 1643—1651), comprising sonnets, madrigals, epistles, satires, songs, &c.; *Le Roman Comique* (Par. 1651), a most amusing account of the life led by a company of strolling players—it is the best known, and perhaps the best of all S.'s productions; *Nouvelles Tragi-comiques*, from one of which (*Les Hypocrites*) Molière has taken the idea of Tartufe; besides a number of clever but coarse comedies. The editions of his works are very numerous, but the best is that of Bruzen de la Martinière (Amster., 10 vols., 1737; Par., 7 vols., 1786). Victor Fournel, to whom we are indebted for most of the information in this article, republished *Le Roman Comique*, in 1857, and *Le Virgile Travesti* in 1858.

SCA'TTERY ISLAND, a small islet in the estuary of the Shannon, three miles south-west of the town of Kilrush. Besides a fort, the islet contains fragments of several small churches, and an ancient round tower 120 feet high.

SCAUP DUCK (*Fuligula*—or *Nyroca*—*marila*), an oceanic species of duck, of the same genus with the Pochard (q. v.) an inhabitant of the northern parts of the world, spending the summer



Scaup Duck (*Fuligula marila*).

in arctic or subarctic regions, and visiting the coasts of Britain and of continental Europe as far south as the Mediterranean in winter, when it is also to be seen in great flocks in the United States, not only on the sea-coast, but on the Ohio, Mississippi, and other rivers. It breeds in fresh-water swamps. It is nearly equal in size to the Pochard. The male has the head, neck, and upper part of the breast and back black, the cheeks and sides of the neck glossed with rich green; the back white, spotted, and striped with black lines; the wing-coverts darker than the back, the speculum white; the rump and tail-coverts black. The female has brown instead of black, and old females have a broad white band around the base of the bill. The flesh of the S. D. is tough, and has a strong fishy flavor.

SCEATTÆ. See NUMISMATICS.

SCENA. See THEATER.

SCEPTICISM (Gr. *skeptomai*, 'I consider') strictly denotes that condition in which the mind is before it has arrived at conclusive opinions—when it is still in the act of reflecting, examining, or pondering over subjects of thought. Scepticism is therefore the opposite of dogmatism (see DOGMA). The notion of 'disbelief,' is quite a secondary meaning of the term. Among

the Greeks, a *skeptikos*, 'sceptic,' was originally only a thoughtful person, and the verb *skeptomai*, never acquired any other signification than 'to consider.' But inasmuch as the mass of men rush to conclusions with haste, and assert them with far more positiveness than their knowledge warrants, the discerning few of clearer vision or cooler head, are often brought into collision with popular beliefs—more especially in religion, the sphere in which popular beliefs are most numerous, most positive, and most inconsiderate—and are compelled by the violent shock given to their reason to 'doubt,' it may be to 'disbelieve' what they hear affirmed by the multitude with indefensible emphasis of speech. Thus it is that in common parlance a sceptic has come to mean an infidel, and scepticism infidelity. But the field of thought in which scepticism properly so-called has preferred to exercise itself is not religion but philosophy. Philosophical sceptics in all ages and countries have generally denied or at least doubted the trustworthiness of the senses as vehicles of absolute truth, and so have destroyed the very possibility of speculation. In ancient times, Pyrrhon (q. v.), in modern, David Hume (q. v.), are the most characteristic representatives of this kind of scepticism.

SCEPTRE (Gr. *skeptron*, staff; from *skepto*, to send or thrust), originally a staff or walking-stick, hence in course of time, also a weapon of assault and of defence. At a very early period the privilege of carrying it came to be connected with the idea of authority and station. Both in the Old Testament and in Homer, the most solemn oaths are sworn by the sceptre, and Homer, speaks of the sceptre as an attribute of kings, princes, and leaders of tribes. According to Homer, the sceptre descended from father to son, and might be committed to any one to denote the transfer of authority. Among the Persians, whole classes of persons vested with authority, including eunuchs, were distinguished as the 'sceptre-bearing classes.' The sceptre was in very early times a truncheon pierced with gold or silver studs. Ovid speaks of it as enriched with gems, and made of precious metals or ivory. The sceptre of the kings of Rome, which was afterwards borne by the consuls, was of ivory, and surmounted by an eagle. While no other ensign of sovereignty is of the same antiquity as the sceptre, it has kept its place as a symbol of royal authority through the middle ages and down to the present time. There has been considerable variety in its form; the sceptre of the kings of France of the first race was a gold rod as tall as the king himself.

SCHADOW, Godenhaus Friedr. Wilh. von, a distinguished German painter, of the Düsseldorf school, was born at Berlin, September 6, 1789. His father, Joh. Gottf. S., an eminent sculptor, died director of the Berlin Academy of Arts, in 1850. At first young S. did not give much promise of excellence, but during his first visit to Rome, the influence of Overbeck, Cornelius, Führich, Veit, &c., awoke his dormant genius, and both singly and in company with some of these artists, he executed several pictures remarkable for their depth of religious sentiment; as 'An Explanation of the Dream of Joseph' and 'The Grief of Jacob when told of the Death of his Son.' While residing in the city of the pope, he passed over to Roman Catholicism. Scarcely had S. returned to Berlin when he was appointed professor of the academy, and soon gathered round him a host of brilliant pupils; but in 1826 he went to Düsseldorf as successor of Cornelius in the direction of the notable academy there. His pupils followed him, and ever since the 'Düsseldorf School' has been associated specially with their names. S.'s principal works are 'Mignon' (1828); 'The Four Evangelists,' 'The Wise and Foolish Virgins,' 'The Source of Life,' 'The Assumption,' and 'Heaven.' 'Purgatory,' and 'Hell.' S. was ennobled in 1843. *Der Moderne Vasari* (1854) is a book from his hand. He died 19th March 1862.

SCHAFFHAU'SEN, the most northern canton of Switzerland, is bounded on all sides but the south by the duchy of Baden. Area, 116 sq. m.; pop. (1870) 37,721; (1880) 38,348, of whom about 34,000 are Protestants. The chief river is the Rhine, which forms part of the southern boundary, and within the basin of which the canton is wholly included. The surface is hilly, especially in the north and east, and of the many rich valleys that slope southward to the Rhine, that of the Klettgau is famous for its unusual fertility, and for its wines, the bouquet of which is peculiarly fine. The climate is mild; the soil, which is mostly calcareous, is generally fruitful, and agriculture is the principal branch of industry. Grain, fruits, flax, hemp, and wine are the chief crops. Iron is obtained. The sovereignty is usually exercised by the great council of 600 members, wholly renewed by ballot every 4 years; but the people have the right of veto. S. sends 2 members to the National Council.

SCHAFFHAUSEN, a town of Switzerland, capital of the canton of the same name, beautifully situated on the right bank of the Rhine, immediately above the celebrated falls of that river. Higher up the slope on which the town stands, is the curious castle of Munoth, and this edifice and the minster, founded in 1052, are the chief buildings. The town is remarkable for the antique architecture of its houses. The old wall and gateways of S. are also very picturesque. Pop. (1880) 11,795, partly engaged in the manufacture of iron, cotton, and silk goods. The *Falls of Schaffhausen*, about three miles below the town, form, perhaps, the most imposing spectacle of the kind in Europe. The river is here 300 feet broad, and the entire descent is about 100 feet. From a projecting balcony which overhangs the roaring cataract, the visitor may appreciate the full grandeur of the fall.

SCHALL, Johann Adam von, a celebrated Jesuit missionary to China, was born of noble family at Cologne in 1591, and having made his studies and entered the Jesuit order in Rome, in 1611, he was selected, partly in consequence of his great knowledge of mathematics and astronomy, to form one of the mission to China in 1620. Having, with the characteristic skill and ability of his order, turned to good account among the Chinese his familiarity with mathematical and mechanical science, he not only succeeded in forming a flourishing mission, but was ultimately invited to the imperial court at Pekin, where he was entrusted with the compilation of the calendar, and the direction of the public mathematical school, being himself created a mandarin. Such was his favor with the emperor, that, contrary to all the received etiquette, he had the privilege of free access to the presence of the Emperor Chun-Tche, the founder of the Tartar dynasty (1645), and was honored by visits from the emperor at four stated times in each year. Through this favor with the emperor, S. obtained an edict which authorized the building of Catholic churches, and the liberty of preaching throughout the empire, and in the space of 14 years the Jesuit missionaries in the several provinces are said to have received into the church 100,000 proselytes. On the death of this emperor, however, a change of policy fatal to the prospects of Christianity took place. The favorable edict above referred to was revoked; S. was thrown into prison and sentenced to death. He was afterwards liberated; but he was again imprisoned, and, at the end of a long incarceration, died August 15, 1669. He had acquired a perfect mastery of the Chinese language, in which he compiled numerous treatises upon scientific and religious subjects. A large MS. collection of his remains in Chinese, amounting to 14 volumes in 4to, is preserved in the Vatican Library. He also translated into Chinese several works, doctrinal and medical, especially some treatises of Father Lessius, a Flemish Jesuit, the most important of which was that *On the Providence of God*.—See Mailly's *Histoire Générale de la Chine* and Huc's *Le Christianisme en Chine*.

SCHÄ'SBURG, or SCHÄSSBURG (Magyar, *Segesvár*), a town of Austria, in Transylvania, on the great Kokel. It consists of the Burg or Upper-Town and the Lower-Town. Pop. (1880) 8788.

SCHAU'MBURG-LI'PPE, a sovereign German principality, includes the western part of the former county of Schaumburg, and is bounded on the W. by Westphalia, and on the N. by Hanover. Area, 170 sq. miles; pop. (1880) 35,374. Till 1866, the constitution was on the ancient patriarchal basis; but since then, S.-L. has a representative diet of 15 members, 10 of whom are elected by the towns and the country districts, the rest by the prince, the nobility, and the clergy and educated classes. It has one vote in the Federal council of the German empire, and sends one deputy to the Reichstag. The revenue of S.-L. in 1882–83 was £27,153; the expenditure just balanced it. The debt amounted to £18,000, besides £55,800 as quota towards the paper money of the empire.

SCHEELE, Charles-William, an eminent Swedish chemist, was born at Stralsund, 1742, and after receiving a brief and incomplete education, was apprenticed to an apothecary at Gothenburg, where he laid the foundation of his knowledge of chemistry. In 1767, he settled at Stockholm as an apothecary; and in 1770, removed to Upsala, where at that time the celebrated Bergmann was professor of chemistry. It was during his residence at Upsala that he carried on those investigations in chemical analysis which proved so fruitful in important and brilliant discoveries, and placed their author by the side of Linnæus and Berzelius his countrymen—in the front rank of science. In 1777, he removed to Köping to take possession of a vacant apothecary business, but died of ague-fever, 24th May 1786, at a time when he was receiving the most tempting offers from England to persuade him to settle in that country. The chief of his discoveries were tartaric acid (1770), chlorine (1774), baryta (1774), oxygen (1777), and glycerine (1784) the second-last of which had been previously made known through the labors of Priestley, though S. was not aware of this till after his own discovery of it, in 1777.

In experimenting on arsenic and its acid, he discovered the arsenite of copper, which is known as a pigment under the name of *Scheele's Green* on *Mineral Green*. In 1782, during an eminently delicate and subtle investigation to determine the nature of the coloring-matter in Prussian Blue, he succeeded in obtaining, for the first time, prussic acid in a separate form. The mode and results of his various investigations were communicated from time to time, in the form of memoirs, to the Academy of Stock-

holm, of which he was an associate, and also in his chief work, the *Chemical Treatise on Air and Fire* (1777), and in an *Essay on the Coloring Matter in Prussian Blue* (1782).

SCHEELE'S GREEN. See ARSENIOUS ACID.

SCHEFFER, ARY, a French painter, born at Dort, in Holland, 10th February 1795, studied under Guerin of Paris, and made his début as an artist in 1812. Some years later appeared his 'Mort de Saint-Louis,' 'Le Dévouement des Bourgeois de Calais,' and several *genre* pieces, such as La Veuve du Soldat,' 'Le Retour du Conscrit,' 'La Sœur de Charité,' 'La Scène d'Invasion,' &c., which have been popularized in France by engravings; but compared with his later performances, these early pictures have little merit. It was not till the 'Romantic' movement reached art that S. began to feel conscious of his peculiar power. The influence of Goethe and Byron became conspicuous in his choice of subjects, and to the remarkable facility of execution that had always marked him, he now added a subtilty and grace of imagination, that gave an inexpressible charm to his works. The public admired his new style greatly, and lavished eulogy with liberal hand on his 'Marguerite à son Rouet,' 'Faust tourmenté par le doute,' 'Marguerite à l'Eglise,' 'Marguerite au Sabbat,' 'Marguerite sortant de l'Eglise,' 'Marguerite au Jardin,' 'Marguerite à la Fontaine,' 'Les Mignons,' 'Le Larmoyeur,' 'Francesca de Rimini,' &c. Towards the year 1836, his art underwent its third and final phase—the religious. To this class belong his 'Le Christ Consolateur,' 'Le Christ Rémunérateur,' 'Les Bergers conduits par l'Ange,' 'Les Rois Mages déposant leurs Trésors,' 'Le Christ au Jardin des Oliviers,' 'Le Christ portant sa Croix,' 'Le Christ enseveli,' and 'Saint Augustin et sa Mère Sainte Monique,' some of which are well known in England by Engravings. S. also executed some remarkable portraits; among others, those of La Fayette, Béranger, Lamartine. He died at Argenteuil, near Paris, 15th June 1858.

SCHELDT, THE (pron. *Skelt;* Lat. *Scaldis*, Fr. *l'Escaut*), rises in the French dep. of Aisne, flows northerly to Cambrai, Valenciennes, Bouchain, and Condé, when entering Belgium, it passes Doornik, Oudenarde, Ghent, Dendermonde, Rupelmonde, and Antwerp, having received, among other tributaries, the Lys, Dender, and Rupel. Navigable from its entrance into Belgium, the S. at Antwerp becomes a noble river, of sufficient depth for large ships. From Antwerp, the course is north-west, to Fort Bath, in the Netherlands, where, coming in contact with the island of South Beveland, it divides into two arms. The left or southern, called the Honte or Wester S., takes a westerly direction, south of the islands of Zeeland, and meets the North Sea at Flushing; the northern or right arm, called the Kreekerak, flows between Zeeland and North Brabant, near Bergen-op-zoom, dividing again into two branches, the left, called the Easter S., passing between the islands of Tholen and Schouwen on the right, and the Bevelands on the left, reaches the sea through the Roompot (*Romanorum portus*); the other branch, flowing between North Brabant and Zeeland, discharges itself by several passages. These several mouths of the S., forming various islands, are called the Zeeland streams.

The Dutch had long monopolized the navigation of the lower S.; and by the treaty signed in London (April 19, 1839), the Netherlands secured the right of levying 2*s*. 6*d*. per ton on all vessels. By a treaty signed at Brussels July 16, 1863, this toll has been bought up, nominally by Belgium, but in reality from a sum of £750,000 paid to that country by the powers whose ships navigate the S., the proportion falling to Great Britain being fully £350,000.

SCHE'LLENBERG, a village in the south-east of Upper Bavaria, six miles south-west of the Austrian town of Salzburg, near which occurred the first battle of the 'War of the Spanish Succession,' in which the English took part. Maximilian-Emmanuel, elector of Bavaria, had fortified the hill of S. to resist the progress of Marlborough; but on July 4th, 1704, the work was attacked by the English, led on by Prince Ludwig of Baden, and carried by storm after a bloody fight.

SCHELLING, FRIEDR. WILH. JOS. VON, an illustrious German philosopher, was born at Leonberg, in Würtemberg, January 27, 1775, studied at Tübingen and Leipzig, and in 1798 proceeded to Jena, then the headquarters of speculative activity in Germany, through the influence of Reinhold and Fichte. S.'s philosophical tendencies were originally determined by Fichte; in fact, he was at first only an expounder, though an eloquent and independent one, of the Fichtian idealism, as one may see from his earliest speculative writings, *Über die Möglichkeit einer Form der Philosophie* (On the possibility of a Form of Philosophy, Tüb. 1795), *Vom Ich als Princip der Philosophie* (Of the Ego as the Principle of Philosophy, Tüb. 1795), and others. Gradually, however, S. diverged from his teacher, and commenced what is regarded as the second phase of his philosophy. Fichte's idealism now seemed to him one-sided and imperfect through its rigorous and exclusive subjectivity, and he sought to harmonize and complete it. The result of his speculations, in this direction, was the once famous *Identitätsphilosophie* (Philosophy of Identity), which claimed to show that the only true knowledge, and, therefore, the only philosophy, was that of the Infinite-absolute, in which the 'real' and 'ideal,' 'nature' and 'spirit,' 'subject' and 'object,' are recognized as absolutely the same; and which affirmed the possibility of our attaining to such knowledge by a mysterious process, known as 'Intellectual Intuition.' The 'philosophy of identity,' though only the second stage in S.'s speculative career, is the most important, and is the one by which he is best known in England—Sir William Hamilton having elaborately discussed it, and endeavored to demonstrate its untenableness in his essay on the 'Philosophy of the Conditioned' (see *Discussions in Philosophy and Literature, Education and University Reform*, 1852). The principal works in which it is more or less completely developed, are *Ideen zu einer Philosophie der Natur* (Ideas towards a Philosophy of Nature, Leips. 1797, 2d ed. 1803); *Von der Weltseele, eine Hypothese der Höhern Physik zur Erläuterung des allgemeinen Organismus* (Of the World-soul, an Hypothesis of the higher Physics in elucidation of the Universal Organism, Hamb. 1798, 3d ed. 1809); *Erster Entwurf eines Systems der Naturphilosophie* (First Attempt at a Systematic Philosophy of Nature, Jena, 1799); and *System des Transcendentalen Idealismus* (System of Transcendental Idealism, Tüb. 1800).

In 1803, after the departure of Fichte from Jena, S. was appointed to succeed him, but in the following year went to Würzburg, whence, in 1808, he was called to Munich as secretary to the Academy of Arts, and was ennobled by King Maximilian-Joseph. Here he lived for 33 years, during the last 14 of which he occupied the chair of philosophy in the newly-established university of Munich, but in 1841 he followed a call from Friedrich-Wilhelm IV. to Berlin, where he mainly resided for the rest of his life. He died at the baths of Ragaz, in Switzerland, August 20, 1854. We now revert to S.'s philosophical career. What may be regarded as its third period, if not its third phase, is chiefly marked by incessant controversy. With the exception of *Bruno, oder über das Göttliche und Natürliche Princip der Dinge* (Bruno, a Dialogue concerning the Divine and Natural Principle of Things, Berl. 1802), and the *Vorlesungen über die Methode des Akademischen Studiums* (Lectures on the Method of Academical Study, Stuttg. and Tüb. 1803), most of S.'s writings are polemical—often hotly so. The most notable are, his *Philosophie und Religion* (Tüb. 1804), in reply to Eschenmayer; *Denkmal der Schrift von den Göttlichen Dingen* (Tüb. 1812); in reply to Jacobi; and *Darlegung des Wahren Verhältnisses der Naturphilosophie zur verbesserten Fichte'schen Lehre* (Statement of the true relation of the Nature-philosophy to the improved Fichtian Doctrine, Tüb. 1806). Meanwhile, a most formidable adversary had risen up in his old college-friend, Hegel (q. v.), who was at first an ardent disciple of S.'s, just as Schelling had been of Fichte, but who had, in a similar manner, broken away, and was now pursuing an independent, and professedly antagonistic, course of speculation.

During the reign of Hegelianism, S. preserved an almost unbroken silence. For more than 20 years he published almost nothing, but we know that he was far from being idle. He was observing narrowly the practical as well as the speculative results of the rival system, and maturing his own philosophy for the final phase which it assumed, and which he called variously, the 'positive,' the 'historical,' and the 'system of Freedom'—the design of which was to interpret, at once philosophically and reverentially, the history, and, especially, the religious history of mankind. S. admitted that his earlier speculations, though sound in themselves, attained only to 'negative' truth, and to show that the most transcendental metaphysician need not be a Pantheist, but might be a believer in a Personal God, or even in a Trinity, with a whole Augsburg Confession to boot, he began to apply or develop in a practical way what he conceived to be the principles of his system. It cannot be said that the result has proved satisfactory, though many of his contemporaries thought it would—Neander, for example, dedicating to him, in the most eulogistic terms, the first volume of his *Kirchengeschichte*, on the ground that it was in harmony with S.'s new philosophy. The writings that contain the fruits of S.'s latest thinking were for the most part posthumously published, although a general idea of them had become known to the public through such lectures as those on the *Philosophy of Mythology*, and the *Philosophy of Revelation*. S.'s *Sämmtliche Werke* (14 vols., Stuttg. 1856—1861) were edited by his sons, Karl Friedr. Aug. and Hermann Schelling. His Correspondence was published at Munich in 1863. Various French writers, such as MM. Matter, Remusat, Cousin, Michelet, have tried (with indifferent success) to explain the great mystic to their countrymen; and English philosophical literature is dubiously associated with his name, through what may be called the somnambular plagiarisms of a kindred genius, Samuel Taylor Coleridge. These were first

pointed out by Professor Ferrier in *Blackwood's Magazine*, March 1840.

SCHE'MNITZ, the largest and most famous mining town of Hungary, stands in a narrow mountain gorge, at the height of 1054 feet, on a river of the same name, 70 miles north of Pesth. Together with its six suburbs, some of which, however, are at a distance of several miles, it has a pop. of 22,000; but the town proper has only (1869) 14,029 inhabitants. The academy for mining and wooderaft, embracing collections of minerals and a chemical laboratory, is the principal building, and forms the chief architectural feature of the town. It is attended by about 200 students, who receive lessons from six professors. A highly-esteemed kind of tobacco-pipe heads are manufactured here. The mines, which extend under the town, have been worked for centuries, though recently they have yielded but an inconsiderable profit. They produce gold and silver, as well as copper, iron, and sulphur. One of the passages is more than 9 miles long. Twelve of the mines belong to the crown, the others are private property.

SCHENE'CTADY, a city of New York, U. S., on the Erie Canal and the south bank of the Mohawk River, 16 miles northwest of Albany. It is the seat of Union College, and contains 17 churches, 4 banks, 6 newspapers, large machinery and locomotive works, 4 foundries, cotton-mills, and manufactories of shawls, agricultural implements, &c. S. was settled by the Dutch in 1661. In 1690, a large number of the inhabitants were massacred by the French and Indians. Pop. (1870) 11,026; (1880) 13,675.

SCHE'RZO (Ital. jest, sport), in Music. A term applied to a passage or movement of a lively and sportive character, forming part of a musical composition of some length, as a symphony, quartett, or sonata.

SCHE'VENINGEN (pron. *Skaveningen*), a populous and thriving village in South Holland, is situated on the coast of the North Sea, about two miles from the Hague. Pop. about 8500. Fishing is the chief industry; ship-building, rope-spinning, and making sailcloth, being also carried on. It is the most fashionable seabathing resort in the Netherlands, and is visited by many distinguished strangers, there being an excellent 'Bath House,' and other hotels. In the neighborhood, are summer residences of the royal family and nobility. A range of sand hills defends the village from the sea, which has, nevertheless, made so great encroachments that the Protestant church, originally built in the center, is now close by the strand. The road from the Hague to S. is a long avenue of fine trees and wooded banks, with a tramway for passengers and goods.

SCHIEDA'M, a town in S. Holland, situated on the Schie, which is connected with the Maas by a canal. Pop. (1875) 21,103, of whom nearly two-thirds are Protestants. The streets are narrow, irregularly built, and, compared with other Dutch towns, have a dirty appearance, from the distilleries, malting-works, and grain-mills. Gin is so largely manufactured that the air and water smell and taste of it. In 1875, 418,572 hectolitres of spirits were produced, the grain-mills and malt-works giving 24,040,771 kilogrammes of rye-meal, and 21,150,331 of malt. The neighboring meadows are rich in cattle, partly fed from distillery refuse. Imported 660,000 hectolitres rye, 900,000 barley, 17,670 wheat, &c.; exported 54,940 hectolitres of spirits, 7,600,000 kilos of yeast, &c. The sterine factory used 4,700,000 kilos tallow and palm oil, producing 1,405,000 kilos stearine in cakes, 1,825,000 kilos candles, 1,404,000 oleine, and 244,500 of glycerine. Beer-brewing, metal-founding, basket-making, cork-cutting, &c., are carried on.

SCHILLER, JOHANN CHRISTOPH. FRIEDRICH VON, one of the greatest poetical geniuses of Germany, was born at Marbach, a little town of Würtemberg, on November 11, 1759. His father, Joh. Kaspar Schiller, was overseer of the nurseries attached to a country-seat of the Duke of Würtemberg. S. received his first formal instruction from the parish priest Moser, at Lorch; and in 1773, the duke, who had formed a favorable opinion both of S. and his father, offered to educate the boy, free of expense, at the military academy founded by him at the castle of Solitude, and afterwards transferred to Stuttgart under the name of Karlsschule. The offer was accepted, and entering the rigorous academy, S. tried to devote himself to jurisprudence. His success in the new study was small, and after two years, he exchanged it for medicine. But literature, especially poetry, was the secret idol of his soul, and its chief delight. Already the characteristics of his genius—his tendency towards epic and dramatic idealism—were showing themselves in his predilections. His first literary attempts of any moment were dramatic—*Der Student von Nassau* and *Cosmus von Medici*—which were consigned (doubtless not without reason) to the fire. Meanwhile, the poet's general intellectual culture and his professional studies went steadily on; and in 1780, he passed as a military surgeon, but with no liking for such a career. In 1778, S. completed the first sketch of his memorable drama, *Die Räuber* (The Robbers), the publication of which, in 1780, excited the most violent enthusiasm among the young all over Germany, so wild, and strong, and glowing were the passion and fancy displayed in it. Respectable people, dignitaries, functionaries, and the like, were, of course, deeply scandalized; and the duke himself, a 'Serene Highness' sort of man, was induced to lecture the poet on his delinquency, and forbade him to write any more poetry 'without submitting it to *his* inspection!'

In 1782, *The Robbers* was brought upon the stage at Mannheim—the poet being present without the knowledge of his superiors, the result of which was arrest for a fortnight! This led to further complications; and finally, in October of the same year, S. fled from the harsh service of the duke into Franconia, and lived for a year under a feigned name at Bauerbach, near Meiningen, where he completed his *Fiesco* and *Cabale und Liebe*, begun at Stuttgart. *Don Carlos* was also sketched in outline here. In September 1783, he went back to Mannheim, and was for some time closely connected with actors and theatrical life. To this period belong several of his lesser poems. With the *Cabale und Liebe* above mentioned ended the first poetic period in S.'s career, otherwise known as the *Sturm und Drang* period, in which a burning energy of passion and a robust extravagance, passing often into sheer bombast of speech, are the predominant characteristics. In March 1785, S. left Mannheim, and proceeded to Leipzig, where he became acquainted, among others, with Huber and Körner, and wrote his beautiful *Lied an die Freude;* thence, after a few months, he went to Dresden, where he began the practice of composing during the night, which so fatally assisted in shortening his life. *Der Geisterseher* (The Ghost-seer), a strikingly powerful romance, was written here; and the drama of *Don Carlos* was completed. In 1787, he was invited to Weimar, and was at once warmly received by Herder and Wieland; but some years elapsed before Goethe and he could unders and one another; after that, they became the closest friends. Henceforth, S. owed more to Goethe than to all other men: we may even call the later and best writings of S. inspirations of Goethe. The study of the spirit and literature of antiquity in particular exercised a wholesome influence over him, and in his *Götter Griechenlands* (Gods of Greece), which belongs to this stage, we see how calm, and clear, and sunny his once turbid and stormful imagination was gradually becoming. Reinhold of Jena introduced him to the Kantian philosophy, and for some little time S. was in danger of lapsing from a poet into a metaphysician.

The philosophical and æsthetic treatises springing out of this new study were collected and published under the title of *Kleine prosaischen Schriften* (4 vols., Jena, 1792—1802). His *Geschichte des Dreissig-jährigen Kriegs* (History of the Thirty Years' War) originally appeared in the *Taschenkalender für Damen* (1790—1793). On the occasion of the poet's marriage in 1790 with Charlotte von Lengefold, the Duke of Meiningen made him a *Hofrath* (privy-councillor); the French Republic also conferred on him the right of citizenship; and in 1802, the emperor raised him to the rank of nobility. While staying for a year with his relatives in Würtemberg, he wrote his exquisite *Briefe über ästhetische Erziehung* (Letters on Æsthetic Culture). This period, reaching to the close of 1794, is generally regarded as S.'s *transition* period; in poetic accomplishment, it is not rich, but in earnest, thoughtful, and manifold speculation it was highly important to the poet, and we find that it prepared the way for the last and most splendid development of his genius. After 1795, the finest of his lyrics and dramas were produced—as *Der Spaziergang* and the *Lied der Glocke* (Song of the Bell) in 1796, *Wallenstein* (1799), *Maria Stuart* (1800), *Die Jungfrau von Orléans* (1801), *Braut von Messina* (Bride of Messina, 1803), and finally his greatest drama, *Wilhelm Tell* (1804). But his health had been long giving way, partly owing to a natural weakness of constitution, and partly to incessant application to study; and on May 9, 1805, he expired, at the early age of 46. Ever since his death, the fame of S. has been on the increase; he has long been recognized as, next to Goethe, the greatest poet that Germany has produced, and innumerable editions of his works have been published. See *The Life of Friedrich S.* by Carlyle (1825). There are numerous German biographies, the best being Düntzer's *S.'s Leben* (1880).

SCHINKEL, KARL FRIEDR., a German architect of great celebrity in his own country, was born at Neuruppin, March 13, 1781, and studied the principles of drawing and design at Berlin under Professor Gilly. In 1803, he went to Italy to extend his professional knowledge; but on his return in 1805, he found the aspect of public affairs so threatening that he could obtain little employment, and was forced to betake himself to landscape-painting. In May 1811, he was elected a member of, and in 1820 a professor at, the Berlin Academy of Arts. Other offices and honors were also conferred on him. He died October 9, 1841. The designs to which he chiefly owes his reputation are those of the Royal Guard-house, the Memorial of the War of Liberation, the New Theater, the New Potsdam Gate, the Artillery and Engineers' School, in Berlin; the Casino, in Potsdam; another in the

gardens of Prince Karl at Blienike, near Potsdam; and a great number of castles, country-houses, churches, and public buildings. S. was a man of powerful and original genius; his designs are remarkable for the unity of idea by which they are pervaded, and the vigor, beauty, and harmony of their details.—See Kugler's *Karl Friedr. Schinkel* (Berl. 1842).

SCHI'NUS, a genus of trees and shrubs of the natural order *Anacardiaceæ*, natives of South America. The leaves so abound in a resinous or turpentine-like fluid, that upon the least swelling of the other portions of the leaf by moisture, it is discharged from the sacs which contain it. Thus they fill the air with fragrance after rain, or if thrown into water, start and jump about as if alive, discharging jets of this peculiar fluid. The same phenomenon is exhibited by the leaves of some species of the kindred genus *Duvauo*, of which specimens are occasionally to be seen in our greenhouses. The leaves and twigs when bruised have a very strong odor of turpentine.

SCHISM, GREEK, the separation between the Greek and Latin churches, which originated in the 9th, and was completed in the 12th century. See GREEK CHURCH.

SCHISM, WESTERN, a celebrated disruption of communion in the Western Church, which arose out of a disputed claim to the succession to the papal throne. On the death of Gregory XI. in 1378, a Neapolitan, Bartolomeo Prignano, was chosen pope by the majority of the cardinals in a conclave at Rome under the name Urban VI. Soon afterwards, however, a number of these cardinals withdrew, revoked the election, which they declared not to have been free, owing to the violence of the factions in Rome by which the conclave had, according to them, been overawed; and, in consequence, they proceeded to choose another pope under the name Clement VII. The latter fixed his see at Avignon, while Urban VI. lived at Rome. Each party had its adherents, and in each a rival succession was maintained down to the council of Pisa in 1410, in which assembly both were deposed, and a third pope John XXIII., was elected. This measure not having been acquiesced in by all, a new council was convened at Constance in 1417, in which not alone the former rivals, but even the new pontiff elected, by consent of the two parties, at Pisa, were set aside, and Otho Colonna was elected under the name of Martin V. In this election the whole body may be said to have acquiesced; but one of the claimants, Peter de Luna, called Benedict XIII., remained obstinate in the assertion of his right till his death in 1430. The schism, however, may be said to have terminated in 1417, having thus endured nearly 40 years.

SCHI'SMA, the name given to one of the very small intervals known in the theory of music, which amounts to the difference between the *Comma ditonicum* and *Comma syntonicum*. See COMMA.

SCHIST (Gr. *schistos*, split), is a term applied somewhat loosely to indurated clays, as bituminous schist and mica schist. It is more correctly confined to the metamorphic strata, which consist of plates of different minerals, as mica schist, made up of layers of quartz separated by laminæ of mica; chlorite schist, a green rock in which the layers of chlorite are separated by plates of granite or felspar; and hornblende schist, a black rock composed of layers of hornblende and felspar, with a little quartz.

SCHLA'NGENBAD, one of the most distinguished spas of Germany, on the northern frontier of the Rheingau district, 6 miles west of Wiesbaden, in a beautiful and secluded situation, embosomed amid wooded hills. The water of the baths has a temperature of 80° F., and contains the muriates and carbonates of lime, soda, and magnesia, with a slight excess of carbonic acid. The baths have a marvelous effect in beautifying the skin, and in soothing and tranquillizing. The village is itself very small, and in the height of the season the pop. is only about 2000.

SCHLEGEL, AUGUST WILHELM VON, a distinguished critic, poet, and scholar, was born at Hanover, 8th September 1767, and studied at Göttingen, where he acquired a reputation by his devotion to philological and classical studies. He first began to assume a prominent position in literature, while a lecturer at Jena, contributing assiduously to Schiller's *Horen* and *Musen-Almanach*, and to the *Allgemeine Literaturzeitung*. About the same time, his translation of Shakspeare began to appear (9 vols. Berl. 1797—1810), the influence of which on German poetry and the German stage was equally great. Subsequently, the poet Tieck, with S.'s consent, undertook a revision of the work, together with a translation of such pieces as S. had omitted (12 vols. Berl. 1825, 1839, 1843); and from their conjoint labors, the people of Germany are able to form a faithful idea of the surpassing genius of our countryman. S. also delivered at Jena a series of lectures on æsthetics, and along with his brother, Friedrich, edited the *Athenaeum* (3 vols. Berl. 1796—1800), which in spite of, perhaps because of, the severity of its criticism, gave a lively and wholesome impulse to the poetry of its time. He published, besides, his first volume of poems (*Gedichte*, Tüb. 1800); and, again in company with his brother, the *Charakteristiken und Kritiken* (2 vols. Königsb. 1801).

In 1802, S. left Jena for Berlin, where he gave a second series of lectures on literature, art, and the spirit of the time. Next year appeared his *Ion*, an antique tragedy of considerable merit. It was followed by his *Span. Theater* (2 vols. Berlin, 1803—1809), consisting of five pieces of Calderon's, admirably translated, the effect of which has been to make that poet quite a favorite with the German people; and his *Blumensträusse der Ital., Span., und Portug. Poesie* (Berl. 1804), a charming collection of lyrics from the sunny south from the appearance of which dates the naturalization in German verse of the metrical forms of the Romanic races. Probably his most valuable, and certainly his most widely popular work, was his *Vorlesungen über dramatische Kunst und Literatur* (3 vols. Heidelb. 1809—1811), originally delivered at Vienna, in the spring of 1808, and translated into most European languages. During 1811—1815, S. published a new collection of his poems (*Poetische Werke*), which contains his masterpieces, 'Arion,' 'Pygmalion,' 'St. Lucas,' and is notable for the richness and variety of its poetic forms, as also for the singular facility and elegance of the versification. In 1818, S., now raised into the ranks of the nobility, and privileged to use the sacred *von* before his name, was appointed Professor of History in the university of Bonn, and devoted himself especially to the history of the fine arts and to philological research. He was one of the first students of Sanscrit in Germany, established a Sanscrit printing-office at Bonn, and an *Indische Bibliothek* (2. vols. Bonn, 1820—1826). Among the proofs of his scholarly activity in this department of knowledge, may be mentioned his edition of the *Bhagavad Gîta*, an episode from the epic poem, *Mahâbhârata*, with a Latin translation (2d ed. Bonn, 1846), and of part of the *Râmâyana* (Bonn, 1829—1839). His other works it is unnecessary to mention. S. was not happy in his domestic relations. He was twice married first to a daughter of Professor Michaelis of Göttingen, and again to a daughter of Professor Paulus of Heidelberg, but in both cases a separation soon became necessary. S. was quarrelsome, jealous, and ungenerous in his relations with literary men, and did not even shrink from slander when his spleen was excited. He died 12th May 1845.

SCHLEGEL, KARL WILHELM FRIEDRICH VON, distinguished both for his scholarship and intellectual ability, was a brother of the preceding, and was born at Hanover, 10th March 1772. He studied at Göttingen and Leipzig, and in 1797, published his first work, *Griechen und Römer* (The Greeks and Romans), which won praise from old Heyne. It was followed in the course of a year by his *Geschichte der Poesie der Griechen und Römer* (History of Greek and Roman Poetry), a sort of fragmentary continuation of the former. Both of these productions bore evidence of rich learning, independent thought, and a thorough appreciation of the principles and method of historic criticism; but the chief vehicle at this time for the dissemination of his philosophical views of literature was the sharp-fanged periodical called the *Athenaeum*, edited by himself and his brother, August Wilhelm. Proceeding to Jena, he started there as a *privat-docent*, holding lectures on philosophy, which met with great applause, and still editing the *Athenaeum*, to which he also began to contribute poems of a superior quality, and in the most diverse metres. In 1802, appeared his *Alarkos*, a tragedy in which the antique-classical and new-romantic elements are singularly blended. From Jena, he soon went to Dresden, and thence to Paris, where he gave a few more of those philosophical prelections, in the manufacture of which both he and August Wilhelm were unhappily much too expert; edited the *Europa*, a monthly journal (2 vols. Frankf. 1803—1805); and applied himself assiduously to the languages of Southern Europe, and still more assiduously to Sanscrit, the fruits of which were seen in his treatise, *Ueber die Sprache und Weisheit der Indier* (Heidelb. 1808). See PHILOLOGY.

During his residence in Paris, he also published a *Sammlung Romantischer Dichtungen des Mittelalters* (Collection of Medieval Romantic Poems, 2 vols. Par. 1804), and the pious-chivalric romance of *Lother und Maller* (Berl. 1805). On his return to Germany, he published a volume of dithyrambic and elegiac poems (*Gedichte*, Berl. 1809). At Cologne, he passed over to the Roman Catholic Church, a change to which his medieval studies powerfully contributed, and which, in its turn, no less powerfully affected his future literary career. In 1808, S. went to Vienna, where, in 1811, appeared his *Ueber die neuere Geschichte* (Lectures on Modern History), and in 1815, his *Geschichte der alten und neuen Literatur* (History of Ancient and Modern Literature). In 1822, a collected edition of his writings, in 12 vols. (*Sämmtliche Werke*), was published by himself. Subsequently, he delivered two series of lectures, one on the Philosophy of Life (*Philosophie des Lebens*, Vienna, 1828), and another on the Philosophy of History (*Philosophie der Geschichte*, Vienna, 1829), both of which are well known in England and other countries through the medium of transla-

tions. S. died 12th January 1829. His MSS. were published by his friend Windischmann (2 vols. Bonn, 1836—1837).

SCHLEIERMACHER, Friedrich Ernst Daniel, one of the greatest and most influential theologians of modern times, was born at Breslau, 21st November 1768. His boyish years were spent in the school kept by the Moravian brotherhood at Niesky, and here he first received those religious impressions the influence of which was visible in his whole after-life. In 1787, he proceeded to the university of Halle; and on the conclusion of his academic course, acted for some time as a teacher; but in 1794 became assistant-clergyman at Landsberg-on-the-Warthe, where he remained for two years. He then went to Berlin, and occupied himself partly in the translation of some of Blair's and Fawcett's Sermons, and in the redaction of the *Athenaeum*, conducted by his friend Friedrich Schlegel; but the first work that won for him general celebrity was his *Reden über die Religion* (Discourses on Religion, Berl. 1799), which startled Germany from its spiritual torpor, vindicated the eternal necessity of religion, and sought to separate those elements of it that are essentially divine from the incrustations of dogma and the formalities of practice.

Neander looked upon these *Reden* as making the turning-point in his spiritual career. They are now regarded as both making and marking an epoch in the theological history of Germany. The *Reden* were followed by the *Monologen*, and the *Briefe eines Predigers ausserhalb Berlin* in 1800. Two years later, he was appointed preacher at the Charity-house in the Prussian capital; and during 1804—1810, produced his famous translation of Plato, with commentary, which is considered in Germany, to this day, the most profound and penetrating treatise on the philosophy of the great Athenian, though English scholars are disposed to regard its criticism as decidedly too subjective, and in many important respects baseless. In 1801 appeared the first collection of his *Predigten* (Sermons), followed between 1808—1833 by no fewer than six other collections. They are masterpieces of penetrating and eloquent discussion, appealing equally to the heart and the intellect of hearers and readers. In 1802, S. went as court-preacher to Stolpe, where he published his *Grundlinien einer Kritik der bisherigen Sittenlehre;* and in 1804, was called to Holle as University-preacher and Professor of Theology and Philosophy. In 1807, he returned to Berlin, having previously published *Die Weihnachtsfeier, ein Gespräch* (Christmas Festival, a Dialogue, Halle, 1806), bearing on the calamitous state in which Germany then found herself, owing to the victorious insolence of the French. Among his next publications may be mentioned *Ueber den sogenannten ersten Brief des Paulus an den Timotheus* (Concerning the so-called first Epistle of Paul to Timothy, Berl. 1807). In 1809, he became pastor of Trinity Church, Berlin; and in 1810, when the university of Berlin was reopened, with a brilliant array of professors, under the rectorship of Fichte, no name shone more conspicuous than that of Schleiermacher. In 1811, he was chosen a member of the Berlin Academy of Sciences, in whose Transactions are to be found many valuable papers by S. on the ancient philosophy; and in 1814, secretary of the philosophical section.

In 1817, he was appointed president of the synod assembled in Berlin. His latest, and perhaps his most important work is *Der Christliche Glaube nach den Grundsätzen der Evang. Kirche im Zusammenhange dargestellt* (The Christian Faith systematically presented according to the fundamental Propositions of the Evangelical Church, 2 vols. Berl. 1821—1822), in which his deepest and most Christian thought is visible. He died at Berlin, 12th February 1834. The list of S.'s disciples—i. e., of men who have derived the groundwork of their principles from him—is one of the most splendid that any theological reformer could show, embracing, among others, the names of Neander, Nitzsch, Twesten, Olshausen, Lucke, Bleek, and Ullmann. In 1864, appeared a posthumous work of S., *Das Leben Jesu, Vorlesungen an der Universität zu Berlin im Jahr* 1832, in which he conceives of Jesus, as a man in whom the divine spirit works as perfectly as it possibly can in humanity, and treats his history accordingly. Strauss has replied in a critique (Berl. and Lond. 1865). S. was very far from what in England is called orthodox, but he was a great, earnest, devout Christian man, of massive understanding, and whose eloquence was scarcely less golden than that of Plato himself. Germany overflows with literature on S., his system, and his ideas.—Among the more important works on S. are Dilthey's *Leben S.'s* (vol. i. 1870); *Aus Schleiermacher's Leben in Briefen* (1858; Eng. transl. 1860); Bender's *S.'s Theologie* (1878); Lang, *Religiöse Charactere* (1862).

SCHLESWIG. See Slesvig.

SCHLETTSTADT (French, *Schlestadt*), a town of Lower Alsace, on the left bank of the Ill, 26 miles south-west of Strasburg. Till the war of 1870—71, S. was a French fortress of the third class. It was bombarded and compelled to capitulate, 24th Oct. 1870. The fortifications have been demolished. Pop. (1875) 9094; (1880) 8979.

SCHLOSSER, Friedr. Christoph, a distinguished German historian, was born at Jever, 17th November, 1776, educated at Göttingen, and after spending many years as a private tutor and academic teacher, he was, in 1817, called to Heidelberg as a Professor of History, where he died, September 23, 1861. His principal writings (arranged in the order of time) are *Abälard und Dulcin* (Gotha. 1807); *Leben Beza's und des Peter Martyr Vermili* (Heidelb. 1809); *Geschichte der Bilderstürmenden Kaiser des Oeström Reichs* (Frankf. 1812); *Weltgeschichte in Zusammenhängender Erzählung* (Frankf. 1817—1824); *Geschichte des* 18 *Jahrh.* (Heidelb. 1823); *Universalhistorische Uebersichte der Geschichte der Alten Welt und ihrer Cultur* (Frankf. 1826—1834); *Weltgeschichte für das Deutsche Volk* (1844—1853); and *Studien über Dante* (1856). Of these works, the most notable are the *Geschichte des* 18 *Jahrh.*, continued by S. in the later editions till the fall of Napoleon, and the *Weltgeschichte für das Deutsche Volk*, which have been translated into English and other tongues. S. is a keen, critical, and powerful writer, who judges men and events by a stern ethical standard.

SCHMALKALD, League of, the name given to the defensive alliance concluded provisionally for nine years at Schmalkalden (q. v.), 27th February, 1531, between nine Protestant princes and eleven imperial cities, with whom other five princes and ten imperial cities subsequently made common cause; and the Elector of Saxony and the Landgrave of Hesse were appointed chiefs of the league, and empowered to manage its affairs. The object of this formidable alliance, which included the whole of Northern Germany, Denmark, Saxony, and Würtemberg, and portions of Bavaria and Switzerland was for the common defence of the religion and political freedom of the Protestants against the Emperor Charles V. and the Catholic states. The league was not rendered superfluous by the religious peace of Nürnberg in 1532, and on the rumor that the emperor was meditating new hostile measures against the Protestants, another meeting of the confederates was held 24th December, 1535, which resolved to raise a permanent army of 10,000 foot and 2000 cavalry, and to prolong the league for ten years.

The confederation was further consolidated by articles of guarantee which were drawn up by Luther at Wittenberg in 1536, and being subscribed by the theologians present at the meeting of the league at Schmalkalden in February 1537, were called the *Articles of Schmalkald*. Against the league, the emperor, engaged as he was at the time in contests with the Turks and French, found himself unable to contend, though supported by the Holy League, a Catholic confederation formed in 1538, in opposition to the Protestant one. But impolitic management, mutual jealousies, and conflicting petty interests, dissipated their energies, and prevented united action. The 'War of Schmalkald' commenced by the advance of the army of the league, under Sebastian Schärtlin, into Swabia, to bar the approach of the imperial army from Italy. Schärtlin forced his way to the banks of the Danube, but the miserable jealousy of the Saxon princes paralyzed his action. The emperor, by a proclamation bearing date 20th July 1546, put the two chiefs of the league under the ban of the empire; Maurice, Duke of Saxony, took possession of the electorate, by virtue of an imperial decree; and the Protestant army was forced to retreat. The Elector of Saxony reconquered his electorate in the autumn of 1546, but meantime the imperial army subdued the northern members of the League of S., and advanced into Franconia to meet the combined armies of Saxony and Hesse. The latter were totally routed at Mühlberg (24th April 1547), and both chiefs fell into the emperor's hands. This defeat, which has been ascribed to treason, and was perhaps as much owing to this cause as to weakness, finished the war. The object of the league, the guarantee of the liberty of religion to the Protestants, was subsequently effected by Maurice, now Elector of Saxony, who, by a brilliant feat of diplomacy and generalship, compelled the emperor to grant the treaty of Passau (31st July 1552), by which this freedom was secured.

SCHMA'LKALDEN, an old and interesting town of Hessen-Nassau, Prussia, at the confluence of the Stille and Schmalkald, 11 miles north of Meiningen. It is surrounded with double walls, contains two castles, and carries on considerable mining operations, especially in iron, and various manufactures, the chief of which are hardwares. Pop. (1880) 6452.

SCHNEE'BERG, a pleasantly-built and important mining town of Saxony, surrounded by mountains, 20 miles south-west of Chemnitz. The principal products of the mines are silver (though not in its former great abundance), cobalt, bismuth, and nickel, iron, &c. Cloth, shoes, and cigars are manufactured. Pop. (1880) 7642.

SCHNEE'KOPPÉ, the culminating point of the mountain chain of the Riesengebirge. See Bohemia.

SCHOLARSHIP, a benefaction, generally the annual proceeds of a bequest permanently invested, paid for the maintenance of a student at a university. At the university of Oxford there are

37, and at Cambridge, 43 scholarships; their values ranging from £20 to £100 per annum. In both universities, the scholars are chosen from the undergraduates, and are often elected before they have begun their attendance at the university. They are on the foundation, but their connection with the college is not so intimate as that of the Fellows. The regulations under which they are placed, and the advantages which they enjoy, differ in the different colleges. A number of the scholarships which were formerly restricted have recently been thrown open to public competition. The Bursaries (q. v.) of the Scottish universities are nearly analogous to the Scholarships of the English.

SCHOLA'STICS, or SCHOOLMEN, originally the name given to the teachers of rhetoric at the public schools under the Roman empire, but now used almost exclusively to denote the so-called philosophers of the middle ages. After the fall of the old classic civilization, there ensued a long anarchy of barbarism, lasting from the 6th to the 8th c.; but from the time of Charlemagne, a visible improvement took place. That great monarch encouraged learning; and the monasteries as well as the schools which he established, became subsequently the seats of a revived culture of philosophy. Conformably, however, to the spirit of a time in which learning and literary skill were confined to churchmen, philosophical activity showed itself chiefly in the domain of theology. This preparatory period of scholasticism—say from the 9th to the 11th c.—embraces the distinguished names of Johannes Erigena Scotus (see ERIGENA), who cannot, however, be properly classed among the Scholastics; Gerbert of Aurillac, afterwards Pope Sylvester II. (q. v.); Berengarius (q. v.) of Tours; and Lanfranc (q. v.), Archbishop of Canterbury. A further development of Scholasticism occurred towards the middle of the 12th c., when Roscelinus opened up the question concerning the nature of universal conceptions, which led to the great struggle between the *Nominalists* (q. v.) and *Realists* (q. v.). This struggle terminated in the triumph of the latter; and henceforth, during the golden age of Scholasticism (the 12th and 13th centuries), it continued to be the prevalent mode of thought in philosophy. Still, however, Scholasticism regarded philosophy as dependent on theology. No one dreamed of doubting, or at least of disputing the truth of any of the church doctrines. These were alike too sacred and too certain to be so handled, and the only thing left for a humble philosopher to do was, in fact, to sort and systematize them: hence the expression *philosophia theologiæ ancilla* (philosophy is the handmaid of theology), which has found its way down to modern times.

Whatever did not directly belong to ecclesiastical dogma, was either neglected or treated in accordance with the vague traditions of Platonic or Aristotelian thought handed down from antiquity. Hence sprung that vast array of artificial subleties and distinctions which had no better foundation to rest on than gross ignorance of the matters discussed, combined with a restless speculativeness. The formulas of logic were abused through an irrational realism, which regarded them not only as a means to the attainment of philosophical knowledge, but as the material organon of philosophy itself. At first, the dialectic treatment of dogma was only fragmentary, as we see it in the principal Scholastics of the 12th c., Gilbert de la Porrée, Alanus ab Insulis, and Petrus Lombardus (q. v.). During the 12th c., however, the increased intercourse of the West with the Arabs and Greeks led to a more definite acquaintance with the physical and metaphysical writings of Aristotle, though still only through the medium of incomplete translations, and in this way the circle of vision of the Scholastics at least widened, if it did not become clearer. From this period dates the almost *papal* authority of the great Stagyrite in philosophy, and the rise of the vast and elaborate systems of medieval theology. The three chiefs of Scholasticism is this, its highest development, were Albertus Magnus (q. v.), Thomas Aquinas (q. v.), and Duns Scotus (q. v.); around each of whom stand groups of more or less independent scholars and followers. The celebrity of such teachers was largely increased by the want of books, which compelled their pupils to rely upon their oral communications, and necessitated those extraordinary public disputations which were the only means 'philosophers' had of advertising their wares in the middle ages. The honor paid to them by their admirers is visible in the epithets attached to their names; thus, Alanus is the *Doctor universalis;* Alexander Hales (q. v.), the *Doctor irrefragabilis;* Duns Scotus, the *Doctor subtilissimus;* Thomas Aquinas, the *Doctor angelicus;* Guilaume Durand of St. Pourcain, the *Doctor resolutissimus,* &c.

With Thomas Aquinas and Duns Scotus, Scholasticism culminated. After their time, various causes co-operated to bring about its decline and fall. The mystical theology (see MYSTICISM) gradually developed its natural antagonism to speculations resting on a basis of formal logic, and not appealing to the human heart and spirit. Such men as St. Bernard (q. v.) of Clairvaux, and the monks of St. Victor at Paris, in the 12th c.; together with Bonaventura, in the 13th, were unconsciously hostile to the dominant style of thought; while in the 14th and 15th centuries, Tauler, Thomas à Kempis, Gerson, Nicholas of Clemangis, and others, deliberately set themselves against it. The very nature of the Scholastic thought was inimical to its own perpetuity. The hyper-logical, hair-splitting course which it followed produced rival systems, and results discordant with the doctrines of that theology which it undertook to support, until it finally laid down the astounding proposition, that a thing might be philosophically true and theologically false, and *vice versâ*. The quarrels of the two great orders—The Dominicans and the Franciscans—each of which took part with its metaphysical chief; the former being called Thomists (from Aquinas), and the latter, Scotists (from Duns Scotus), materially injured the common cause of Scholasticism; and the revival of Nominalism under William of Occam (q. v.), its most distinguished advocate, powerfully contributed to the same result; but it was not till after the revival of letters had done its work of enlightening the judgment and purifying the taste of Europe, that Scholasticism was visibly in danger.

The reformation shook the system to its foundations—Luther himself leading the assault with the strength and valor of a Cœur-de-Lion; but still, so tenaciously did it cling to the semblance of life, that in the universities it held its footing till the 17th c., and even later. In fact, in some Roman Catholic states, such as Spain, it is still almost the only kind of philosophy going. The two great intellectual reformers whose writings mark the transition from the medieval to the modern mode of thought, are Lord Bacon (q. v.) and Descartes (q. v.), who may be said to have administered the death-blow to Scholasticism. The literature of this phase of speculation is enormous, and few critics have ventured far into its cob-webbed regions. For example, the printed writings of Albertus Magnus, Thomas Aquinas, and Duns Scotus, amount to 51 folio volumes; but however glad we may be that the reign of Scholasticism is over, and however thankful to men like Laurentius Valla, Erasmus, Rudolf Agricola, and Ramus, who riddled its ancient and time-honored flag with the sharp shot of their wit and logic, we ought never to forget, that in ages when the conditions of scientific knowledge or refined taste did not exist, these old monkish dialecticians kept alive the philosophical faculty in Europe by the vivacity and restless ingenuity with which they prosecuted their fantastic speculations.

SCHOMBURGK, SIR ROBERT HERMANN, a celebrated traveler, was born at Freiburg in Prussian Saxony, June 5, 1804. He began at an early age to apply himself to geographical science and natural history, and subsequently made an abortive attempt to succeed as a tobacco-manufacturer in Virginia, United States. In 1830, he went to Anegada, one of the Virgin Isles, and having, by the advice of the governor, carefully surveyed the island, and laid a report before the Royal Geographical Society, he was charged by that learned body with the survey of Guiana in 1835. This enterprise, which was surrounded with formidable difficulties, he satisfactorily achieved, and from time to time laid the results of his investigations before the Society, in whose *Journal* they were regularly published. It was during this exploration, and while he was ascending the Berbice River, that he discovered, January 1, 1837, the magnificent aquatic plant denominated the *Victoria regia* (q. v.).

On his return to England in 1839, he was presented with the medal of the Geographical Society for his *Travels and Researches in British Guiana in* 1835—1839 (Lond. 1840), a work which largely contributed to almost every branch of natural science. In 1840, he returned to Guiana, this time under the auspices of the British government, to complete his survey of that country, and survey the boundary-line between it and Brazil; and on his return in 1844, after the completion of his labors, he received the honor of knighthood. The *Description of British Guiana,* a valuable work, was the fruit of this expedition. In 1847, he published an excellent and elaborate *History of Barbadoes,* and in the following year departed for San Domingo, whither he had been accredited as British consul and representative. In this new sphere, he continued to pursue his geographical and scientific researches, the results of which he communicated in Reports to the Geographical Society till 1853. In 1857, he was appointed British representative to the Siamese court. He returned ill in 1864, and died next year.

SCHÖNBEIN, CHRISTIAN FRIEDRICH, a German chemist, was born at Mitzingen in Würtemberg, 18th October 1799, studied natural science at Tübingen and Erlangen, and in 1824—1825 taught chemical physics at Keilhau, near Rudolstadt. To increase his knowledge, he visited England in 1826, repairing thence to Paris; and in 1828 he was called to a chair in the university of Basel, where his eminent qualifications were speedily recognized. In 1839, he discovered *Ozone* (q. v.), and invented *Gun-cotton* (q. v.) in 1845, obtaining from it by dissolution in ether the material called Collodion (q. v.). In his later years, he confined himself chiefly to experiments with oxygen. Of his works, which generally first appeared in periodicals, the chief are—*Das Verhalten*

des Eisens zum Sauerstoff (Basel, 1837), *Beiträge zur physikalischen Chemie* (Basel, 1844), *Ueber die Erzeugung des Ozons* (Basel, 1844), *Ueber die langsame und rasche Verbrennung der Körper in atmosphärischer Luft* (1845). He died in 1868.

SCHÖNBRUNN, a royal palace in the outskirts of Vienna (q. v.), the summer residence of the imperial family.

SCHÖ'NEBECK, a manufacturing town of Prussia, ten miles south-east of Magdeburg, on the left bank of the Elbe. The chemical works, which give employment to about 400 men—the salt refineries, where the brine obtained from the abundant salt-springs is boiled down, and salt made to the annual value of 413,000 thalers—and the breweries and distilleries, are the principal industrial establishments. Pop. (1880) 12,333.

SCHOOLCRAFT, HENRY ROWE, American author, geologist, and ethnologist, was born at Watervleit (now Guilderland), New York, March 28, 1793. He entered Union College in his fifteenth year, and studied French, German, Hebrew, chemistry, and mineralogy. In 1817—1818, he visited the mining region west of the Mississippi, sent a collection of minerals and geological specimens to Washington, and wrote *A View of the Lead Mines of Missouri*, &c. (8vo, New York, 1819), and a narrative, since enlarged, entitled *Scenes and Adventures in the semi-alpine Region of the Ozark Mountains of Missouri and Arkansas* (8vo, Philadelphia, 1853). In 1820, he was appointed geologist of an exploring expedition to the Copper Regions of Lake Superior and the Upper Mississippi. He was afterwards secretary of a commission appointed to investigate Indian claims and negotiate treaties, at Chicago. As the result of these labors, he made a report to the government and wrote also *Travels in the Central Portion of the Mississippi Valley* (8vo, New York, 1825). In 1822, he was appointed Indian agent for the north-western frontier, and established himself at Sault Ste. Marie. In 1823, he married Miss Johnston, grand-daughter of an Indian chief, who had been educated in Europe. At this period, being in intimate relations with many Indian tribes, he devoted himself to the study of their history and ethnology.

From 1828 to 1832, he was an active member of the legislature of Michigan Territory, and founded its Historical Society, and the Algic Society of Detroit. For his Lectures on the Indian Languages, he received the gold medal of the French Institute. Adding poetry to science, he wrote: *The Rise of the West; Geehale, an Indian Lament; Indian Melodies; The Man of Bronze, or Portraitures of Indian Character; Iosco, or the Vale of Norma;* also a grammar of the Algonquin language. In 1832, he was appointed to the command of an expedition which discovered the sources of the Mississippi, the *Narrative* of which was published (8vo., New York, 1834). As superintendent and disbursing agent for the Indians, he negotiated treaties by which the government acquired lands to the extent of 16,000,000 acres. He visited Europe in 1842, and the following year he made a tour, chiefly for the observation of Indian antiquities, in Western Virginia, Ohio, and Canada. In 1845, he collected the statistics of the Six Nations, and published *Notes on the Iroquois*, &c. (8vo., Albany, 1848). In 1847, the United States Congress authorized his publication of *Historical and Statistical Information concerning the History, Condition, and Prospects of the Indian Tribes of the United States, in six volumes quarto, with* 336 *Plates by Major Eastman and others* (Philadelphia, 1851—1857). He also published *Algic researches; Thirty Years with the Indian Tribes of the North-western Frontier; The Indian in his Wigwam*, &c. In 1847, he was married, for the second time, to Miss Howard of South Carolina. He died in 1864.

SCHOOLMASTER, ARMY AND NAVY. In the Army, the schoolmaster is a non-commissioned officer of the first class, ranking next to a sergeant-major. His pay varies with length of service, rising gradually from 4*s*. a day on appointment, to 8*s*. a day after long service. He has an advantage over other non-commissioned officers in quarters and certain allowances. To become an army schoolmaster, it is necessary either to be a certificated schoolmaster, or to have served the apprenticeship as a pupil-teacher, and to pass through a course of training for one year at the Normal School in the Royal Military Asylum, Chelsea. After the completion of the training, the candidate is required to enlist as a common soldier for ten years' general service, whereupon he is immediately promoted to the rank of schoolmaster. A few of the most deserving schoolmasters are promoted to be sub-inspectors of schools, when they rank as lieutenants, and have 10*s*. a day for pay. The duties of the schoolmaster are to teach the soldiers and their children the rudiments of general knowledge, to examine the girls' school, and to deliver lectures to the soldiers. There were, in 1880, 176 army schoolmasters, besides 13 sub-inspectors.

In the Navy, the schoolmaster is a chief petty officer, whose duties are analogous to those of the army schoolmaster, except that he has no pupils younger than the ship's boys. Among the subjects he teaches are the taking of solar and lunar observations, and the elements of navigation. His pay ranges from 4*s*. to 6*s*. a day.

SCHOOLMISTRESS, ARMY, is a person attached to each regiment or corps for the purpose of instructing the daughters of soldiers and their sons, under eight years old in the rudiments of English and in plain needlework. She must be a certificated schoolmistress, or a pupil-teacher who has served her apprenticeship. After admission to the service, she is specially trained for six months at one of four training institutions. This training is at the expense of government. The salary of a schoolmistress varies from £30 a year in the third class to £50 a year in the first class. Proper provision is made for the quarters and supplies of the schoolmistress, whose somewhat anomalous position among rough men calls for the most circumspect behavior. The annual charge (1880—1881) for army schoolmistresses amounted, for 167, to the sum of £5450.

SCHOOLS, BROTHERS OF CHRISTIAN, a religious congregation in the Roman Catholic Church, established for the religious and secular education of the poor. It originated in France in the end of the 17th c., and was organized by a charitable ecclesiastic, the Abbé de la Salle, canon of the church of Rheims. The members are all lay brothers, and are subject to one general head. Houses of the order are found in almost every country of Europe. In France, this congregation was one of those which were specially excepted from among the suppressed orders, and which were re-established in France by General Bonaparte in the concordat of 1801. It continues to flourish in that country, as also in Belgium, Italy, Southern Germany, Great Britain, and North America. The brethren are bound by the ordinary religious vows of poverty, chastity, and obedience. Their system of education has received the highest testimonies, and they still form one of the most flourishing of all the lay orders in the Roman Church, numbering, it is said, nearly 3000 members. Besides this order, which is of French origin, similar institutes have been formed under the same or analogous names in other countries, the several varieties of which it would be tedious to enumerate.—SISTERS OF THE CHRISTIAN SCHOOLS. Several congregations of women for the education of poor female children also exist in the Roman Catholic Church. A long catalogue of these, with the history of their origin, and their specific constitution, will be found in Wetser's *Kirchen-Lexicon*, vol. ix. pp. 782—784.

SCHOOLS, PUBLIC AND GRAMMAR. Under their respective heads, GYMNASIUMS, EVENING SCHOOLS, REFORMATORY SCHOOLS, and INDUSTRIAL SCHOOLS, have been treated of at sufficient length for the purposes of an encyclopædia. The list of educational institutions would, however, be incomplete were nothing to be said regarding the Public and Grammar schools of England. By the term 'public schools' are generally designated the ancient foundations of Winchester, Eton, Harrow, Rugby, Westminster, Charter-house, Shrewsbury, St. Paul's School, and Merchant Taylors.' But there exist more modern seminaries, which have been instituted chiefly on the model of these, such as Marlborough College, Cheltenham College, and Wellington College. Endowed Grammar Schools of old foundation exist in almost all the principal towns of England, and are frequented both by day pupils and boarders from the country. As almost all the independent and endowed grammar schools of England are taught by men whose notions of school discipline have been formed at one or other of the great public schools, these may fairly be added to those already enumerated as in point of fact Public schools. The course of instruction pursued, the methods of teaching, and the habits of life and of discipline, will be found to be substantially similar in all endowed middle schools, whether called Public or Grammar schools. A great number of these schools derive not only the *fixed* emoluments of the masters from old bequests, but also the means of boarding and educating a certain number of boys on the foundation. It was originally for these foundationers or collegians that a large proportion of the old schools were founded; but round them has grown up a large community composed of pupils from all parts of the British dominions, tutors, and keepers of boarding-houses.

The foundationers consequently form simply the nucleus of these schools. The course of instruction is intended to prepare for the universities, and is consequently adapted to this purpose. Latin and Greek form the basis of the whole instruction; geography, ancient history, arithmetic, and mathematics being admitted to a very subordinate place in the curriculum. The school-time devoted to arithmetic and mathematics is now, however, considerably greater than was formerly given, and modern languages and the elements of science begin to receive a larger share of attention. There are, of course, tutors available at these educational seats for all usual branches of instruction, including music and drawing; but these subjects are alien to the proper work of the school, and do not affect the standing or promotion of the pupils. At Rugby, the school course includes *both* French and German, and natural science is admitted as an alternative study with these. In the more modern institutions, such as Marlborough, Cheltenham, and Wellington Colleges, attempts have been

made to provide a modern course of instruction, running parallel with the classical, for the benefit of those boys who either show an inaptitude for classical studies, or who are not destined for the universities. That a sound education may be obtained by means of science and modern languages cannot be doubted; but its value, as compared with classical discipline, even for those who do not contemplate a university course, or one of the learned professions, is still an open question. If, however, it be the case that there is a natural inaptitude in some boys for linguistic discipline, who *yet* possess capacity for scientific study or the acquisition of a modern language, we are driven to the conclusion, that such a course of study ought to be provided for this portion of the youth of Great Britain. Whether it ought to be provided at the existing grammar and public schools, is a subject at present keenly debated, but must be ultimately very much a question of finance.

In Germany, many of the gymnasiums provide a course of modern or *real* study, and this, combined with the wide diffusion of middle-schools, under the name of *Real-schulen*, meets all the reasonable wants of that portion of the middle class which does not contemplate a professional life. In France, the *Lycées* provide an ancient and modern course, running parallel with each other, for all pupils above a certain age. Up to that age, all are taught the same subjects. In Scotland, the number of middle schools in important towns, either established by private enterprise or by the town council or endowment, renders it unnecessary for boys to seek away from their homes the preparation necessary for either the Scottish universities or commercial life. The Scotch schools are elastic in their system, adapting themselves to the wants of parents, and all of them admit the modern element into their course of study; but the curriculum of study does not carry pupils so far as it ought, and the funds of the schools are wholly inadequate.

The 'Schools Inquiry Commission' reported on the grammar schools of England in 1868, and their Report led to the appointment of an endowed Schools Executive Commission for purposes of Reform. The Scotch Endowed Schools Commission reported to government in 1874–75.

SCHOOLS, REGIMENTAL, in the British army comprise the school for adults and boys above eight years of age, under the Schoolmaster (q. v.), and the infant and industrial schools under the Schoolmistress (q. v.), for girls and little boys. In the first, plain subjects are taught to soldiers who voluntarily attend, or to soldiers' children. The education is wholly secular: the only theological teaching being exposition of a portion of Scripture during the first half hour of morning school; but even at this, attendance is at the option of the parents. The infant school is conducted on similar principles. The industrial school is to fit girls for the occupations of life, and to render them capable of entering domestic service; a grant of money is made by government for the provision of materials. There is a school of each sort in every battalion of infantry or regiment of cavalry, the total cost of which amounts, for 1880, to £35,704. Adult soldiers are admitted gratuitously; for children, there is a nominal charge of 1*d*. each a month. The orphans of soldiers and the children of soldiers serving abroad are received at any neighboring school without payment; those of pensioners, contractors, &c. at 3*d*. a month; and the children of officers at 5*s*. a month. It is forbidden that any difference should be made in the schools, in the treatment of these different classes of pupils.

SCHOONER is a swift, sharply-built vessel, carrying usually two masts, though occasionally a greater number, and commonly

Topsail Schooner.

is of small size. There are two classes of schooners—the 'fore-and-aft schooner,' or schooner proper, and the 'topsail schooner.' In the former, both foremast and mainmast are rigged like the mainmast of a cutter, with four-and-aft sails. In the latter, the foremast carries a square topsail and a square topgallant-sail. Off a wind, the former rig has a great advantage, as the schooner can sail up within 4½ or even 4 points of the wind; but before the wind, the square topsail gives the advantage to the topsail schooner; and as the latter can on occasion strike her squaresails, and set a fore-and-aft topsail in their place, she has usually the preference. No sailing-vessel is faster than a schooner of fine build, when she

Fore-and-aft Rigged Schooner

carries ample canvas; hence it is a favorite form for the larger class of yachts; and before the introduction of steam dispatch-vessels, was employed much in the packet service. Schooners are still employed in the navy as revenue cruisers; and to a great extent in the merchant service, for running small cargoes, and especially those of perishable goods, as fish or fresh fruit. They are easily managed by a small crew; but from the sharpness of their build, have no great amount of stowage.

SCHOPENHAUER, ARTHUR, a German philosopher, son of Johanna Schopenhauer, an authoress of considerable distinction (born 1770, died 1838), was born at Danzig, 22d February 1788. He studied first at Göttingen, where the lectures of Schulze inspired him with a love of philosophy, and afterwards at Berlin and Jena, in the last of which places he graduated in 1813. During the same year, he published his first treatise, *Ueber die vierfache Wurzel des Satzes vom zureichenden Grunde* (Rudolst. 1813, 2d ed. Frankf. 1847), in which he lays down the logical basis of his future system. S. spent the winter of 1813 at Weimar, where he enjoyed the society of Goethe, and the orientalist Friedr. Maier, who first turned his attention to the ancient Indian literature and philosophy, the study of which exercised a great influence on his future development. He then proceeded to Dresden, where he published a treatise on Sight and Color (*Ueber das Sehen und die Farben*, Leip. 1816), which was followed, three years later, by his great work, *Die Welt als Wille und Vorstellung* ('The World considered as Will and Idea, Leip. 1819; 2d ed. 1844). After 1820, S. lived partly in Italy and partly in Berlin, up till 1831, when he fixed himself in Frankfurt-on-the-Maine, devoting himself uninterruptedly to the elaboration of his system. The fruits of his studies were *Ueber den Willen in der Natur* (Frankf. 1836); *Ueber die Freiheit des Willens, Ueber das Fundament der Moral*, the supplements to his principal work, which appear in the 2d edition of 1844; and *Parerga und Paralipomena* (Berl. 1851). He died September 21, 1860. The fundamental doctrine of S. is, that the only essential reality in the universe is will; that what are called appearances exist only in our subjective representations, and are merely forms under which single original will shows itself.

This will is not necessarily accompanied by self-consciousness, though it ever strives after its attainment, and hence S. declared himself the uncompromising opponent of all the contemporary systems—those of Fichte, Schelling, and Hegel—in which the 'Absolute Reason,' 'Consciousness,' &c., are posited as the necessary basis of thought. For his great rivals, S. professed the most unmeasured scorn—calling Hegel, for example, a mere 'scribbler of nonsense'—and in return was treated by them with such sovereign contempt, that for years his name was almost unknown to the majority of German students. The ethics of S. are based on a thoroughly pessimistic theory of life. S. has of late had a great influence on philosophical speculation. The literature of the subject is boundless; some of the chief writers on S. being Frauenstädt, Cornill, Asher, Seydell, Haym, and Hartmann; in French, Ribot. See Miss Zimmern's *Life of S.* (1876).

SCHORL. See TOURMALINE.

SCHORL ROCK is a granitoid rock, in which the mica is replaced by schorl or tourmaline. Some specimens occur in which the felspar is also absent, and the mass is composed entirely of quartz and schorl. Schorl rocks are rare, occurring probably only as small bosses in granite.

SCHOTTI'SCHE (a Frenchified form of the German word for *Scottish*) a somewhat fanciful name given to a slow modern dance in $\frac{2}{4}$ time.

SCHOUW'EN, an insular portion of the province of Zeeland (q. v.). Pop. 20,000.

SCHREVELIUS, CORNELIUS, a Dutch scholar, was born at Haarlem in 1615. In 1642, he succeeded his father as rector of the university of Leyden, and died 11th September 1664. S. was a laborious and erudite man, but possessed little critical discernment. His most notable performance was a *Lexicon Manuale Græco-Latinum et Latiano-Græcum* (Leyden, 1654, 1657, 1664), of which there have been innumerable editions. S. also executed many *variorum* editions of the classics—Juvenal (1648), Hesiod (1650), Terence (1651), Virgil (1652), Horace (1653), Homer (1656), Martial (1656), Lucan (1658), Cicero (1661), Ovid (1662), and Claudian (1665).

SCHUBERT, FRANZ PETER, a German composer, was born in Vienna, Jan. 31, 1797. He began to compose about the age of twelve, and from that time onwards proceeded from his pen a series of works, increasing year by year in number and importance. His life was uneventful, but he underwent much suffering from poverty and want of recognition. For long after his death, which occurred Nov. 19, 1828, he was almost solely known by his songs, of which alone 457 are now published. But more recent years have brought to light a vast store of orchestral and chamber music, foremost among which stands his great symphony in C. His known works amount to over 1000. His music is distinguished above all by its overflowing wealth of expressive melody, control over its exuberance being perhaps his only want. His operatic works have probably owed their ill success mainly to the worthlessness of their *libretti*. His characteristics may be summed up in Liszt's words, 'the most poetical musician that ever was.'

SCHUMANN, ROBERT ALEXANDER, a German composer, was born at Zwickau, in Saxony, June 8, 1810. His gift for music showed itself early. After passing more than two years, in obedience to his mother's wish, in the study of law at the university of Heidelberg, he was at length permitted to devote himself to music. His ambition at first was to excel as a pianist, but owing to the disablement of one of his fingers, he was compelled to relinquish this aim. His efforts were then directed for a while almost exclusively to the composition of pianoforte music, in which he originated a completely new style, reflecting his own dreamy imaginative nature, often exhibiting genuine humor, and always thoroughly solid. About the time of his marriage, in 1840, to Clara Wieck, one of the greatest living pianists, he produced a series of songs, remarkable for their profound suggestiveness, which have taken a lasting hold on the kindred minds of his countrymen. His piano concerto, and five symphonies, productions of later life, are generally considered the finest of their class since Beethoven's. He has also produced some choral works of the highest class, notably the cantata, *Paradise and the Peri*, and settings of parts of Goethe's *Faust* and Byron's *Manfred*. Among his chamber music his piano quintet claims the highest rank. From 1834 to 1844, S. was editor of the famous *Neue Zeitschrift für Musik*, originated principally by himself; and his critical contributions have a foremost place in the literature of art. S. died at Endenich, near Bonn, July 29, 1856. Since then his name has been the watchword of the *Romantic* school of music, in opposition to the *Ideal*, represented by Mendelsshon; but during their lives these composers stood on terms of the warmest mutual esteem, and there seems no reason why the two schools should not co-exist in the same amicable relations.

SCHUY'LKILL, a river of Pennsylvania, U. S., which rises in the carboniferous highlands of the eastern center of the state, and flowing 120 miles south-east, empties into the river Delaware 5 miles below Philadelphia.

SCHWANTHALER, LUDWIG MICHAEL, a celebrated German sculptor, was born in 1802 at Munich, where his father, Franz Schwanthaler, practised the same art. Young S. entered his father's workshop at the age of 16; and on the death of the latter in 1821, he undertook to carry on his father's business. His first important commissions were received in 1824 from King Maximilian. After a brief residence in Rome, he set up a studio of his own at Munich, and shortly after executed for the *Glyptothek* there two fine bas-reliefs from Homer: 'Achilles struggling in the Scamander,' and the 'Battle by the Ships,' besides a statue of Shakspeare for the saloon of the theater, and the Bacchus-frieze for the Banqueting-hall in the Palace of Duke Maximilian. In 1832, he revisited Rome, for the purpose of preparing models for that portion of the national monument of Valhalla intrusted to his supervision. He remained two years. On his return to Munich, he began his bas-reliefs to illustrate Pindar's *Epinikia* (Triumphal Odes) and the myth of Aphrodite, the latter of which is a frieze. In 1835, he was appointed professor at the Munich Academy. Henceforth, the interest of his career is mainly professional; but the number of his works is singularly great, while their excellence is such as to place him in the first rank of German sculptors. His distinguishing characteristics are a thorough originality of design, and boldness of imagination; while the extraordinary extent of his acquaintance with the sculpture of Greece and of the Middle Ages gave a great richness and variety to his execution of details. Among his works may be mentioned 24 statuettes in the *Pinakothek* at Munich; the great bas-relief frieze (in the Barbarossa Hall), more than 200 feet long; the models for the 12 statues of the ancestors of the House of Wittelsbach, the 15 colossal statues for the front pediment of the Valhalla, the models of the 15 statues of the 'Battle of Arminius' for the northern end of the same structure, and the model of the colossal statue of Bavaria, 54 feet high; a marble statue of the Emperor Rudolf for the cathedral of Spires, models for the statues of Goethe and Jean-Paul Richter, a statue of Mozart, marble groups of Ceres and Proserpina (at Berlin), &c., besides numerous other works executed by his pupils from his designs. He died in 1848.

SCHWARZ, CHRISTIAN FRIEDRICH, a distinguished German missionary, was born at Sonnenburg, in Brandenburg, October 26, 1726. He studied at Halle, and having resolved to become a missionary in the East Indies, obtained ordination at Copenhagen, with the view of joining the Danish mission at Tranquebar, where he arrived in 1750. His career is a beautiful example of what may be accomplished when piety, integrity, good sense, and a charity that knows how to prevent the virtue of zeal from lapsing into the vice of fanaticism, unite harmoniously in a man. After laboring 15 years at Tranquebar, he went to Trichinopoly, where he founded a church and school, and also acted as chaplain to the garrison. Here the fruits of his long and consistent career of pious activity gradually began to show themselves in considerable conversions from Hinduism. In 1777, another missionary was sent to his assistance; and by the permission of the Rajah of Tanjore, whose friendship he had acquired, he built a church in that city. So highly did the native rulers admire his integrity, that once, when Hyder Ali, of Mysore, was arranging terms of peace with the Madras government, he demanded that S. should act as their agent—'him, and no other one,' said the Sultan, 'will I receive and trust.' On this occasion, S. resided three months at Seringapatam. During the terrible Carnatic war which soon after followed (1781—1783), and for which S. thought the British were to blame, a striking testimony was given of that universal respect entertained for his character. The inhabitants and garrison of Tanjore were dying of starvation, and neither the British nor the Rajah could induce the cultivators to sell them provisions. In despair, S. was appealed to, and when he gave his word that payment should be made, the farmers believed him, and sent the requisite supplies. On the death of the Rajah of Tanjore, in 1787, S. was appointed tutor and guardian of his young son, Maha Sarboji, who turned out, under S.'s care, one of the most accomplished sovereigns in or out of India. S. died February 13, 1798.

SCHWARZBURG, HOUSE OF, one of the oldest German families, founded about the middle of the 12th c., by Sizzo, Count of Schwarzburg and Käsernburg. The two sons of Sizzo were Heinrich, who succeeded his father as Count of Schwarzburg, and Günther, who became Count of Käsernburg. The former, dying childless in 1184, his possessions went to his brother, who left two sons, Günther, who continued the family of the Counts of Käsernburg, and Heinrich, from whom sprung the Counts of Schwarzburg. In 1349, Günther XXI., the younger son of Heinrich XII., was elected Emperor of Germany, but he died within the year of his election. Count Günther XL. of Schwarzburg and Arnstadt, who introduced (1541) the reformation into his states, was the common ancestor of the two existing lines of the Schwarzburg family; his son, Johann Günther, founding the line of Schwarzburg-Sondershausen (q. v.), and Albert, that of Schwarzburg-Rudolstadt (q. v.).

SCHWA'RZBURG-RU'DOLSTADT, a German principality, bounded on the E. by Weimar, Altenburg, and Meiningen, with a detached part, 30 miles to the north, in Prussian Saxony. Area, 367 sq. m.; pop. (1880) 80,296, of whom above 76,000 were Lutherans. It consists of the Upper Lordship (*Rudolstadt*, 282 sq. m.) and the Lower Lordship (*Frankenhausen*, 85 sq. m.). The Schwarza, Ilm, and Saale water the surface, which is for the most part covered with spurs of the Thuringer-wald. The ordinary crops are raised, and timber, salt, and metals are the principal products. The principality contains many spots distinguished for beautiful scenery; and besides the vale of the Schwarza, the convent-ruins of Paulenzelle, and the remains of the castle of Kyffhausen, attract many visitors. S. has a diet of 16 members, of whom 12 are chosen by general election. S. has one vote in the federal council, and one in the diet.

SCHWA'RZBURG-SO'NDERSHAUSEN, a German principality, is partly surrounded by Prussian Saxony. Area, 333 sq. m.; pop. (1880) 71,107, mostly Protestants. It consists of a

Lower Lordship (*Sondershausen*) and an Upper Lordship (*Arnstadt*). The former of these, watered by the Helbe and Wipper, is fertile and agricultural; while the latter is mountainous, and is the seat of active manufactures. The diet contains 5 members nominated by the prince, 5 chosen by the most heavily taxed, and 5 by general election. S.-S. has one voice in the federal council, and sends one representative to the imperial diet.

SCHWARZENBERG, a princely family of Germany, dates from 1420, when *Erkinger von Seinsheim* purchased the lordship of S. in Franconia, and was raised (1429) by the Emperor Sigismund to the dignity of Baron of the Empire. Two of this family have acquired a European reputation: the first, ADAM, Count of S., who was born in 1587, and became prime-minister and adviser of Georg-Wilhelm, Elector of Brandenburg. He was all-powerful during the Thirty Years' War, and brought down terrible calamities on Brandenburg by his obstinate adherence to the Alliance with Austria against the Protestant league, for which he was punished after the accession of the 'Great Elector,' in 1640, by being despoiled of his power, and imprisoned in the fortress of Spandau, where he died 17th March, 1641. The other, KARL PHILIPP, Prince of S., was born at Vienna, 15th April, 1771, first served against the Turks, and had risen to the grade of lieutenant field-marshal in 1799, at which date he raised a regiment of Hulans at his own cost. He was under the orders of Mack in the campaign of 1805, and commanded a division at Ulm; but when he saw that the battle was lost, he cut his way through the French army, and retired with his regiments to Eger, afterwards taking part in the great battle of Austerlitz. He was ambassador at the Russian court in 1808, by the express wish of the Emperor Alexander; fought at Wagram in 1809; and after the treaty of Vienna, conducted the negotiations preliminary to the matrimonial connection of Napoleon with the Hapsburg family; and both in this capacity and as ambassador at Paris, so gained the esteem of Napoleon, that the latter expressly demanded for him the post of general-in-chief of the Austrian contingent of 30,000 men which had been sent to aid France against Russia in 1812.

S. with his little army entered Russia from Galicia, passed the Bug, and achieved some slight successes, but was afterwards driven into the 'duchy of Warsaw' (see POLAND), and took up a position at Pultusk, where he concluded with the Russians an armistice which secured the French retreat. S. was much blamed for his dilatory conduct at the time; and his tardiness, ascribed by the French historians to secret instructions from his own government, has since been much animadverted upon by them; but nevertheless Napoleon concealed any dissatisfaction he might have felt, and demanded (1813) for him from the Austrian government the baton of field-marshal. After a brief sojourn at Paris S. was appointed to the command of the Austrian army of observation in Bohemia; and when Austria joined the allied powers, he became generalissimo of the armies of the coalition; gained the victory of Leipzig (q. v.), and introduced a cautious system of tactics, which insured a progressive hemming-in of the French, and in spite of their occasional successes, completely wore them out. On the return of Napoleon from Elba, he obtained the command of the allied army on the Upper Rhine, and a second time entered France. On his return to Vienna, he was made president of the imperial council for war, received an extensive grant of lands in Hungary, and was allowed to engrave the imperial arms of Austria on his escutcheon. He died of apoplexy at Leipzig, 15th October 1820.—His nephew, FELIX LUDWIG JOHANN FRIEDRICH, born October 2, 1800, distinguished himself in the Italian campaign of 1848, was placed at the head of affairs at Vienna, called in the aid of the Russians against Hungary, and pursued a bold policy in Germany. He died at Vienna, April 5, 1852.

SCHWEDT, a handsome town of Prussia, in the province of Brandenburg, on the Oder, 31 miles south-south-west of Stettin. Weaving, brewing, the manufacture of soap and of tobacco, which is here extensively grown and sold, are the principal branches of industry. Pop. (1880) 9899.

SCHWEI'DNITZ, a charmingly situated town of Prussian Silesia, on the left bank of the Weistritz, 42 miles south-east of Liegnitz, and about the same distance south-west of Breslau by railway. Woollen goods, leather, and agricultural implements are manufactured; and the fairs for corn, cattle, and yarn are much frequented. S. was besieged and taken four times within 50 years, the last time by the French in 1807, when the defences were in great part destroyed. Pop. (1880) 22,202.

SCHWEI'NFURT, an ancient, and long an imperial free city, the *Trajectus Suevorum* of the Romans, now a town of Bavaria, in Lower Franconia, on the Main, 29 miles north-east of Wurzburg by railway. It contains a beautiful market-place, in which important cattle and wool markets are held. Wine-culture, sugar-refining, and manufactures of chemicals and dyeing materials, as white-lead, ultramarine, Schweinfurt green, &c., are carried on. See GREEN. Pop. (1880) 12,601.

SCHWEINFURTH, GEORG AUGUST, a distinguished African traveler, was born in Riga, 29th September, 1836. He studied at Heidelberg, Munich, and Berlin, making botany his specialty. In 1864 he made a journey through the valley of the Nile and along the coasts of the Red Sea, and on his return to Berlin in 1866, had the botanical, zoological, and geological fruits of his travels classified. In 1868, by the aid of a grant from the Royal Academy of Sciences of Berlin, he again started for Africa, and made his way from Khartoum into the interior, in the company of the ivory-traders, along the valley of the White Nile. Between the 4th and 6th parallels of north latitude, he penetrated as far westward as the 26th meridian, carefully noting the nature of the countries through which he passed, and the character of their various tribes. He returned in 1872; and in 1874 published the results of his travels under the title of *Im Herzen von Afrika* 2 vols. An English translation, *The Heart of Africa*, was published the same year. S. was made president of the Egyptian Geographical Society in 1875.

SCHWE'RIN, capital of the grand duchy of Mecklenburg-Schwerin, is agreeably situated on the west shore of the Schweriner See, a lake 14 miles in length, and 3 miles broad, and abounding in fish. S. is divided into the old town, the new town, and the suburb, is well built, and contains one of the finest Gothic cathedrals in Northern Germany, begun in 1248, and finished in the 15th c. The ducal castle, erected by Wallenstein, stands on a small island. In S. there are tobacco-factories, an iron-foundry, breweries, &c. Pop. (1880) 30,146.

SCHWYZ, one of the mountain cantons in the middle of Switzerland, is bounded on the N. by the canton of St. Gall, and the canton and Lake of Zürich, and on the S. by the canton of Uri and the Lake of Lucerne. Area, 350 sq. m.; pop. (July 1880) 51,235, of whom only 800 are Protestants. The whole surface is covered with mountains, except small tracts in the south-west and north-east; but there are no glaciers nor any everlasting snow except on the Rieselstock, 8890 feet high, on the east frontier. The canton comprises a third part of Lake Zug, the most northern angle of the Lake of the Four Cantons, the whole of the mountain-mass of the Righi (q. v.), the plain in which lies the small Lake Lowerz, and the valleys of the Muotta, Sihl, and Aa, the principal rivers. Cattle-breeding is the employment of almost the whole of the inhabitants, and the number of cattle is estimated at about 20,000. Only about one-thirtieth of the whole area is cultivable; fruits and wine are cultivated to some extent; and cattle, cheese, and timber are exported. Woven fabrics for home use are almost the only manufactures.

S., one of the three original cantons, and also one of the Four Forest Cantons, has supplied the name to the whole country of which it forms a part. The government is a representative democracy.—SCHWYZ, the capital, is a small town, containing a beautiful parish church, and most picturesquely situated 17 miles east of Lucerne.

SCIA'CCA (anc. *Thermæ Seluntinæ*), a seaport of Sicily, in the province, and thirty miles west-north-west of the city of Girgenti. It is defended by the castle of Luna, is surrounded by old walls, and has a fine cathedral. Outside the walls are the hot springs, which are visited by invalids, and upon a neighboring height, the so-called *Stufe di St. Calogero*. At the bottom of one of the wells a noise is heard resembling that of a cascade. Pop. (1881) 19,965. S. was the birthplace of Agathocles, tyrant of Syracuse, and of Fazelli the historian.

SCIÆ'NIDÆ, a family of acanthopterous fishes, somewhat resembling perches; having a compressed body; a simple or double dorsal fin, the first part spiny; the gill-covers variously armed; the head generally inflated, and its bones cavernous; the scales are ctenoid, and in general obliquely ranged. The S. are divided into many genera, and widely distributed. Most of them are marine, but a few inhabit fresh water. Only two species are reckoned as British, the Maigre (q. v.) and the Bearded Umbrina (q. v.), both excellent for the table. The power of emitting sounds which belongs to the maigre is possessed also by others of the family in a remarkable degree. Among these are species of *Pogonias*, as *P. chromis*, known by the name DRUM-FISH, because the sound which it emits resembles that of a drum.

SCIA'TICA is the term given to neuralgia of the great sciatic nerve. See NERVOUS SYSTEM. It has been shown by Graves to be a frequent complication of gout; but rheumatism, or exposure to cold and wet, is its most common cause. It is characterized by irregular pains about the hip, especially between the great trochanter of the thigh-bone and the bony process on which the body rests when sitting, spreading into neighboring parts, and running down the back of the thigh to the leg and foot; or the pains may occupy only isolated parts, as the knee-joint, the calf of the leg, or the sole of the foot. S. is a very obstinate disease, but the

treatment is the same as that of neuralgia generally, except when it is merely a complication of gout, in which case the primary disease must be attacked as well.

SCIATIC STAY (possibly a corruption of *Asiatic*), in merchant-vessels, is a strong rope fastened between the main and foremast heads. When loading or unloading, a traveling tackle is suspended to it, which can be brought over the fore or main-hatchway as occasion demands.

SCI'CLI, a town of Sicily, in the province of Syracuse, on the small river Scicli, 21 miles west-south-west from Noto. The woollen manufacture is carried on. S. is supposed to be the ancient *Casmenæ*. Pop. 10,029.

SCIENCES, the name for such portions of human knowledge as have been more or less generalized, systematized, and verified. Generality as opposed to mere particulars, system as opposed to random arrangement, and verification as opposed to looseness of assumption, concur in that superior kind of knowledge dignified by the title in question. Geography, Chemistry, and Political Economy are now sciences. The first has been so for many ages, although greatly advanced in recent times; the two last, scarcely more than a century. Chemical facts and maxims of political economy had been known from a much earlier date, but they did not in either case amount to science; the generalities were few or bad, system and certainty were both wanting. In the different branches of Natural History—Mineralogy, Botany, Zoology—there had been a large store of accumulated facts before any one branch could be called a science. The *quality* of the knowledge is of more consequence than the quantity.

The term *Philosophy* (q. v.) is to a certain extent, but not altogether, coincident with science, being applied to the early efforts and strainings after the explanation of the universe, that preceded exact science in any department. Both names denote the pursuit of knowledge as knowledge, or for intellectual satisfaction, in contrast to the search that is limited to immediate practice or utility.

The sciences have been variously classified, and the principles of their classification have been a subject of discussion. We shall here describe the mode of classifying them in accordance with present usage, and with the principles most generally agreed upon.

It is convenient to prepare the way by distinguishing between Theoretical Sciences, which are the sciences properly so called, and Practical Sciences. A Theoretical Science embraces a distinct department of nature, and is so arranged as to give, in the most compact form, the entire body of ascertained (scientific) knowledge in that department: such are Mathematics, Chemistry, Physiology, Zoology. A practical Science is the application of scientifically obtained facts and laws in one or more departments to some practical *end*, which end rules the selection and arrangement of the whole; as, for example, Navigation, Engineering, Mining, Medicine. Navigation selects from the Theoretical Sciences—Mathematics, Astronomy, Optics, Meteorology, &c.—whatever is available for guiding a ship on the seas, and converts the knowledge into rules or prescriptions for that purpose. The arts that can thus draw upon the exact sciences are by so much the more certain in their operation; they are the scientific arts.

Another distinction must be made before laying down the systematic order of the Theoretical Sciences. A certain number of these sciences have for their subject-matter each a separate department of natural forces or powers; thus, Biology deals with the department of Organized Beings, Psychology with Mind. Others deal with the application of powers elsewhere recognized to some region of concrete facts or phenomena. Thus, Geology does not discuss any natural powers not found in other sciences, but seeks to apply the laws of Physics, Chemistry, and Biology to account for the appearances of the earth's crust. The sciences that embrace peculiar natural powers are called Abstract, General, or Fundamental Sciences; those that apply the powers treated of under these to regions of concrete phenomena are called Concrete, Derived, or Applied Sciences.

The Abstract or Theoretical Sciences, as most commonly recognized, are these six: Mathematics, Physics, Chemistry, Biology (Vegetable and Animal Physiology), Psychology (mind), Sociology (society). The Concrete Sciences are the Natural History Group—Meteorology, Mineralogy, Botany, Zoology, Geology, also Geography, and we might, with some explanations, add Astronomy. The Abstract or Fundamental Sciences have a definite sequence, determining the proper order for the learner, and also the order of their arriving at perfection. We proceed from the simple to the complex, from the independent to the dependent. Thus, MATHEMATICS relates to *Quantity*, the most pervading, simple, fundamental, and independent attribute of the universe. The consideration of this attribute has therefore a natural priority; its laws underlie all other laws. As Mathematics is at present understood, it has an Abstract department which treats of quantity in its most general form, or as applied to nothing in particular—including Arithmetic, Algebra, and the Calculus—and a Concrete or Applied department—viz., *Geometry*, or Quantity in Space or Extension. It has been suggested that General Mechanics, or the estimation of Quantity in *Force* should be considered a second Concrete department. But usually Mechanics ranks with the next Fundamental Science in order, called Physics.

NATURAL PHILOSOPHY has long been considered the name of a distinct department of science: the designation PHYSICS is now more common. This science succeeds Mathematics, and precedes Chemistry. Of all the fundamental sciences, it has the least unity, being an aggregate of subjects with more or less connection. Mechanics, Hydrostatics, Hydraulics, Pneumatics, Acoustics, Astronomy, are all closely related; they represent the phenomenon of movement in *mass*, as applied to all the three states of matter, Solid, Liquid, and Gas. The remaining subjects—Heat, Light, and Electricity—together with the attractions and repulsions that determine Cohesion, Crystallization, &c., are described as relating to movement in the *molecule*. We have thus Molar Physics and Molecular Physics; and the tendency is now to treat the two separately.

CHEMISTRY lies between Physics and Biology, reposing upon the one, and supporting the other. It assumes all the physical laws, both molar and molecular, as known, and proceeds to consider the special phenomenon of the composition and decomposition of bodies considered as taking place in definite proportions, and leading to change of properties. The composition of a cup of tea from water, sugar, milk, and infusion of tea-leaf, is physical; the composition of marble from oxygen, carbon, and calcium, is chemical. In the one case, the properties of the separate ingredients are still discernible: in the other, these are merged and untraceable.

BIOLOGY, or the science of living organization, involves mathematical, physical and chemical laws, in company with certain others, called vital. It is most usually expounded under the designations Vegetable and Animal Physiology; and in the Concrete departments, Botany, Zoology, and Anthropology.

PSYCHOLOGY, or the Science of MIND, makes a wide transition, the widest that can be taken within the whole circle of the sciences, from the so-called material world, to the world of Feeling, Volition, and Intellect. The main source of our knowledge of mind is self-consciousness; and it is only from the intimate connection of mind with a living organism, that the subject is a proper sequel to Biology. Not until lately has any insight into mind been obtained through the consideration of the physical organ—the brain; so that Psychology might have been placed anywhere, but for another consideration that helps to determine the order of the sciences—viz., that the *discipline*, or method, of the simpler sciences is a preparation for the more abstruse. Mathematics and Physics especially are an admirable training of the intellect for the studies connected with mind proper, although the laws of Physics may not of themselves throw any direct light on the successions of thought and feeling.

These five sciences embrace all the fundamental laws of the world, and, if perfect, their application would suffice to account for the whole course of nature. To a person fully versed in them, no phenomenon of the explained universe can appear strange; the Concrete sciences and the Practical sciences contain nothing fundamentally new. They constitute a liberal scientific education. It is not uncommon, however, to rank SOCIOLOGY, or the Laws of Man in Society, as a sixth primary science following on Psychology, of which it is a special development.

Dr. Neil Arnott, in his work on *Physics*, first published in 1828, gave as the primary departments of Nature—Physics, Chemistry, Life, and Mind (under which he would include the Laws of Society). He did not discard Mathematics, but looked upon it as a system of technical mensuration, created by the mind to facilitate the study of the other sciences, as well as the useful arts. The natural laws expressed by Mathematics are few and simple, and the body of the science consists of a vast scheme of numerical computation, whose value appears in its applications to Astronomy and the other physical sciences.

Auguste Comte, who, in his *Cours de Philosophie Positive*, went over the entire circle of the Theoretical, Abstract, or Fundamental sciences, enumerated these as follows: Mathematics, Astronomy, Physics, Chemistry, Biology, Sociology. He thus detaches Astronomy from Physics, considering it as the abstract science that brings forward and works out the Law of Gravitation. He has no distinct science of Psychology, an omission that has been generally condemned. See POSITIVISM.

Mr. Herbert Spencer, in a tract on the *Classification of the Sciences*, takes exception to the scheme of Comte, and proposes a threefold division, according to the gradations of Concreteness in the subject-matter. The first group is termed ABSTRACT SCIENCE, and treats of the *forms* of phenomena detached from their embodiments. The most comprehensive forms are Space and Time; and the sciences corresponding are Mathematics and Logic.

The second group is ABSTRACT-CONCRETE SCIENCE, or the phenomena of nature analyzed into their separate elements—Gravity in the abstract, Heat in the abstract—as in Physics and Chemistry. These are two of the fundamental sciences in every scheme, and they are called Abstract-Concrete by Mr. Spencer, in comparison with the foregoing class. The great principle, of recent introduction, termed the Law of Correlation, Conservation, or Persistence of Force, serves to connect Physics with Chemistry, and imparts to the two taken jointly a greater unity than belongs to Physics singly. The third and last group is CONCRETE SCIENCE, or natural phenomena in their totalities, or as united in actual things—Astronomy, Biology, Psychology, Sociology, Geology, &c. Mr. John Stuart Mill, in an article in the *Wesminster Review*, April 1865, has described Comte's scheme at length, and also criticised that of Spencer. See SPENCER.

It may be held as generally admitted that Mathematics, Physics, Chemistry, Biology, and Psychology, with or without Sociology, are the sequence of the primary or fundamental sciences, and that the Natural History group, from not containing any new laws of nature, are not fundamental. Astronomy, or the laws of the solar system, and of the other celestial bodies, might be called a Natural History or Concrete science, if we supposed a prior abstract science that discussed the operation of gravity, together with the laws of motion in bodies generally, or without special application to the existing solar and sidereal systems. The first book of Newton's *Principia* would be the Abstract, the third book the Concrete, form of the science.

The Practical Sciences do not admit of any regular classification. They are as numerous as the separate ends of human life that can receive aid from science, or from knowledge scientifically constituted. Connected with Mind and Society, we have Ethics, Logic, Rhetoric, Grammar, Philology, Education, Law, Jurisprudence, Politics, Political Economy, &c. In the manual and mechanical arts, there are Navigation, Practical Mechanics, Engineering Civil and Military, Mining and Metallurgy, Chemistry applied to Dyeing, Bleaching, &c.

The medical department contains Medicine, Surgery, Midwifery, Materia Medica, Medical Jurisprudence. A science of Living, or of the production of Happiness by a skilled application of all existing resources, was greatly desiderated by Plato, and would be the crowning practical science.

SCI'LLA. See SQUILL.

SCI'LLY ISLANDS. These islands, situated a little west of 6° W. long. and about 50° N. lat., are the most southern parts of the United Kingdom of Great Britain, if we except the Channel Islands. The group consists of about 40, comprising a circuit of about 30 miles; and their general denomination is derived from a

Scilly Islands.

very small island, about an acre in extent, and almost inaccessible, called Scilly, probably from its position near dangerous rocks, similar to that of Scylla near Sicily. By the ancients, these islands, it has been commonly understood, were named Cassiterides, Hesperides, and Siluræ Insulæ. Some authorities have assumed that the term Cassiterides, or 'Tin Islands,' under which they were known to the Greeks and Romans, was once applied to the peninsula of Cornwall. Elton, in his *Origins of English History*, affirms, however, that the Cassiterides were the headlands of Galicia, or the islands off that part of the Spanish coast, and not the Scilly Islands at all.

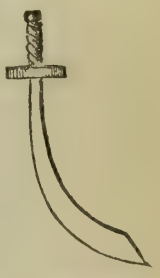
Numerous remains may be seen of rude pillars, circles of stones, kistvaens, rock-basins, and cromlechs. The granite of which the islands are composed is, in general, of a rather coarse quality, and from its color, iron seems to be frequently associated with it. There are metalliferous veins, or lodes, in some of the rocks, but none that could have yielded any considerable quantity of ore. The S. I. were in 936 granted by Athelstane to some monks who settled at Tresco. They were afterwards granted to the Abbey of Tavistock by Henry I., and were conferred by Queen Elizabeth on the Godolphin family. They are now the property of the crown.

Only five of the islands are inhabited. St. Mary's, the largest, comprises 1528 acres; Trescoe, 697; St. Martin's, 515; St. Agnes (a light-house station), 313; Sampson and Bryher, 269. The inhabitants are chiefly engaged in agriculture. Barley, oats, and a little wheat are grown. Large quantities of potatoes are sent to London and Bristol. Fishing, though not to any great extent, occupies some portion of the population. The climate is mild. The soil is in general sandy, but in Trescoe and St. Agnes it is remarkably fertile. The cliffs abound with sea-fowl, and are covered with samphire.

St. Mary's had, in 1871, a population of 1383, while the other four inhabited islands (Trescoe, St. Martin's, St. Agnes, Bryher) were collectively inhabited by only 707 persons; the total population in 1881 was 3315. Hugh Town is the capital, and contains an odd mixture of old-fashioned and neat modern houses. The pier, built in 1750 by Lord Godolphin, has been much improved by Mr. Smith, the present lessee of the islands. The custom-house and post-office are in the center of the town. Some remains of the old church are still seen in the fields, on the southern side of the island. The modern church, at the east end of the main street, is seated on rising ground, and forms a conspicuous object in the panoroma of the islands.

At Trescoe are the remains of an abbey founded in the 10th century. Among the objects of curiosity on this island are the ruins of Oliver Cromwell's camp, castle, and battery, built by the Parliamentarians under Blake and Ayscough. At Dolphin Down may be seen traces of ancient mining.

St. Agnes is about three miles south-west from St. Mary's. It is well cultivated, and is surrounded by some fine rock-scenery. The principal attraction is the light-house, 78 feet high, containing a revolving light, seen at a distance of 18 miles.



Scimitar.

SCI'MITAR, a description of sword used among eastern nations. It is considerably curved, and has its edge on the convex side. Being usually of high temper, and its shape favorable to incision, it forms an admirable cutting instrument, but is powerless as a thrusting weapon. The scimitar is not, however, any match for the bayonet.

SCINK, or SKINK (*Scincus officinalis*), a saurian reptile, found in the north of Africa, and in some parts of Asia. It is from six to eight inches long, generally of a reddish-dun color, with darker transverse bands, a wedge-shaped head, and four pretty strong limbs. It has been in great repute for imaginary medicinal virtues from remote times; it was largely imported on this account into ancient Rome, and is still in high esteem in the East, dried scinks finding a ready sale in many places, as Cairo and Alexandria. There is almost no disease for which it has not been supposed to be a cure.—The S. belongs to the family *Scincidæ*, which is interesting as one of the connecting links between saurians and serpents. The S. itself is in general appearance quite lizard-like; but in some of the allied genera, the limbs become rudimentary, or nearly so. In some, one of the pairs is wanting; and even the Slow-worms (*Anguis*) are by many naturalists reckoned in this family, in which the limbs are not manifest externally, although

Scink (*Scincus officinalis*).

they may be observed on careful dissection. Among the genera in which the four limbs are all externally manifest, although very small and imperfect, is *Seps*, sometimes made the type of a separate family, *Sepsidæ*, in which the body is much elongated and snake-like.

SCINTILLA'TION (Lat. *scintilla*), a term applied to denote the sparkling or flickering of the stars. The phenomenon is not yet quite explained, but that it is certainly due to the earth's atmosphere is proved by the following facts, which embrace nearly all that is known on the subject. If, on a clear evening, we look at

a bright star, such as Sirius, we observe that the intensity and color of its light are constantly changing—from great brilliancy to almost total obscurity, from bright red to fine blue, and so on. As it rises above the horizon, these appearances diminish in intensity; and stars near the zenith scarcely scintillate at all. Again, the amount of the scintillation depends upon the character of the weather—on some evenings, all large stars appear to scintillate strongly; on others, there is barely a trace of the appearance. It is commonly said that a planet can be distinguished from a star by the absence of scintillation. This is nearly, but not quite, true; for feeble scintillations have been occasionally observed in Mars and Venus, but very rarely in Jupiter and Saturn. One of the reasons of the non-scintillation of planets seems to be their finite apparent size; for all the more conspicuous planets show a sensible disc even in a poor telescope, while no instrument that has ever been constructed has shown a real disc in a star. Thus, a single particle or vesicle of vapor may be large enough to conceal a star for an instant, while it could have no such effect on a planet. It is pretty certain that scintillation is not due to unequally heated masses of air, since it usually modifies only the *appearance*, not the *position*, of a star. Another cause is easily seen in the comparatively feeble light of the planets. It is well ascertained that the scintillation is much less when viewed from the top of a mountain.—For a good idea of what is known, and what we desire still to know, on this subject, see a paper by Professor Dufour, *Philosophical Magazine*, 1860.

SCI'O, one of the most beautiful islands in the Ægean Sea, belongs to Turkey, and lies seven miles off the coast of Asia Minor, at the entrance to the Gulf of Smyrna. It is 32 miles long, and 18 miles in greatest breadth. Area, 400 sq. m.; pop. about 60,000. It is mountainous in the north, and is extremely fertile. Silk, figs, cheese, wool, and gum-mastic are its principal products; and its wine, which was famous in ancient times, is still esteemed. Kastro, the capital, a thriving and handsome town of 18,800 inhabitants, stands on the east coast, has a harbor, a castle, and two lighthouses, and carries on a growing trade in fruits, confectionery, and silk and woollen goods.

In early times, S. formed one of the 12 Ionian states, and it contributed 100 ships to the Greek force that fought and was defeated by the Persians in the sea-fight off Miletus (494 B.C.). In more recent times, the island was taken by the Genoese in 1346, and in 1566 by the Turks, in whose hands it has since, except for a short interval, remained. It was conferred as private property upon the sultana, enjoyed her protection, and consequently prospered. After it had enjoyed a long period of ease and wealth, a dreadful calamity befell the island at the outbreak of the Greek insurrection. A number of the Sciotes having, in 1822, joined the Samians, who had revolted, the island was attacked by a Turkish fleet and army, and the inhabitants, enervated by peace and wealth, were indiscriminately massacred; 25,000 fell by the sword, 45,000 were sold as slaves, and 15,000 escaped from the island. Gradually the island has recovered the blow it sustained. Repeated shocks of earthquake devastated it in April 1881; hardly a house was left standing; about 8000 of the inhabitants were killed, and several thousands were wounded.

SCIO'GRAPHY, the drawing of Sections (q. v.) of buildings, so as to show the interior of them.

SCIOPPIUS (Latinized form of *Schoppe*), KASPAR, a noted classical scholar and controversialist, was born at Neumark, in the Palatinate, 27th May 1576; studied at Heidelberg, Altdorf, and Ingolstadt; and in 1597, visited Italy, Bohemia, Poland, and Holland. Already he had become celebrated by his Latin verse and his notes upon different Latin authors. Next year, he abjured Protestantism, and became a Roman Catholic, in consequence of which he was decorated by the pope with various titles, and received a pension of 600 florins, together with a residence in the Vatican. Henceforth, his career is a series of fierce onslaughts chiefly on his former co-religionists, but also directed against all whom accident or malice led him to hate. The first person whom he selected for attack was the illustrious Scaliger (q. v.), against whom, in 1607, he launched his *Scaliger Hypobolimæus* (Mainz). In this production, Henry IV. is also assailed. Sent in 1608 by the court of Rome to the diet of Ratisbon, for the purpose of observing the religious condition of Germany, he published in the same year more than twenty pamphlets against the Protestants, recommending the Catholic powers to use every means for their extermination. Such sentiments were, of course, highly satisfactory to the emperor of Germany, who was a devoted Catholic; and, in consequence, S., on visiting Vienna, met with a favorable reception, and was raised to the dignity of count-palatine. In 1611, he fired off two libels against King James I. of England; the first was entitled *Ecclesiasticus Auctoritati Ser. D. Jacobi, Mag. Brit. Regis, Oppositus* (Hartberg); and the second, *Collyrium Regium*, &c. Some three years after, when staying at Madrid, he was dreadfully beaten by the domestics of Lord Digby, the English ambassador in retaliation for the abuse of his sovereign. S. fled from Spain to Ingolstadt, where he issued his *Legatus Latro* against the ambassador. In 1618, S. went to Milan, where he resided for the next twelve years, devoting himself partly to philological studies, and partly to theological warfare. He died, 19th November 1649.

S. was a prodigious scholar, and might have rivalled Scaliger himself in reputation, as he did in learning, had it not been for the infirmities of his temper and judgment. To this day, his works, especially those on the Latin language, are reckoned valuable. The principal are: *Poemata Varia* (Heidelb. 1593); *Verisimilium Libri Quatuor* &c., (Nürnb. 1596); *Suspectæ Lectiones* (Nürnb. 1597); *De Arte Critica* (Nürnb. 1597); *Symbola Critica in Apuleii Opera* (Augsburg, 1605); *Observationes Linguæ Latinæ* (Frankf. 1609); *De Rhetoricarum Exercitationum Generibus* (Mil. 1628); *Grammatica Philosophica, sive Institutiones Grammaticæ Latinæ* (Mil. 1628); *Paradoxa Literaria* (Mil. 1628); *Mercurius Bilinguis*, &c. (Mil. 1628); *Rudimenta Grammaticæ Philosophicæ* (Mil. 1629); *Astrologia Ecclesiastica* (1634); *De Scholarum et Studiorum Ratione* (Pad. 1636); *Mercurius Quadrilinguis* (Basel, 1637), &c.

SCI'OTO, a river of Ohio, U. S., rises in the high lands of the north-west portion of the state, flows south-east to Columbus, then south to its junction at Portsmouth with the river Ohio. It is 200 miles long, flows through a rich valley, is navigable 130 miles, and for 90 miles feeds the Ohio and Erie Canal. It is crossed by numerous railways.

SCI'PIO, PUBLIUS CORNELIUS, surnamed AFRICANUS MAJOR, one of the most accomplished warriors of ancient Rome, but whose reputation is perhaps somewhat greater than his merits, was born 237 or 234 B.C. He is first mentioned as taking part, though only a youth, in the battle of the Ticinus (218 B.C.) where he saved his father's life. Two years later, he fought at Cannæ as a military tribune, and was one of the few Roman officers who escaped from that disastrous field. In 212 B.C., he was elected ædile, though not legally qualified by age, and in the following year, proconsul, with command of the Roman forces in Spain. His appearance there restored fortune to the Roman arms. By a bold and sudden march, he captured *Nova Carthago*, the stronghold of the Carthaginians, and obtained an immense booty. His humane and courteous manners won over many of the native chiefs; and when he commenced the campaign of 209 B.C., his superiority over his opponents in address, if not in generalship, was manifest.

At Bæcula, in the valley of the Guadalquiver, he defeated Hasdrubal with heavy loss, but could not prevent him from crossing the Pyrenees to the assistance of Hannibal. In 207 B.C., he won a more decisive victory over the other Hasdrubal, son of Gisco and Mago, at an unknown place called Silpia, or Elinga, somewhere in Andalusia—the effect of which was to place the whole of Spain in the hands of the Romans. Soon after, he returned to Rome, where he was elected consul (205 B.C.), though he had not yet filled the office of prætor; and in the following year he sailed from Lilybæum, in Sicily, at the head of a large army, for the invasion of Africa. His successes compelled the Carthaginian senate to recall Hannibal from Italy. This was the very thing that S. desired, and had labored to achieve. After some abortive efforts at reconciliation, the great struggle between Rome and Carthage, between S. and Hannibal, was terminated by the battle fought at Naragra, on the Bagradas, near Zama, 19th October 202 B.C., in which the Carthaginian troops were routed with immense slaughter. Hannibal advised his countrymen to abandon what had now become a hopeless and ruinous contest, and his advice was taken. Peace was concluded in the following year, when S. returned to Rome, and enjoyed a triumph. The surname of AFRICANUS was conferred on him; and so extravagant was the popular gratitude, that it was proposed to make him consul and dictator for life, honors that would have been the destruction of the constitution, but which S. was either wise enough or magnanimous enough to refuse. When his brother, Lucius, in 190, obtained the command of the army destined to invade the territories of Antiochus, S. served under him as legate; in fact, it was only when he offered to do so, that the senate granted Lucius the Province of Greece. The latter was victorious in the war, and on his return to Rome (189 B.C.), assumed (in imitation of his brother) the surname of ASIATICUS. But the clouds were now gathering heavily round the Scipios.

In 187 B.C., Cato Major and others induced two tribunes to prosecute Lucius for allowing himself to be bribed by Antiochus in the late war. He was declared guilty by the senate; his property was confiscated; and he himself would have been thrown into prison, had not his brother forcibly rescued him from the hands of the officers of justice. In 185 B.C., S. himself was accused by the tribune, M. Nævius; but instead of refuting the charges brought against him (and which were probably groundless), he delivered, on the first day of his trial, a eulogy on his own achievements, and opened the second day by reminding the

citizens that it was the anniversary of the battle of Zama, and therefore not a time for angry squabbling, but for religious services. He then summoned the people to follow him to the Capitol, to give thanks to the immortal gods, to pray that Rome might never want citizens like himself. His audience were electrified, and the thing was done before opposition became possible. To resume the trial, was out of the question; but S. felt that popular enthusiasm was not to be depended on; that the power of the oligarchy—of that compact body of ambitious and exclusive nobles—was irresistible; that its hatred of him was unappeasable, and that his day was over. He retired to his country-seat at Liternum, in Campania, where he spent the remainder of his life, and where he died, 183 or 185 B.C.—S. is commonly regarded as the greatest Roman general before Julius Cæsar; and certainly, in the brilliancy of his gifts and accomplishments, he was unsurpassed; but if his career be strictly criticised, it will be found that he owed as much to fortune as to genius. Nevertheless, he won a multitude of splendid successes, and made the most of his great advantages. His beauty, bravery, and courtesy; his proud, yet pious belief that the gods favored him with their inspiration, won him the love and reverence of soldiers and women; and his magnanimity towards his fallen rival, who flitted about the eastern courts in dreary exile, is a bright feature in his character, and nobly distinguishes him from the cruel-hearted oligarchs of the senate.

SCIPIO ÆMILIANUS, PUBLIUS CORNELIUS, surnamed AFRICANUS MINOR, born 185 B.C., was a younger son of Lucius Æmilius Paulus, who conquered Macedon, but was adopted by his kinsman, Publius Scipio, son of the great Scipio, who had married the daughter of that Lucius Æmilius Paulus who fell at Cannæ. S. accompanied his father on his expedition against Macedon, and fought at the decisive battle of Pydna, 168 B.C. In Greece, he made the acquaintance of Polybius the historian, who afterwards became one of his closest and most valued friends. In 151 B.C., he went to Spain as military tribune, in the wake of the consul Lucius Lucullus, where he distinguished himself alike by his valor and his virtue. Two years later began the third and last Punic war, which mainly consisted in the siege of Carthage. S. still held the subordinate position of military tribune; but the incapacity of the consuls Manius Manilius and Lucius Culpurnius Piso, and the brilliant manner in which he rectified their blunders, fixed all eyes upon him. The favorite both of the Roman army and the Roman people, S. was at length, in 147 B.C., when only a candidate for the ædileship, elected consul by an extraordinary decree of the Comitia, and invested with supreme command; old Cato, who could with difficulty be got to praise any one, applying to the young hero and his incapable comrades (according to Plutarch) the Homeric line—

He only is a living man ; the rest are flitting shades.

The story of the siege of Carthage, the despairing heroism of its inhabitants, the determined resolution, the sleepless vigilance, the incessant labors of S., are too well known to require description. Suffice it to say, that after a protracted defence of months, the city was finally taken by storm in the spring of 146 B.C.; and by the orders of the senate, it was levelled to the ground, and the plough-share driven over its site. S., a man of noble and refined soul, obeyed the savage behest with sorrow, even with horror. As he gazed on the ruin he had wrought, the thought flashed across his mind that some day Rome too might perish, and the words of the *Iliad* rose to his lips—

The day shall come when sacred Troy shall perish,
And Priam and his people shall be slain.

S., though probably the most accomplished Roman gentleman of his age, was rigorous in his observance of the antique Roman virtues; and when holding the office of censor in 142 B.C., he strove to follow in the footsteps of Cato. But his efforts to repress the increasing luxury and immorality of the capital were frustrated by the opposition of his colleague, Lucius Mummius, the rough conqueror of Corinth. In 139 B.C., S. was accused of the *crimen majestatis* by the tribune Tiberius Claudius Asellus, but was acquitted, and soon after was sent to Egypt and Asia on a special embassy. Meanwhile, however, affairs had gone badly in Spain. Viriathus, the Lusitanian patriot, had again and again inflicted the most disgraceful defeats on the Roman armies, and his example had roused the hopes of the Celtiberian tribes, who also rushed to war against the common foe. The contest continued with varying success; but the interest centers in the city of Numantia, whose inhabitants displayed amazing courage in the struggle with Rome. For long it seemed as if the Numantines were invincible—one consul after another finding their subjugation too hard a task—but at length, in 134 B.C., S., re-elected consul, was sent over to Spain; and after a siege of eight months, forced the citizens, who were dying of hunger, to surrender, and utterly destroyed their homes. He then returned to Rome, where he took a prominent part in political affairs, appearing as the leader of the aristocratic party, in consequence of which his popularity with the democratic party greatly declined. Although a brother-in-law of Tiberius Gracchus, whose sister, Sempronia, he had married, he rather disclaimed any sympathy with his political aims; and when he heard of the murder of his kinsman, quoted his favorite Homer: 'So perish all who do the like again.' His attempt (129 B.C.) to rescind that portion of the agrarian law of Tiberius Gracchus relating to the lands of the *Socii*, excited the most furious indignation. When he went home from the senate, he had to be accompanied by a guard. Next morning, he was found dead in his bed; the prevailing suspicion being, that he was murdered either by or at the instigation of Papirius Carbo, his most rancorous political enemy. S. was neither a rigid aristocrat nor a flatterer of the people. Inferior in splendor of genius to his adoptive grandfather, he surpassed him in purity of character, in simplicity of patriotism, and in liberality of culture.

SCI'RPUS, a genus of plants of the natural order *Cyperaceæ*. The English name Club-rush is sometimes given to them. The Common Bulrush (q. v.) is a familiar example. There are several British species, some of them very small in comparison with the Bulrush, as *S. cæspitosus*, called *Deer's Hair* in the Highlands of Scotland, which is only two or three inches high, and abounds in moors, affording food to sheep in spring. The root-stocks of *S. dubius* are eaten by the natives of the south of India; as are the tubers of *S. tuberosus*, which is called *Pi-tsi* by the Chinese, and is cultivated by them in tanks and ponds, copious supplies of manure being given. The tubers are roundish.

SCI'RRHUS (Gr. hard), a term applied to a kind of Cancer (q. v.).

SCITAMI'NEÆ, or ZINGIBERA'CEÆ, a natural order of endogenous plants, herbaceous perennials. There are about 250 known species, among which are the different kinds of Ginger, Galangale, Zedoary, Cardamom, Grains of Paradise, Turmeric, &c. Most of them are notable for their aromatic properties, which reside chiefly in their root-stocks or in their seeds. The root-stocks of some, particularly when young, contain much starch, which is used as arrow-root. All the species are tropical or sub-tropical.

SCIU'RIDÆ. See SQUIRREL.

SCLERODE'RMI, Cuvier's name for the family of fishes called *Balistidæ* by Müller. See BALISTES.

SCLEROGE'NIDAE. See MAILED CHEEKS.

SCLERO'STOMA (from the Gr. *scleros*, hard, and *stoma*, the mouth) is the term applied to a well-known genus of the family of *Strongylidæ*, belonging to the order of round worms or Nematoidea (q. v.). One species, the *Sclerostoma syngamus*, is of special

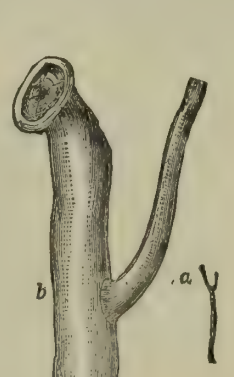


Fig. 1.—Sclerostoma syngamus.
a, Male and female—natural size; *b*, upper part of the same, enlarged (from Cobbold). The male is the smaller worm on the right side of these figures.

Fig. 2.—Sclerostoma duodenale. Male specimen.
1, The natural size; 2, the same magnified, and seen laterally; *a*, generative organ; *b*, region of anus.

interest, as being the cause of the disease in poultry known as the Gapes (q. v.). Since the article GAPES was published, it has been ascertained that the entozoon which infests the windpipe of the diseased birds is not a trematoid (or fluke-like) worm, but a round worm, possessing many very singular properties. Dr. Cobbold, to whom we are mainly indebted for our knowledge of this worm, removed from a chloroformed fowl with the gapes, seven sclerostomata. 'Six of these parasites were united in pairs, the odd worm being a female, from which the male had in all likelihood been rudely torn during the withdrawal of the forceps' (*Entozoa*, 1864. p. 86). The females thus extracted had an average length of $\frac{4}{5}$ths of an inch; while the males scarcely exceeded $\frac{1}{2}$th of an inch. In both sexes, the breadth of the body was nearly uniform throughout, being about $\frac{1}{36}$th of an inch in

the female, and only $\frac{1}{65}$th of an inch in the male. The mouth of the female is furnished with six prominent chitinous lips. According to Siebold, after sexual congress, 'there is ultimately a lasting continuity of the sexes by means of an actual growing together'—one of the most remarkable facts ever recorded in natural history. Hence the eggs, which are comparatively large, and many of which contain fully formed embryos, can only escape by a breaking-up of the body of the parent.

'By whatever mode,' says Dr. Cobbold, 'the young make their *exit* from the shell, it is manifest, that prior to their expulsion, they are sufficiently developed to undertake an active migration. Their next habitation may occur within the bodies of certain insect larvæ, or even in small land molluscs; but I think it more likely that they either enter the substance of vegetable matters, or bury themselves in the soil at a short distance from the surface.'

Considering that this worm infests the trachea of the domestic fowl, the turkey, the pheasant, and the partridge, as well as of many birds of less importance (as the magpie, the black stork, the starling, the swift, &c.), it is of the greatest importance to check its development. With this view, the worms must not only be removed by the means described in the article GAPES, and more fully in Cobbold's *Entozoa*, pp. 90, 91, but they must be *totally destroyed*, after their removal. If they be merely killed, and thrown on the ground, the mature eggs will probably remain uninjured; and when decomposition sets in, the young embroys will, sooner or later, escape from the shells, migrate in the soil or elsewhere, and ultimately find their way—how, we cannot tell—into the air-passages of certain birds, in the same manner as their parents did before them.

Dr. Cobbold, whose classification of intestinal worms will doubtless for many years be the standard one, places the *Dochmius anchylostomum*, or *Anchylostoma duodenale* (see STRONGYLIDÆ), in this genus, with the name of *Sclerostoma duodenale*. This worm, which usually measures about $\frac{1}{3}$d of an inch in length, is especially characterized by an asymmetrical disposition of four horny, conical, oval papillæ, of unequal size, forming the so-called teeth. The female is larger than the male in about the ratio of 4 to 3, and is the more numerous in the ratio of 3 to 1. This worm was first discovered by Dubini at Milan in 1838, and though at first thought rare, is now known to be tolerably common throughout Northern Italy. It is remarkably abundant in Egypt, where Pruner found it in nearly every corpse, sometimes, in hundreds of specimens, in the jejenum, and to a less extent in the duodenum. Griesinger, in his Memoir *On the Frequency of Entozoa in Egypt, and the Diseases they occasion* (1854) considers that about one-fourth of the population are constantly suffering from a severe anæmic chlorosis, occasioned solely by the presence of this parasite. A tolerably full account of this disorder, and of the treatment to be adopted, is given by Küchenmeister in his *Manual of Parasites*, vol. i. pp. 386—389.

SCLERO'TIUM, a spurious genus of fungi, now regarded as merely the mycelium of fungi, and these probably of very different kinds, which have been arrested in their development, assuming a peculiar form. This form is that of a fleshy mass, often a ball. Examples are to be found among almost all kinds of decaying vegetable matter, as fruits, esculent roots, &c. When a crop of onions rots off, as is often the case, to the vexation of the gardener, a S. will generally be found attached to the bulbs in the form of little irregular black masses, or as a multitude of small granules. On the under side of decaying cabbage-leaves, and scattered on the ground beneath the plant to which they belong, may in like manner be seen little balls, varying from white or reddish-brown to dark brown and black, in size about equal to cabbage-seeds, whence stories of showers of seeds have sometimes originated.

SCO'LEX. See TAPE-WORMS.

SCOLOPA'CIDÆ, a family of birds of the order *Grallæ*, having a long, feeble, soft, and somewhat flexible bill, which is remarkably furnished with nerves, particularly towards the tip, so as to be extremely sensitive, whilst many of them have also a peculiar muscle, enabling them to separate the points of the mandibles the moment that their prey is felt. They are thus admirably fitted for seeking their food—which generally consists of worms, slugs, &c.—in mud, soft earth, or wet sand. The membrane of the tip of the bill is almost pulpy in many of them. The species are numerous, and very widely distributed, generally inhabitants of swampy or very moist places. Snipes, woodcocks, sand-pipers, and curlews are familiar examples.

SCOLOPE'NDRA. See CENTIPEDE.

SCOLOPE'NDRIUM. See HART'S TONGUE.

SCOLY'TUS, a genus of coleopterous insects of the family *Xylophagi*. See BARK-BEETLE. One species *S. destructor*, a beetle only about one-sixth of an inch in length, of a dull color, with short antennæ, thickened at the extremity, has of late years destroyed great numbers of fine elms in the neighborhood of London and elsewhere in England. The female insect burrows in the wood, and lays a row of eggs; the larvæ, as soon as they are

Scolytus destructor, and Section of Wood, showing the burrows of the larvæ.

hatched, begin to feed upon the wood, and eat their way in long tunnels, diverging on all sides from the original one. This pest appears to be spreading in England.

SCOMBERESO'CIDÆ, a family of fishes, of the order *Plectognathi*, having the maxillary bones united with the elongated premaxillaries at the corners of the mouth. The Fying-fish (*Exocœtus*) belongs to this family. The Gar-fish and the Saury Pike are the only species common on the British coasts. Until the Plectognathi were recognized as a separate order, the S. were reckoned as belonging to the *Esocidæ*, or pike family.

SCOMBE'RIDÆ, or SCO'MBRIDÆ, a large family of acanthopterous fishes, containing many species highly esteemed as articles of food, and some of them of great value on account of the abundance in which they are caught. Some of them attain a large size. They have a smooth body, covered generally with small scales, and often very beautifully colored; the tail-fin generally large, and the tail very muscular and powerful. The gill-covers have no armature. The sides of the tail are often keeled and armed with sharp-keeled scales. The front spines of the anal fin are generally detached, and sometimes those of the first dorsal fin. The second dorsal fin is often represented by numerous finlets, as in the Mackerel (q. v.). To the same tribe with the mackerel, characterized by finlets and by the want of armature on the lateral line, belong the Bonito (q. v.), the Tunny (q. v.), the Albacore (see TUNNY), and the Seir-fish (q. v.) The importance of the Mackerel fishery is well known, also that of the Tunny fishery of the Mediterranean. The Sword-fish (q. v.) is an example of another group, comprising only a few species, having no finlets, and remarkably characterized by the dagger-like prolongation of the muzzle. The Pilot-fish (q. v.) belongs to a tribe having the first dorsal represented by isolated spines. There are other tribes or groups, some having the lateral line cuirassed, some not having this armature, and not having finlets nor detached spines. The Dory (q. v.) and allied genera, often regarded as forming a tribe of S., have been constituted into a distinct family, *Zeidæ*.—The S. are all marine. They are more numerous in warm than in cold climates, although some are found in very northern seas, of which the mackerel is the most important instance. It and the Scad (q. v.), or Horse Mackerel, are the only species common on the British coasts, although several others are known as of rare occurrence.

SCONCE, in Fortification, is a term applied to any small redoubt or fort, detached from the main works for some local object, as the defence of a pass, or ford, &c. The word is not now often used.

SCONCE, a candlestick affixed to a wall by a bracket, and frequently with a mirror or other reflector.

SCONE (pronounced *Scoon*), a parish in Perthshire, lying on the left bank of the Tay, about two miles from Perth. It is famous as the seat of one of the most venerable of Scottish abbeys. S. is first mentioned in the beginning of the 10th c., when a council was held there in the 6th year of the reign of King Constantine, at which time it is styled, by the Chronicle which records the fact, *regalis civitas*, the royal city. A monastery was built at S. probably about the same period, and there was located the famous stone on which the kings of the Scots were inaugurated, and which was carried by Edward I. of England to Westminster Abbey. In place of the ancient monastery, an abbey of Canons Regular was founded by Alexander I., in 1115, and there the sovereigns continued to be inaugurated and crowned. Alexander III., the last of the ancient race of kings, and Robert Bruce, the founder of the new dynasty, were crowned at S.; but after the accession of the House of Stuart, the coronation sometimes took place in other churches. In the summer of 1559, when Perth was held by the Lords of the Congregation, a disorderly multitude of their adherents assaulted the monastery of S., set it on fire, and left it a blackened ruin. The last coronation which was celebrated at S. was that of Charles II., on the 1st of January 1651. The abbey church had never been restored, and the solemnity

took place in the parish kirk, the crown being placed on the king's head by the Marquis of Argyle. In January 1716, the Jacobite leaders endeavored to encourage their followers by fixing a day for the coronation of the Chevalier at S., but the design was abandoned. In the reign of James VI., the abbey of S. was erected into a temporal lordship in favor of Sir David Murray, afterwards created Viscount of Stormont. The great chief-justice, the Earl of Mansfield, a younger son of the fifth Viscount Stormont, was born at S.; and the Scottish peerage is now merged in the British earldom. The Viscounts of Stormont had a residence near the site of the abbey, and hence known as the Palace of Scone. The present palace was erected on the same site in the beginning of this century.

SCO'PAS, a celebrated Greek sculptor and architect, belonging to the later Attic school, the head of which was Praxiteles (q. v.), was born in the island of Paros, and flourished during the first half of the 4th c. B.C. Nothing is known regarding his life or the period of his death. His principal architectural works are: 'The Temple of Athena Alla at Tegea,' the first both in point of size and beauty in the Peloponnesus; 'The (second) Temple of Diana at Ephesus' (though Deinocrates is also and even more generally named as the architect of this building); some of the bas-reliefs in the famous Mausoleum erected by Artemisia, queen of Caria, in memory of her husband (and now in the British Museum). His sculptures, by which we mean his single statues and groups illustrating the divinities of Greek mythology, were very numerous, and for the most part were executed in marble. They embrace subjects from the myths of Aphrodite (Venus), Dionysus (Bacchus), Apollo, Artemis (Diana), &c. But perhaps the noblest, and certainly the most famous piece of sculpture executed by S., was that which latterly stood in the Flaminian Circus at Rome, and represented Achilles conducted to the island of Leuce by the divinities of the sea. It included statues of Neptune, Thetis, the Nereids, Tritons, and a variety of sea-monsters, and according to Pliny, the whole was so beautiful, that it would have been sufficient to have immortalized S., even if he had done nothing more.

SCOPE'LIDÆ. See SALMONIDÆ.

SCORE, in Music, compositions for several voices or instruments, or for an orchestra, so written, that each part has a separate staff for itself, these staves being placed over each other, bar corresponding to bar. It is so called because the bars are *scored* or drawn through all the parts from top to bottom. Occasionally, where there is a deficiency of staves for all the parts, or where any of the parts have so little to do that it is not worth while to assign them a separate staff, parts related to or connected with each other, as two flutes, two clarionets, or three trombones, may be written on the same staff together. The arrangement or distribution of the parts in a score is matter of some importance. As a general rule, the highest part should be placed uppermost, then the next lower, and gradually descending. All the parts of a chorus should be placed together. Perfection in reading score is not very easily attained, but is necessary for a thoroughly trained musician. The student of music who can read or play the great master-works from the score, will become far more intimately acquainted with them than he could by mere piano-forte arrangements, and will come to understand the means by which their composers have produced the wonderful effects that are to be found in their music. The use of so large a number of clefs, and the practice which has obtained of writing parts for particular instruments in other keys, have added greatly to the difficulty of studying the score. Among various suggestions for simplifying the score, one which was lately advocated in Brown's *Elements of Musical Science*, consists in the use of but one clef, the bass or F clef, the other parts being distinguished from the bass by short bars attached to the clef, which direct the performer to take the notes one, two, or three octaves higher.

SCORESBY, WILLIAM, D.D., a celebrated Arctic explorer and savant, was the son of William Scoresby, the most distinguished whale-fisher of his time, and was born at Cropton in Yorkshire, October 5, 1789. He commenced a seafaring life at the age of ten, and in his 21st year, succeeded his father as commander of the *Resolution*, and carried on the business of whale-fishing. After having made 17 voyages to the Spitzbergen and Greenland whaling-grounds, he published the results of his observations of the countries within the Arctic Circle in *An Account of the Arctic Regions* (2 vols., 1820), a work which not only increased and extended the author's reputation, but added largely to the sciences of meteorology, hydrography, and natural history. In 1822, he explored the east coast of Greenland, a tract hitherto wholly unknown, and published in the following year at Edinburgh an account of this expedition and its fruits. In 1824, he was elected a Fellow of the Royal Society of London, and some time after was chosen *correspondent* of the French Institute. He had retired from his profession in 1822, and now proceeded to give effect to a strong desire which had long possessed him, of becoming an authorized teacher of religion, by entering himself at Queen's College, Cambridge; he graduated as B.D. in 1834, subsequently (1839) received the degree of D.D., and labored faithfully and zealously, first at Liverpool and afterwards at Bradford, till failing health compelled him to retire to Torquay. He still continued his physical researches, giving special attention to terrestrial magnetism, especially in its relation to navigation; and published the results, many of which were of great value and interest, in the form of Memoirs, in the *Philosophical Transactions*, the *Transactions of the Royal Society of Edinburgh*, the *Reports of the British Association*, and subsequently in an improved form in his *Magnetical Investigations* (Lond. 2 vols. 1839—1852).

For the better prosecution of these researches, he made a voyage to the United States in 1847, and to Australia in 1853, returning from the last-named country in 1856, enfeebled in health by the arduous labors which he had undergone. He died at Torquay on March 21, 1857. Besides his work on *Zoistic Magnetism*, which described a series of researches entered into for the purpose of eliciting some natural connection between magnetic and mesmeric agencies, he published various works of a religious nature. His life has been written by his nephew, R. E. Scoresby-Jackson (Lond. 1861).

SCO'RIÆ are the cinders and slags of volcanoes, more or less porous from the expansion of the gases contained in the melted materials. See VOLCANIC ROCKS.

SCORPÆ'NA, a genus of fishes, of the family of *Mailed Cheeks*. The head is large and compressed, more or less armed with spines or tubercles. The body is of a somewhat perch-like form. Some of the *Scorpænæ* are remarkable for their ugliness; some exhibit very fine colors. They are numerous in the Mediterranean, and widely distributed in the seas of warm climates. They frequent rocky shores in shoals, and feed on crustaceans, small fishes, &c. They are popularly called *Hog-fish* and *Scorpion-fish*. The flesh is dry and tasteless, but the liver yields a useful oil.—The Bergylt (q. v.) belongs to a nearly allied genus.

SCO'RPION (*Scorpio*), a genus of *Arachnida*, of the order *Pulmonaria*, formerly including the whole of the family *Scorpionidæ*, to all of which the popular name is still extended. Scorpions are natives of warm climates, both in the eastern and western hemispheres. The species are numerous. They have the body elongated,

Scorpion (*Scorpio Europæus*).

and no marked division between the thorax and abdomen. Six segments of the abdomen are broad; but the last six are narrow, forming a tail; and the last segment is modified into a curved and sharp sting, having two pores on its lower side, from which the venom flows, supplied by two poison glands in the base of the segment. The palpi are modified into pincers or claws like those of the lobster, by means of which prey is seized. There are four spiracles or breathing pores on each side of the abdomen. There are two remarkable comb-like appendages on the under surface of the thorax, the use of which is unknown. The number of eyes is various; in the restricted genus *Scorpio*, of which the COMMON S. (*S. Europæus*) of the south of Europe is an example, there are only six: but in some of the genera eight and twelve. Scorpions feed on beetles and other insects, and after seizing them, pierce them with a sting before eating them. They also eat the eggs of spiders, &c. They lurk under stones and in holes and crevices, but come forth to seek their prey, running with great activity. In running, they carry the tail curled over the back. When alarmed or irritated, they show great fierceness, evidently aware of the power of their sting, and moving it in all directions, as if threatening an adversary. They are universally disliked, and not a little dreaded, being apt to get into houses, and into beds, hiding themselves under pillows, in shoes, boots, &c., so that accidents are very frequent in countries where they abound.

The sting of a S. is seldom fatal, but even that of the Common European S. is very painful, and that of some of the largest species—which are six inches long—is much more severe, attended with much nausea and constitutional derangement, nor do the effects soon cease. It is of use to press a large key or other tube on the wound, so as to force out part of the poison. The best remedy is ammonia, internally administered, and also applied externally.

The female S. displays great regard for her young, which she

carries for some time clinging in great numbers to her back, limbs, and tail.

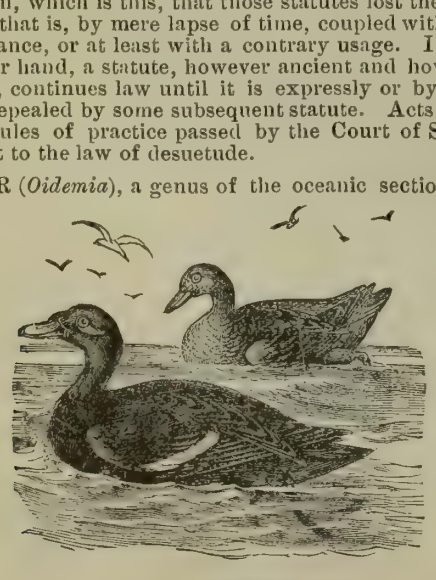
SCORZONE'RA, a genus of plants of the natural order *Compositæ*, suborder *Cichoraceæ*, having yellow or rarely rose-colored flowers. The species are numerous, mostly natives of the south of Europe and the East. No species is found in Britain. The Common S. of our kitchen-gardens, *S. Hispanica*, a native of the south of Europe, has long been cultivated for its esculent roots. The root is black externally, white within, about the thickness of a man's finger, long, and tapering very gradually, whence the name *Viper's Grass*, sometimes given to the plant, the root being supposed to resemble a viper. It contains a white milky juice, and has a mild sweetish mucilaginous taste; it is very pleasant when boiled, the outer rind being first scraped off, and the root steeped in water, to abstract part of its bitterness. The leaves are an inferior substitute for mulberry leaves in feeding silkworms.—Other species of S. are used in the same way.

SCOT, REGINALD, a writer who has acquired an honorable reputation as an early disbeliever in the reality of witchcraft, was a younger son of Sir John Scot of Scotshall, near Smeethe in the county of Kent, and was born in the first half of the 16th century. He studied at Oxford, and on his return home devoted himself exclusively to learned pursuits. Nothing further is known regarding him except that he died in 1599. His famous work, entitled *The Discoverie of Witchcraft*, was published in 1584, and is designed to demonstrate the absurdity of the prevalent belief on the subject. It is full of learning, and is marked in many passages by sound sense and humane feeling, qualities that naturally excited the antipathy of a person like King James, who wrote his *Dæmonology*, as he tells us, 'chiefly against the damnable opinions of Wierus and Scot; the latter of whom is not ashamed in public print to deny there can be such a thing as witchcraft.' But the 'British Solomon' only reflected the general ignorance and superstition of his age, and S. had to run the gauntlet of a series of 'Answers' and 'Refutations' by a number of 'eminent' divines, as well as by Glanvil, the author of the *Scepsis Scientifica*. S.'s book was ordered to be burned by the common hangman, and copies of it are now extremly rare. Besides *The Discoverie of Witchcraft*, S. wrote *A Perfect Platform of a Hop Garden*.

SCOT AND LOT VOTERS. The old legal phrase *Scot* (Ang.-Sax. *sceat*, pay) *and Lot* embraced all parochial assessments for the poor, the church, lighting, cleansing, and watching. Previously to the Reform Act, the right of voting for members of parliament and for municipal officers was, in various English boroughs, exclusively vested in payers of Scot and Lot.

SCOTCH STATUTES frequently mean the ancient acts of parliament beginning with the reign of James I. of Scotland, and continuing down to the Union of England and Scotland. There are also many statutes passed since that date which are applicable exclusively to Scotland, and these are to be found among the statutes at large. The rules of construction of Scotch statutes do not differ from those affecting English or British statutes. One peculiarity, however, distinguishes the old Scotch statutes prior to the Union, which is this, that those statutes lost their force by desuetude, that is, by mere lapse of time, coupled with neglect or non-observance, or at least with a contrary usage. In England, on the other hand, a statute, however ancient and however little acted upon, continues law until it is expressly or by strong implication, repealed by some subsequent statute. Acts of Sederunt —that is, rules of practice passed by the Court of Session—are also subject to the law of desuetude.

SCO'TER (*Oidemia*), a genus of the oceanic section of ducks,



Velvet Scoter (*Oidemia fusca*).

having a short broad bill with an elevated knob at the base of the upper mandible, the tip much flattened, and terminated by a large flat nail, the mandibles laminated with broad stong widely separated plates; the wings of moderate length; the tail short and acute; the feet very large; the plumage generally very dark. Their food consists chiefly of marine shell-fish, crustaceans, &c. They obtain their food by diving.—The COMMON S., or BLACK S. (*O. nigra*), is about the size of the common duck. The whole plumage of the male is deep black; the bill and legs are also black, except a line of orange along the ridge of the upper mandible. The female is dark brown. The black S. is abundant in winter on many parts of the British coast, migrating to more northern regions in spring. The flesh is oily, and has a fishy taste; but being therefore permitted to Roman Catholics during Lent, is in great request in some countries, so that at Marseille, Aix, and other places in the south of France, arrangements are made by the magistrates for an annual shooting or *battue* of scoters; in the north of France and in Shetland they are commonly netted.—The VELVET SCOTER (*O. fusca*) is a less common winter visitant of Britain, plentiful only in Orkney.

SCO'TIA. See MOULDINGS.

SCO'TLAND. For the Geography, see GREAT BRITAIN. *History.*—An account has been given under the article Picts (q. v.) of the early inhabitants of the country which has long been known by the name of Scotland. The original Scotia or S. was Ireland, and the Scoti or Scots, at their first appearance in authentic history, were the people of Ireland. The Scots were a celtic race, and their original seat in Northern Britain was in Argyle, which they acquired by colonization or conquest, before the end of the 5th c., and from whence they spread themselves along the western coast from the Firth of Clyde to the modern Ross. The name of S. seems first to have been given to the united kingdom of the Picts and Scots in the 10th century. It was then sometimes styled, by way of distinction, *Scotia Nova* (New Scotland), and it was a considerable time afterwards before the name of S. was applied to it, to the exclusion of Ireland. This interchange of names was a fruitful source of dispute between Irish and Scottish writers in the 16th and following centuries, and it can hardly be said that even now the controversy is entirely at an end.

The first prince of the British Scots mentioned in our authentic annals was Fergus, son of Erc, who crossed over to Britain about the year 503. His nation had been converted to Christianity by St. Patrick, and Fergus himself is said to have received the blessing of the saint in his early years. His great-grandson, Conal, was king of the British Scots when Columba (q. v.) began the conversion of the Northern Picts; and by that prince, according to the best authorities, Iona was given for the use of the mission. Conal was succeeded by his nephew, Aidan, who was inaugurated as sovereign by St. Columba in the island of Iona—a ceremony which Scottish writers, misled by the great French antiquary Martene, long believed to be the first example of the benediction of kings. Aidan was a powerful prince, and more than once successfully invaded the English border, but towards the end of his reign he received a severe defeat from the Northumbrian sovereign Ethelfrid at the battle of Degsestan.

The history of Aidan's successors is obscure and uninteresting, except to the professed students of our early history. Their kingdom was overshadowed by the more powerful monarchy of the Picts, with which, as well as with its neighbors in the south—the Britons of Cumbria—it was engaged in almost unceasing conflict. The Scots were for a time under some sort of subjection to the English of Northumbria, but recovered their independence on the defeat and death of King Egfrid in battle with the Picts at Nechtansmere in 685. In the middle of the 9th c., by a revolution, the exact nature of which has never been ascertained, the Scots acquired a predominance in Northern Britain. Kenneth, son of Alpin, the lineal descendant of Fergus and Aidan, succeeded his father as king of the Scots in 836. The Pictish kingdom was weakened by civil dissension and a disputed claim to the crown. Kenneth laid claim to it as the true heir in the female line, and was acknowledged king in the year 843.

King Kenneth transferred his residence to Forteviot in Stratherne, which had been the Pictish capital, fixing soon afterwards the ecclesiastical metropolis of the united kingdom at Dunkeld, where he built a church, dedicated to St. Columba. The Picts and Scots, each speaking a dialect of the Celtic tongue, gradually coalesced into one people, whose territory extended from the Firths of Forth and Clyde to the northern extremity of Britain. The crown descended to a line of princes of the family of Kenneth, whose rule gave a unity and comparative tranquillity to the Scots of Britain, which those of Ireland, at no time really united under one prince, never possessed, and the good effects of which, as contrasted with the state of the sister island, are experienced to the present day. The first interruption to the descent of the crown in the line of Kenneth was the reign of a usurper named Grig, round whose name, amplified to Gregory by the writers of a later age, a cloud of legendary fiction gathered. The old family was restored on his expulsion in 893.

The reign of Constantine, son of Aodh, who succeeded in 904, was a remarkable one. In his time, it is probable that the seat of the ecclesiastical primacy was transferred from Dunkeld to St. Andrews, and that the regal residence was fixed at Scone. At the latter place, in the sixth year of his reign, the chronicles mention that Constantine, the king, Kellach, the bishop, and the Scots, swore to observe the laws and discipline of the faith and the rights of the churches and the gospels. This seems to indicate the meeting of some sort of council, civil or ecclesiastical, or more probably a combination of both, according to the form prevalent at this period both among the Celtic and the Teutonic nations. Even before the establishment of the kingdom of the Picts and Scots in the person of Kenneth, Northern Britain had experienced the attacks of a new enemy, the Scandinavian invaders, generally spoken of under the name of Danes. Constantine resisted them bravely, but towards the end of his reign he entered into an alliance with them in opposition to the English. A powerful army, composed of Scots and Picts, Britons and Danes, disembarked on the Humber, and was encountered at Brunanburgh by Athelstane, king of England. A battle was fought there, the first of a series of unfortunate combats by Scottish princes on English ground. The confederate army was defeated, and though Constantine escaped, his son was among the slain. Weary of strife, the king soon afterwards retired to the Culdee monastery at St. Andrews, of which he became abbot, and where he died in 953.

During the reign of Malcolm the first of that name, and the successor of Constantine, a portion of the Cumbrian kingdom, including the modern Cumberland and part of Westmoreland, which had been wrested from the Britons by Edmund, king of England, was bestowed by that prince on the Scottish sovereign. This grant was the foundation of that claim of homage made by the English kings on the Scottish sovereigns, which afterwards became the cause or the pretext for the great struggle between the two nations. The northern kingdom was still further increased in the reign of Kenneth, son of Malcolm, by the acquisition of Lothian, and of Northern Cumbria, or Strathclyde. The former province, formerly a part of the Northumbrian kingdom, and entirely English in its population, was bestowed on Kenneth by Edgar, king of England. The Cumbrain kingdom, which had at one time extended along the west coast from the Firth of Clyde to the border of Wales, had been weakened by the loss of its southern territories; and it now fell under the dominion of the Scottish king. The last addition to Scotland in the south took place under Malcolm II., son of Kenneth, who acquired the Merse and Teviotdale from the Earl of Northumbria, and thus advanced his kingdom on the eastern border to the Tweed. The reign of Malcolm II. extended from 1003 to 1033. The kings who immediately followed are better known to the general readers than any of their predecessors, poetry having made their names familiar to every one. Malcolm's successor was his grandson, Duncan, whose brief reign was followed by that of Macbeth (q. v.). The latter was a vigorous and prudent ruler, munificent to the church, and famous as the only Scottish king who made a pilgrimage to Rome. But although by marriage he was connected with the royal line, he was unable to secure the affection of his subjects. Malcolm, the eldest son of Duncan, assisted by his kinsman, Siward, Earl of Northumbria, invaded Scotland. The usurper was defeated and slain at Lumphanan, in Mar, in 1056, and Malcolm was acknowledged as king.

The long reign of Malcolm III. was the commencement of a great social and political revolution in Scotland. His residence in England, and still more his marriage with the English Princess Margaret, the sister of Edgar Atheling, led to the introduction of English customs, the English language, and an English population into the northern and western districts of the kingdom, which hitherto had been for the most part inhabited by a Celtic race. The influx of English colonists was increased by the tyranny of William the Conqueror and his Norman followers. All received a ready welcome from the Scottish king, whose object it was to assimilate the condition of the Scots in every respect to that of their fellow-subjects in Lothian; and what his stern, though generous, character might have failed to accomplish, was brought about by the winning gentleness and Christian graces of his English queen.

Malcolm fell in battle before Alnwick Castle in the year 1093, and Margaret survived only a few days. On this event, it seemed as if the work of their reign was about to be utterly overthrown. The Celtic people of Scotland, attached to their old customs, and disregarding the claims of Malcolm's children, raised his brother, Donald Bane, to the throne. The success, however, of this attempt to restore a barbarism which the better part of the nation had outgrown, was of brief duration; Donald was dethroned, and Edgar, the eldest surviving son of Malcolm and Margaret, was acknowledged as king. The very name of the new sovereign marked the ascendency of English influence. That influence, and all the beneficial effects with which it was attended, continued to increase during the reigns of Edgar and his brother and successor, Alexander I.

The change went steadily on under the wise and beneficent rule of David (q. v.), the youngest son of Malcolm. His reign, which extended from 1124 to 1153, was devoted to the task of ameliorating the condition of his subjects, and never was such a work more nobly accomplished. David was in every respect the model of a Christian king. Pious, generous, and humane, he was at the same time active and just, conforming himself to the principles of religion and the rules of the church with all the devotion of his mother, but never forgetting that to him, not to the clergy, God had committed the government of his kingdom. He was all that Alfred was to England, and more than St. Lewis was to France. Had he reigned over a more powerful nation, his name would have been one of the best known among those of the princes of Christendom. As it is, every Scottish scholar has delighted to do his character justice. At the time of David's accession, Scotland was still but partially civilized, and it depended in a great measure on the character of its ruler whether it was to advance or recede. It received a permanent stamp from the government of David. The Celtic people were improved morally, socially, and ecclesiastically, and all along the eastern coast were planted Norman, English, and Flemish colonies, which gradually penetrated into the inland districts, and established the language and manners of that Teutonic race which forms the population of the greater part of Scotland. David encouraged and secured the new institutions by introducing a system of written law, which gradually superseded the old Celtic traditionary usages, the first genuine collections of Scottish legislation belonging to his reign. David was as great a reformer in the church as in the state.

The ecclesiastical system prevalent in Scotland almost up to his time differed in some points from that established in England and on the continent, bearing a great resemblance to that of Ireland, from which it was indeed derived. David established dioceses, encouraged the erection and endowment of parishes, provided for the maintenance of the clergy by means of tithes, and displacing the old Celtic monastic bodies, introduced the Benedictine and Augustinian orders.

David, though devoting his energies to the improvement of his subjects in the manner which has been mentioned, did not forget duties of a less agreeable kind. He knew that a Scottish king really held his crown by the tenure of the sword, and none of his fierce ancestors was a more intrepid warrior than the accomplished and saintly David. His skill and courage were shown, though without success, at the Battle of the Standard. As the representative through his mother of the ancient kings of England, he had many friends in that country; and had the Scottish army been successful, the history of the two kingdoms might in some respects have been different. As it was, he contented himself with maintaining the cause of his sister's child, the Empress Matilda, against King Stephen.

David's grandson and successor, Malcolm IV., reigned for twelve years, and the next king was William the Lion, Malcolm's brother, who ruled from 1165 to 1214. These princes pursued the policy of their grandfather with equal resolution, though sometimes with less success. They were embarrassed by their connection with the English King Henry II., who took advantage of his superior power and ability to impose unwise and unjust restraints on the independence of the Scottish sovereigns and their kingdom —a policy which laid the foundation of the unhappy national strife of after years. This was averted for a time by the concessions of Richard I. in 1189. 'For more than a century,' says Lord Hailes, 'there was no national quarrel, no national war between the two kingdoms—a blessed period.' That period was well employed by the next two kings, Alexander II. and Alexander III., the son and grandson of William the Lion, to consolidate the institutions of their kingdom, and extend and confirm what had been begun by David. Alexander III. was one of the ablest and best of the Scottish kings. By a treaty with the king of Norway, he added to his kingdom Man and the other islands of the Western Sea, held by the Norwegians. His sudden death, in 1286, was one of the greatest calamities with which Scotland could have been afflicted. It closed a period of prosperity—a course of improvement—which the kingdom did not again enjoy for nearly 500 years. The history of this interesting period has yet to be written. The only modern account of any value is that in the accurate but meagre Annals of Lord Hailes. Tytler begins his History with the reign of Alexander III.; and Robertson, in his narrative of two reigns—which in popular language is called the History of Scotland, just as Lord Macaulay's similar work is called the History of England—speaks of what took place during the whole time from the union with the Picts to the death of Alexander III., as 'events which may be slightly touched, but merit no particular or laborious inquiry.'

On the death of the infant grand-daughter and heiress of Alexander III., in 1290, the succession to the crown was disputed. The question between the two chief claimants, Baliol and Bruce

(q. v.), was not free from doubt according to the customs of the time; and Edward I. of England, to whom the decision was referred, appears at first to have acted with good faith. But this great king, who had already subdued Wales, was now bent on uniting the British Islands under one sceptre; and in the pursuit of that object he sacrificed humanity, honor, and justice. The results were most deplorable. The national spirit of the Scots was finally roused, and after a long struggle under Wallace and Bruce they secured their independence on the field of Bannockburn (q. v.). The battle of freedom was won; but it was at the expense of tranquillity and civilization. The border counties were continually wasted by the English; the central provinces were the scene of frequent warfare among the chief nobles; and the highland districts became more and more the seat of barbarism, the Celtic tribes reacquiring something of their old ascendency, just as they did in Ireland in the troubled times which followed the invasion of Edward Bruce. The strong arm of King Robert might have repressed these disorders, had his life been longer spared after the treaty of Northampton; but his death, and the accession of an infant son, again plunged the country into all the miseries of foreign and civil war. When that son, David II., grew up to manhood, he proved in every respect unworthy of his great father. His reign, and that of his successors Robert II. and Robert III, the two first princes of the House of Stewart, were the most wretched period of Scottish history. In the year 1411, half of the kingdom would have become absolutely barbarous, if the invasion of the Lord of the Isles had not been repulsed at Harlaw (q. v.), by the skill of the Earl of Mar, and the bravery of the lowland knights and burgesses.

A happier time began to dawn on the release of James I., in 1424, from his English captivity. The events of the following period are better known, and a brief notice of the most important will be sufficient. Reference may be made for details to the accounts of the particular kings. The vigorous rule of James I. had restored a tranquillity to which his kingdom had long been unaccustomed; but strife and discord were again brought back on his assassination. One of the most calamitous features of the time, was a succession of minorities in the sovereign. James himself had succeeded when a child and a captive; James II., James III., James IV., James V., Mary, and James VI., all succeeded while under age, and all, except James IV., when little more than infants.

The courage and ability shown by almost all the Stewart princes were insufficient to repair the mischiefs done by others in the beginning of their reigns, and to abate the great curse of the country—the unlimited power and constant feuds of the nobles. The last addition to the Scottish kingdom was made in the reign of James III., when the islands of Orkney and Zetland were made over to him as the dowry of his queen, Margaret of Denmark. The marriage of James IV. with Margaret of England was far more important in its ultimate results, and brought about in the reign of his great-grandson that peaceful union with England which the death of the Maiden of Norway had prevented in the 13th century. Many good laws were enacted during the reigns of the Jameses; but the wisdom of the Scottish legislature was more shown in framing them than the vigor of the government in enforcing them. Among the most important improvements of the period was the establishment of universities—the first of which, that of St. Andrews, was founded during the minority of James I. —and the institution of the College of Justice in the reign of James V.

During the reign of the fifth James, religious discord added another element to the evils with which Scotland was afflicted. The practical corruptions of the church were greater than they were almost in any other country in Europe, and one of the consequences was, that the principles of the Reformation were pushed further than elsewhere. Ths first great ecclesiastical struggle had hardly ceased, by the overthrow of the Roman Catholic system, when the strife began anew in the Reformed Communion in the shape of a contest between Episcopacy and Presbyterianism, the former being supported by the sovereign, the latter by the common people, the nobles throwing their weight into either scale as it suited their policy at the time. James VI. struggled hard to establish an absolute supremacy, both in church and state, in opposition to a powerful party, which admitted no royal authority whatever in the former, and very little in the latter. After his accession to the English crown, he was apparently successful in carrying out his designs, but during the reign of his son, Charles I., the contest again broke out with increased bitterness. The nobility, whose rapacity had been checked by the sovereign, joined the popular party. The opponents of the crown bound themselves together, first by the National Covenant, and afterwards in alliance with the English Puritans, by the Solemn League and Covenant. Their efforts were completely successful, but their success led to the utter overthrow of the monarchy by Cromwell.

The restoration of Charles II. was welcomed by all classes, wearied as they were of a foreign and military rule, but especially by the nobles and gentry, who had learned by bitter experience that the humiliation of the sovereign was necessarily followed by the degredation of their order. Had the government of Charles II. and James VII. been reasonably just and moderate, it could hardly have failed in securing general support; but unfortunately it was more oppressive and more corrupt than any which Scotland had experienced since the regencies in the minority of James VI. The natural result was the revolution, which seated William and Mary on the throne.

Hardly had the majority of the nation been successful in this, when many of them began to repent of what they had done, and Jacobitism became more popular than royalist principles had ever been when the House of Stewart was on the throne. The discontent was greatly increased by the fears entertained of English influence. The state of matters grew so threatening after the accession of Queen Anne, that the ruling English statesmen became satisfied that nothing short of an incorporating union between the two kingdoms could avert the danger of a disputed succession to the throne, and of a civil war. Supported by some of the ablest and most influential persons in Scotland, they were successful in carrying through their design, though it was opposed by a majority of the Scottish people. The Act of Union was formally ratified by the parliament of Scotland on the 16th of January 1707. It subsequently received the royal assent, and came into operatiou on the 1st of May of the same year. The union continued to be unpopular in Scotland for many years, an unpopularity increased by the corrupt means freely used to carry it through. But the discontent gradually ceased, and the ultimate consequences of the measure have been most beneficial to both kingdoms.

A few words may be added regarding the parliament of Scotland. That body was originally composed, like the English parliament, of three classes—the ecclesiastics (consisting of bishops, abbots, and priors), the barons, and the burgesses. The spiritual lords, during the establishment of Episcopacy after the Reformation, were composed of bishops only. When Presbyterianism was established at the time of the Covenant, and when it was formally ratified by law at the Revolution, the ecclesiastical estate ceased to have any place in parliament. The barons, or immediate vassals of the crown, at first sat in their own right, whether holding peerages or not; but afterwards the peers alone sat, the others sending their representatives. The burgesses were the representatives of the burghs. All the three estates sat to the very last in one house, the sovereign presiding in person, or through a commissioner named by him.

It would be impossible within reasonable limits to give a complete account of the original authorities for the history of Scotland. The principal ones are the following. For the period before the accession of David I.—Venerable Bede, the Early Lives of the Saints, the Irish Annals, the brief Scottish Chronicles published by Innes and Pinkerton, and the ancient English Chroniclers. For the subsequent period down to the Reformation—the Chronicles of Melrose and Lanercost, the Scotichronicon of Fordun and Bower, Winton's Chronicle, Leslie's and Buchanan's Histories, the English Chroniclers, the Ecclesiastical Chartularies, and the Acts of the Scottish Parliament. For the period from the Reformation to the Union—Knox's Calderwood's, and Spottiswood's Histories, Baillie's Letters, Wodrow's and Burnet's Histories, the Acts of Parliament, and the State Papers. The Scotch Record publications include *The Exchequer Rolls of S.; Accounts of Lord High Treasurer; Register of Privy Council; Documents illustrating Scotch History;* see also *Calendar of State Papers—Scotland*, 1509—1603. Modern works are Innes's *Critical Essay*, Pinkerton's *Inquiry*, Chalmers's *Caledonia*, Hailes's *Annals*, the histories of Robertson, Tytler, Laing, and Burton, Chambers's *Domestic Annals*, and Skene's *Celtic Scotland*.

SCOTLAND, CHURCH OF. For the Christianization of Scotland, see COLUMBA, CULDEES, NINIAN, PICTS, SCOTLAND. The doctrines of the ancient Scottish Church were the same as those of the rest of Western Christendom. In ritual, there were some points of difference, but so slight, that the most important related to the time of observing the Easter festival. In these, also, the Scots gradually conformed to the usage of the Roman and English Churches. In one point, however, there continued for several centuries to be a marked distinction between the Scots and Irish on one hand, and the churches of England and the continent on the other. This was in reference to ecclesiastical government. The Scots recognized the same orders of the ministry, bishops, priests, and deacons, as other Christians did; and, like them, they held that ordination could be given only by bishops. But they acknowledged no such supremacy of jurisdiction in the Episcopal order as was held by other churches. In Scotland, there were neither dioceses nor parishes; but there were numerous monasteries, in which the abbots, whether bishops or priests, bore the chief rule, all being in subordination to the successor of St. Co-

lumba, the presbyter-abbot of Iona, who, in virtue of that office, was primate of the Picts and Scots.

When Iona was desolated by the Northmen, the primacy seems to have been transferred in the middle of the 9th c. to the Abbots of Dunkeld, and about fifty years afterwards to the Bishops of St. Andrews, who became known as *Episcopi Scotorum*, the bishops of the Scots. Slowly at first, but gradually an assimilation to the English and continental practices began, a change rendered more easy by the Scottish dominion being extended over Lothian, in which the ecclesiastical system was the same as that of England. A great impulse was given in the same direction by the marriage of Malcolm III., king of the Scots, with Margaret, the sister of Edgar Atheling. The king and queen used their utmost efforts to introduce the English usages in ecclesiastical as in other matters; and Margaret herself held repeated conferences for that purpose with the chief Scottish ecclesiastics, at which her husband acted as interpreter. The principal points in which she attempted to bring about a reform were the commencement of the Lent fast, the superstitious infrequency of receiving the communion, and the lax observance of Sunday and of the Scriptural and canonical restrictions on marriage between relations.

The reform begun by Malcolm and Margaret was fully carried out by their youngest son, David I. These improvements were completed by his successors, and before the end of the 12th c. the ecclesiastical system of S. differed in no important point from that of the rest of Europe. Some Scottish writers have lamented the change, as being one from purity of belief and practice to superstition and immorality. This is undoubtedly a mistake. The Celtic Church had become very corrupt, and the clergy were inferior both in learning and morals to their brethren in the south. King David was a reformer in the best sense of the word, and it does not detract from the character of his reformation, that as time went on the Scottish Church became involved in those superstitions with which the rest of Christendom was overspread.

The ritual of the Scottish medieval church was almost the same as that of England, the Salisbury Missal and Breviary being the models of the Liturgies and Office Books used in Scotland The external system of the church—cathedral, parochial, and monastic—was also in almost every point identical. The chief monastic orders were the Benedictine, and its most important branches the Cluniac and Cistercian, the canons regular of St. Augustine, and the Reformnd Premonstratensian canons. The Cluniacs and Cistercians were in strict subordination to the mother-houses of their orders at Cluny and Citeaux.

In the 13th c. the Dominican, Franciscan, and Carmelite friars were introduced into Scotland. The chapters of all the Scottish cathedrals, except those of St. Andrews and Whithorn, were composed of secular canons—the chief dignitaries being a dean, archdeacon, chancellor, precentor, and treasurer. The prior and canons regular of the Augustinian monastery at St. Andrews formed the chapter of that see, and the prior and Premonstratensian canons of Whithorn formed the chapter of the cathedral of Galloway. There were twelve dioceses in the Scottish Church, to which Orkney was added on the transference of those islands to the Scottish sovereign in the 15th century. The twelve dioceses were Caithness, Ross, Moray, Aberdeen, Brechin, Dunkeld, Dunblane, St. Andrews, Argyle, the Isles, Glasgow, and Galloway. The larger of these dioceses were divided, like the English dioceses, into rural deaneries. The single point in which the medieval church down to the 15th c. differed from that of England and other churches of the west, was in its having no metropolitan. St. Andrews, and next to it Glasgow, had a certain precedence; the bishops of the former see, and failing them the bishops of the latter, having the privilege of crowning and anointing the sovereign. But they had no jurisdiction over the other sees, nor did their bishops bear the style of archbishop. This led to claims on the part of Archbishops of York to metropolitan authority in S., which had no foundation except in regard to the southern portion of the diocese of St. Andrews, and the see of Galloway, the bishops of which were, for several centuries, suffragans of York.

The court of Rome found it convenient, for the sake of its own privileges, to encourage this anomalous system; but to provide for the meetings of the Scottish bishops in provincial council, a bull of Pope Honorius III., in 1225, authorized them to meet in synod. In virtue of this bull, the bishops, abbots, priors, and other chief ecclesiastics, with representatives of the capitular, collegiate, and conventual bodies, assembled annually in provincial synod, sitting in one house, under the presidency of a conservator chosen by and from the bishops. The chief government of the church under the pope thus devolved on these synods, and their elective presidents. This continued until the erection of St. Andrews into an archiepiscopal and metropolitan see, in virtue of a bull of Pope Sixtus IV., in 1472. By this bull all the Scottish sees were made suffragans to that of St. Andrews, whose bishops were now to be styled archbishops.

In 1492 Glasgow was raised to the dignity of a metropolitan see by a bull of Pope Innocent VIII., and the Bishops of Dunkeld, Dunblane, Galloway, and Argyle were made suffragans to its archbishop, an arrangement which was soon afterwards altered to some extent—Dunkeld and Dunblane being reannexed to St. Andrews, and Glasgow having for its suffragan sees those of Galloway, Argyle, and the Isles. This last arrangement continued till the Reformation; and afterwards, during the establishment of Episcopacy—the two Scottish archbishops occupying towards each other precisely the same position as the Archbishops of Canterbury and York, and being sometimes involved in the same unseemly broils, in regard to jurisdiction and precedence, which long existed between the English metropolitans.

S. shared in all the errors of belief and superstitious practices in worship to which the rest of Christendom was subjected, and the ignorance and immorality of the clergy were far worse than they were in England, or perhaps anywhere in Europe, except in the Scandinavian churches. The desire for reformation which led to the proceedings of Huss and Wickliffe, produced similar effects in the Scottish kingdom. As early as the year 1406 or 1407, James Resby, an English priest, and a disciple of Wickliffe, was burned at Perth; and in 1433, Paul Crawar, a German Hussite, was burned at St. Andrews. The opinions of Wickliffe continued to be privately taught, particularly in the south-western counties, where his followers were known by the name of the Lollards of Kyle. In the following century, the intercourse with the continent was frequent and close, and the effects of Luther's preaching and writings were soon felt in Scotland. In the year 1525, the importation of Lutheran books, and the propagation of the Reformer's tenets, were forbidden by an act of the Scottish parliament; and in February 1528, Patrick Hamilton, abbot of Ferne, was burned at St. Andrews for teaching and publishing Lutheran doctrines. The piety of Hamilton, and the patience with which he bore his sufferings, induced others to follow his teachings and example. Several persons, both ecclesiastics and laymen, were subsequently burned, and many more fled to England or the continent.

The persecution, though encouraged or permitted by the bishops, was disapproved of by some ecclesiastics of learning and influence, who were desirous of effecting a reform in the church without breaking off from communion with the hierarchy. The efforts of this school were unsuccessful, and the Scottish nation was gradually divided into two parties—one of which, headed by the bishops, and supported by the state, was determined to resist all change; and the other, composed of a considerable number of the clergy both regular and secular, of the gentry, and of the burgesses of the large towns, was disposed to carry its reforming principles far beyond what had been done by Luther and Melancthon. These two parties came into deadly conflict in 1546. On the 28th February in that year, George Wishart, the most eloquent of the Reforming preachers, was condemned to death by an ecclesiastical court—at which Cardinal Beaton, Archbishop of St. Andrews, presided—and was burned. On the 28th of May following, the cardinal was murdered by Norman Leslie and other adherents of the Reforming party. The struggle continued during the regency of the Earl of Arran and that of Mary of Lorraine, the mother of Mary, the young queen of Scots.

In the year 1559 the Reformers became strong enough to set the regent at defiance. Various circumstances encouraged them to demand freedom for their opinions, particularly the death of Mary of England and the accession of Elizabeth. They were further animated at this time by the return from Geneva of their chief preacher, John Knox. The conflict was to be decided by other than spiritual weapons. The regent and the Reformed, now known by the name of the Congregation, met in open warfare. The contest was carried on for a twelvemonth, and ended in the triumph of the Congregation. A parliament met at Edinburgh on the 1st of August 1560. The Reforming party had the complete ascendency, and succeeded in passing several acts, by which the jurisdiction of the pope was abolished, the mass was proscribed, and a Confession of Faith, drawn up by Knox and his associates, was ratified, the spiritual lords making a faint resistance.

The new Confession of Faith adhered, in all essential articles of belief, to the ancient creeds of the church. In regard to the sacraments, it differed entirely from the recent corrupt teaching of the Western Church; but its language, on the whole, was moderate and conciliatory. In reference to ceremonies and the details of church polity, it declared that such things were temporary in their nature, and not appointed for all times and places, and that they ought to be altered when they fostered superstition and ceased to be conducive to edification.

A Book of Discipline was soon afterwards drawn up by the compilers of the Confession, which was generally approved of, but did not receive the sanction of parliament. It followed out in detail the principles laid down in the Confession. In regard to the office-bearers of the church various orders were mentioned, but three were specially of importance—ministers, elders, and deacons. Ministers were to be chosen by each several congrega-

tion, but were to be examined and admitted in public by the ministers and elders of the church. No other ceremony, such as imposition of hands, was to be used. The elders and deacons were to be chosen yearly in each congregation, and were not to receive any stipend, because their office was only to be from year to year, and because they were not to be debarred from attending to their own private occupations. In order to the better provision for the wants of the time, certain persons, called superintendents, were appointed in particular districts, with power to plant and erect churches, and to appoint ministers within the bounds of their jurisdiction.

The chief governing as well as legislative and judicial power in the Reformed Church was intrusted to a General Assembly, which met half yearly or yearly, and was composed of the superintendents, ministers, and lay commissioners, and which gradually, by the introduction of the system of representation, assumed the form and more than the power of a parliament.

The worship of the Reformed Church was modelled on that established by Calvin at Geneva. It was embodied in a formulary called the Book of Common Order, which for nearly a century continued to be generally used. It contained forms for the ordinary worship both on Sundays and week-days, and for the administration of the sacraments, and for certain other occasions. The minister was not absolutely restricted to these forms. Except in the singing of Psalms, the people took no direct part in ordinary worship, and there was no distinction of ecclesiastical seasons, all holydays whatever except Sunday being abolished.

The form of church government established at the Reformation did not remain long undisturbed. Some of the most zealous Protestants thought the danger to which the church was exposed from state tyranny and aristocratical oppression, could best be met by restoring the bishops to their ancient position both in the church and in the parliament; while others, of equal zeal and sincerity, saw in this only the commencement of a plan for bringing back all the errors of popery. A scheme of this kind was actually established for some time, and the sees were filled with Protestant bishops set apart for the office by their brethren of the ministry. It was almost immediately attacked by some of the ministers, who soon found a leader in Andrew Melville, a scholar of considerable eminence, who returned to Scotland in 1574, after a residence in Geneva, during which he had ardently embraced the new opinions as to ecclesiastical government maintained by Beza.

The struggle continued for some years, the bishops being encouraged by the sovereign and his advisers, whose support was frequently of little real advantage to them, and Melville receiving the zealous assistance of many of the ministers, and of the great body of the common people, who sympathized with him in his democratical theories of civil and ecclesiastical government. Melville was at last entirely successful. His opinions were embodied in what was called the Second Book of Discipline, which received the formal sanction of the General Assembly in 1581. This formulary differed very much from the First Book. It laid down authoritatively those principles in regard to ecclesiastical authority which the English Puritans were vainly striving to establish in the southern kingdom, and was in reality an attempt to make the civil power subordinate to the ecclesiastical, even in matters secular. It recognized four orders of office-bearers in the church, the Pastor, Minister, or Bishop, the Doctor, the Presbyter or Elder, and the Deacon. These were to be set apart by ordination, and the imposition of the hands of the eldership, but no one was to be intruded into any office contrary to the will of the congregation, or without the voice of the eldership. Four sorts of church courts, each rising above the other, were sanctioned; first, of particular congregations one or more; second, of a province, or what was afterwards called the Provincial Synod; third, of a whole nation; and fourth, of the universal church. What is generally regarded as the most essential feature of the Presbyterian system—the Presbytery—was not yet introduced in its proper form, the lowest court being a combination of what were afterwards known as the Presbytery and the Kirk-Session. It was, however, introduced before the year 1592, when the privileges of general and provincial assemblies, presbyteries, and parochial sessions were ratified by parliament, though the Book of Discipline itself did not receive any formal sanction.

King James had agreed to the establishment of Presbyterianism, but personally, and as a sovereign, he disliked its discipline, and he soon endeavored to overthrow it. His accession to the crown of England enabled him to do this with more authority. He gradually obtained from the General Assembly a recognition of the civil rights of the bishops, and this led to the restoration of their ecclesiastical privileges. His changes were sanctioned by a General Assembly which met at Glasgow in 1610, and in the course of the same year Episcopacy was restored in reality, as well as in name, by the consecration of three Scottish prelates, by four of the English bishops, at London.

The king wished to assimilate the Scottish Church, as far as possible, to that of England, and his next important movement was the establishment of what are called the Five Articles of Perth. See PERTH, THE FIVE ARTICLES OF.

These various changes excited great dissatisfaction in Scotland, particularly in the southern counties, but it gradually abated to a considerable extent, and might have altogether ceased, had not further innovations been attempted. It was the wish of James to introduce a prayer-book like that of the English Church, in place of the Book of Common Order, but he saw the danger with which the proposal was attended, and gave it up or postponed it. His son Charles was as inferior to his father in prudence, as he excelled him in conscientiousness and religious zeal. During his first visit to Scotland he added another bishopric—that of Edinburgh—to the dioceses of the Scottish Church. Most unwisely, and most improperly, he endeavored by his royal authority to introduce into that church a Book of Canons and a Liturgy framed on the model of those of England. The king had many loyal supporters in all parts of Scotland, and in the north Episcopacy was preferred by the people to Presbyterianism. But the storm of popular indignation which was now roused swept everything before it. The king's opponents banded themselves together by the National Covenant, and at a General Assembly held at Glasgow abolished the Perth Articles and Episcopacy, and re-established Presbyterianism. Charles attempted to maintain his claim by the sword, but was unsuccessful, and obliged to ratify in parliament all that had been done by his opponents.

Had the Covenanters been satisfied with the victory which they had won, Presbyterianism might have remained the established religion of the Scottish kingdom. But they could not resist the entreaties for aid from the English Puritans, or rather they yielded to the delusion of extending their own discipline over the churches of England and Ireland. They just attempted, in an opposite direction, what James and Charles had failed to accomplish. For a time their policy seemed to triumph. The Solemn League and Covenant of the three kingdoms, after having been approved by the General Assembly in Scotland, was signed by the Assembly of Divines which the parliament had summoned to meet at Westminster, and by the parliament itself. The ecclesiastical documents which were afterwards drawn up, originated with the Assembly of Divines, but were sanctioned by the Assembly in Scotland. The principal of these were a Directory for Public Worship, a Confession of Faith, and a Larger and Shorter Catechism. See ASSEMBLY OF DIVINES, and CREEDS AND CONFESSIONS. The first of these documents was intended to supersede the Book of Common Prayer in England, and, indirectly, the Book of Common Order in Scotland. It laid down certain general rules in regard to public worship and the administration of the sacraments, but left very much to the discretion of the particular ministers and congregations.

The union between the Scottish and English Puritans was dissolved by the ascendency of the Independents. Scotland, distracted by civil and ecclesiastical dissension, was unable to defend itself against Cromwell. It was conquered and kept thoroughly under subjection by the English army, which forbade the meetings of the General Assembly, but left the other courts and the rest of the church system as they were before. At the Restoration, the higher classes generally, who had suffered under the ecclesiastical tyranny of the ministers, were zealous for the re-establishment of Episcopacy. The greater part of the nation, except in the south-western provinces, was indifferent, and the king experienced no difficulty in restoring the bishops to their former rights both in church and state. But Episcopacy alone was restored; there was no attempt to introduce a liturgy, or even to enforce the observance of the Perth Articles. The new primate, Archbishop Sharp, was an able man of good moral character, but ambitious and overbearing, and the Covenanters never forgave his change from Presbyterianism, though he had always belonged to the more moderate of the two parties into which the church was divided. He was almost the only one of the bishops who enjoyed political influence; and unfortunately for himself and the hierarchy, that influence was generally used to encourage, not to restrain, the severe measures of the government. When the primate was assassinated, that severity became a cruel tyranny, and many who had no predilection for any particular ecclesiastical opinions were ready to welcome the change which took place at the Revolution.

When the Scottish Estates met in 1689, to consider what course was to be adopted in the northern kingdom, the bishops declined to abandon King James. Whatever might have been the consequences had they taken an opposite course, this resolution was fatal to the Episcopal establishment. William and Mary were called to the throne, and Prelacy was declared to be an insupportable grievance, and was abolished. In the following year, Presbyterianism was re-established, and the Westminster Confession of Faith was ratified as the national standard of belief, and the right of patrons to nominate to ecclesiastical benefices was taken away. In the end of the same year a General Assembly was held the first which had been allowed to meet since its dissolution by

the order of Cromwell. It was composed, as before, of ministers and elders from the various presbyteries, and of elders from the burghs and universities, and was presided over by a lay commissioner, named by the crown, and a minister elected by the members as moderator. With the exception of some years in the reign of William, the Assembly has continued to meet annually since the Revolution, and to transact business during the periods when it was not in session by a commission named by itself for the purpose. See ASSEMBLY, GENERAL. The other chief ecclesiastical events of William's reign were a series of vain attempts on the part of the sovereign to bring about a comprehension of the Episcopal clergy with those of the Establishment, and the passing by the Assembly in 1697 of what was called the 'Barrier Act' (q. v.), which guarded against sudden legislation, by providing that no permanent act should be passed until it had received the approbation of the majority of the presbyteries.

During the reign of Queen Anne, and in the year 1707, England and Scotland were united into one kingdom. A special statute was passed for the security of the Protestant religion and Presbyterian church government in the latter country; providing that these should continue without any alteration in time to come, and confirming the act of William and Mary, which ratified the Confession of Faith, and settled the Presbyterian form of church government.

In the year 1712, an act was passed by the British parliament which restored to patrons in Scotland their right of presentation to benefices. This statute excited great discontent among the members of the Established Church, and for many years attempts were made to obtain a repeal of it. These attempts were unsuccessful, but its provisions were long practically disregarded. When at length the General Assembly began to act upon it, the dissatisfaction increased among those who held the divine right of the people to choose their own ministers. The leader of the discontented party was a minister named Ebenezer Erskine, and he with his adherents, in the year 1733, finally separated from the Establishment, and formed a communion which took the title of the Associate Presbytery, though its members were popularly known as the Seceders. The Seceders themselves were soon divided by a very absurd dispute into two bodies, called the Burgher and Antiburgher Synods. In the year 1761, another secession from the Establishment took place in connection with the law of patronage; and the separated body assumed the name of the Presbytery of Relief.

There were no further secessions from the church; but its members were divided into two parties, known as the Moderates and the Evangelicals (q. v.), the former of whom were favorable, the latter hostile to the law of patronage. For many years the Moderates, headed by Dr. Robertson the historian and others of his school, and supported by the influence of the government, maintained an ascendency in the General Assembly and throughout the country. In the latter years of George III., and during the reign of George IV., this ascendency began to decrease. The political excitement which prevailed in the beginning of the reign of William IV. strongly affected the Scottish Establishment, which from its very constitution is peculiarly liable to be moved by the impulses of popular feeling. The two parties in the General Assembly engaged in a struggle more fierce than any in which they had yet met; and the subject of dispute, as before, was immediately connected with the law of patronage. Dr. Chalmers, the most distinguished minister in Scotland, added the whole weight of his influence to the popular party, and in 1834 an interim act of Assembly was passed, known as the Veto Act, which declared it to be a fundamental law of the church that no pastor should be intruded on any congregation contrary to the will of the people, and laid down certain rules for carrying out this principle. The legality of this act was doubted; and in connection with a presentation to the parish of Auchterarder, the presentee, on being rejected by the presbytery in terms of the Veto Act, appealed, with concurrence of the patron, to the Court of Session—the supreme civil court in Scotland. That court decided that the conduct of the presbytery in rejecting the presentee was illegal, and their judgment was affirmed by the House of Lords.

Other cases of a similar nature followed, and something like a conflict took place between the civil and ecclesiastical courts, the former enforcing their sentences by civil penalties, the latter suspending and deposing the ministers who obeyed the injunctions of the Court of Session. In the General Assembly of 1843 the dispute came to a crisis. A large number of ministers and elders of the popular party left the Assembly, and met apart in a similar body, of which Dr. Chalmers was chosen moderator. They formed themselves into a separate communion under the title of 'The Free Church of Scotland,' and gave up their benefices in the Established Church, and all connection whatever with that body. The Free Church carried off about one-half of the members of the Establishment, and became a rival communion in most of the parishes. See FREE CHURCH. By an act of parliament in 1874, patronage was abolished in the Established Church, and the right of choosing the minister transferred to the congregation. See PATRONAGE.

In 1820 the Burgher and Antiburgher Seceders were united under the name of the Associate Synod of the Secession Church; and in 1847 this Associate Synod and the Relief Synod were united under the name of 'The United Presbyterian Church' (q. v.). The recent negotiations for a union of the United Presbyterian Church and the Free Church have led to no practical result.

A few remarks may be added on the history of Scottish Episcopacy subsequently to the Revolution. It is a common but erroneous opinion that almost all the Episcopal clergy were Jacobites from the time of the accession of William and Mary. The bishops were so; but a large number, probably a considerable majority of the clergy, had at first no objection to take the oath of allegiance to the new government. During the reign of Queen Anne, the Episcopal clergy were well disposed to the government, knowing the queen's good wishes to their communion. They were frequently harassed by the courts of the Establishment; but all who were willing to take the oaths obtained an ample protection for their worship on the passing of the Toleration Act of 1712. On the death of the queen, almost all the clergy, and most of the laity, were involved directly or indirectly in the attempts to overthrow the Hanoverian dynasty, and it was this which finally made the names of Episcopalian and Jacobite for many years to be convertible terms.

In the meantime, the succession of bishops had been kept up by new consecrations, and after some years the dioceses, though diminished in number, were regularly filled. An important change took place in the forms of worship. No longer trammelled by their connection with the state, they adopted liturgical forms similar to those in the English Prayer-book, and in almost all cases identical, except that many of the congregations used an Office for the communion modelled on that of the Scottish Liturgy of King Charles I. The Episcopalians took no such open part in the insurrection of 1745 as they did in that of 1715, but their sympathies were known to be with the House of Stewart; and the government carried through parliament some intolerant acts, which were put in execution with great harshness, and which for many years suppressed all public worship in the Episcopal communion. It was only after the accession of George III. that these statutes ceased to be actively enforced; and it was not till 1792 that the Episcopalians, who from the death of Prince Charles had acknowledged the reigning dynasty, were relieved from the penal laws. The act which gave this relief imposed restrictions on their clergy officiating in England, and prohibited their holding benefices in the English Church. In 1804, the bishops and clergy agreed to adopt the Thirty-nine Articles of the Church of England, and in 1863, the Prayer-book was adopted as the authorized service-book of the Episcopal Church, permission being given in certain cases to use the Scottish Communion Office. The restrictions imposed on the Scottish clergy by the act of 1792 were modified by an act passed in 1840; and in 1864 they were entirely removed, the right being reserved to bishops in England and Ireland to refuse institution to a Scottish clergyman without assigning any reason, on his first presentation to a benefice in England or Ireland, but not after he should have once held such benefice.

The dioceses of the Scottish Episcopal Church are seven in number, viz., Moray, Aberdeen, Brechin, Argyle, St. Andrews, Edinburgh, and Glasgow. The bishops are chosen by the clergy of the diocese, and by representatives of the lay communicants, a majority of both orders being necessary to a valid election. One of the bishops, under the name of Primus, chosen by the other bishops, presides at all meetings of the bishops, and has certain other privileges, but possesses no metropolitan authority. The highest judicial body is the Episcopal College, composed of all the bishops. The highest legislative body is a General Synod, composed of two houses, the one of the bishops, the other of the deans and the representatives of the clergy.

The chief original authorities for the ecclesiastical history of Scotland down to the Revolution are the same as those mentioned in the article on the Civil History (q. v.) The chief modern authorities are: *Cook's History of the Reformation* and *History of the Church of Scotland;* Cunningham's *Church History of Scotland;* Grub's *Ecclesiastical History of Scotland.*

SCOTLAND, ROYAL ARMS OF. The arms of Scotland are—Or, a lion rampant gules, armed and langued azure, within a double tressure flory counterflory of fleurs-de-lis of the second. Supporters—Two unicorns argent armed maned and unguled or, gorged with open crowns, with chains affixed thereto, and reflexed over the back of the last. Crest—A lion sejant affronté gules crowned or, holding in the dexter paw a sword, and in the sinister a sceptre, both erect proper.

The lion is first seen on the seal of Alexander II., and the tressure on that of Alexander III. The unicorn supporters do not appear on any of the royal seals of Scotland till the time of

Queen Mary, on whose first Great Seal (1550) they are represented as chained and gorged with crowns. They, were, however, sculptured on Melrose Abbey as early as 1505.

Royal Arms of Scotland, previous to the Union.

In 1603, in consequence of the union of the crowns of England and Scotland, the Scottish arms came to be quartered with those of England and Ireland, while one of the English lions was adopted as a supporter. Precedence was, however, given within Scotland to the Scottish ensigns, which occupied the first and fourth quarters, and the unicorn also obtained the place of honor, being dexter supporter. From about the time of Charles I. to 1707, it became the practice to represent the unicorn as not merely gorged with an open crown, but crowned with an imperial crown. The Treaty of Union of 1707 declared (Art. 1) that the ensigns of the United Kingdom should be in future such as her majesty should appoint 'on all flags, banners, standards, and ensigns, both on sea and land;' the same mode of marshalling being adopted in England and Scotland. But Art. 24 has been sometimes supposed to leave room for a different mode of marshalling on the seals in use in matters relating exclusively to Scotland, and on the Great and other seals of Scotland. Since, as well as before the Union, precedence has been given to Scotland. The question of the proper marshalling of the royal arms within Scotland was raised in 1853 by a petition to the Queen by the magistrates of Brechin; a reference was made by the Home Office in the first instance to Garter King-at-Arms, and Garter's report was transmitted to the office of the Lord Lyon, where it was returned with observations by the Lyon Depute, who considered Scotland entitled to precedence on the judicial seals of the country; and his views have since continued to be acted on.

SCOTT, DAVID, a remarkable Scottish painter, was born in Edinburgh, October 10, or 12, 1806. He may be said to have commenced his career as an artist by an apprenticeship to his father, who was a landscape engraver; but endowed as he was with a deep, stern, sombre genius, it was soon visible to all who knew him that he was meant to be a painter. The first production that he ventured to send to the British Institution, 'Lot and his Daughters fleeing from the Cities of the Plain,' was returned as too large; but S. was too 'imperiously original' to take advice, and went on courageously painting pictures which, it has been said, 'would have required a hall for their exhibition, and which the public would neither admire nor buy.' In 1831, he exhibited the 'Monograms of Man,' a series of singularly suggestive sketches; and the first of his illustrations to Coleridge's *Ancient Mariner*, which are almost equal to the poem itself in weird and vivid beauty. In 1832, among others, 'Sarpedon carried by Sleep and Death,' a very fine work. In the autumn of the same year he set out for Rome, visiting most of the famous artistic cities on his way.

Nothing, however, that he saw in Italy or France, materially affected the bent of his genius, and his picture of 'Discord, or the Household Gods Destroyed,' painted there, exhibits all the peculiarities of his style and thought in a rampant and even repellent manner. In 1834 he returned to Edinburgh, and resumed his solitary brush. Passing over several interesting works, we may specially mention, as belonging to the year 1838, 'Ariel and Caliban,' and the 'Alchymist,' two of his best efforts in point of execution. Between 1840 and 1843, his chief productions were 'Philoctetes,' 'Queen Elizabeth in the Globe Theater,' 'The Duke of Gloucester taken into the Water-gate of Calais,' 'Silenus praising Wine,' 'Richard III.;' his illustrations (40 in number) of *The Pilgrim's Progress*, in which, as in those of *The Ancient Mariner*, he rivals the genius of the author he illustrates. In 1847, he produced the masterpiece of his whole career, 'Vasco da Gama encountering the Spirit of the Cape.' But S., always delicate, and even drooping in health, had now exhausted himself, and on the 5th of March 1849 he died, when fame was only beginning to encircle his name. S. contributed some vigorous essays on 'The Characteristics of the Great Masters' to *Blackwood's Magazine*. An unusually interesting *Memoir* by his brother, W. B. Scott, was published in 1850.

SCOTT, SIR MICHAEL, a medieval scholar and philosopher of the 13th c., whose real history is not only obscure but positively unknown. Boece identifies him with a Michael Scott of Balweary, in the parish of Kirkcaldy, in Fifeshire, who, along with Sir Michael de Wemyss, was sent to Norway in 1290, by the Scottish Estates, to bring home the 'Maiden of Norway,' and his death is fixed in the following year. But Sir Robert Sibbald, in his *History of Fife and Kinross* (published in the reign of Charles II.), speaks of a certain indenture, dated 1294, to which S.'s name was affixed, and in another part of the same book states that he went on a second embassy to Norway, in 1310, to demand the cession of the Orkneys. If we may rely upon Sir Robert's statement, it is hardly possible that the Scotch 'wizard' of European renown could have been the same person as Michael Scott of Balweary, because (as the story goes) after studying at Oxford or Paris, he went to the court of Frederic II., and wrote there some books at the request of that monarch. Now Frederic died in 1250, and supposing 'the wizard' not more than 30 years old at that time, this would make him 70 when he went to Norway the first time to bring home the 'Maiden,' and 90 on his second visit to demand the cession of the Orkneys; neither of which things is likely. Hector Boece, it should be observed, is our sole authority for the identification of Michael Scott of Balweary with the wizard, while, on the other hand, Dempster, in his *Historia Ecclesiastica Gentis Scotorum* (Bologna, 1627), distinctly avers that the name *Scotus*, borne by the latter, was that of his nation and not of his family —Michael, 'the Scot.'

It has been suggested that the ambassador may have been the son of the wizard, and that Boece may have confounded the two —a supposition probable enough in itself, but for which, in the absence of evidence, nothing can be said. The legend is further complicated by the fact that it appears to be English as well as Scottish. Cumberland claims the magic hero for herself. Camden, in his *Britannia* (1586), asserts that he was a monk of Ulme or Holme Cultram in that country, about 1290, 'who applied himself so closely to the mathematics, and other abstract parts of learning, that he was generally looked on as a conjuror; and a vain credulous humor has handed down I know not what miracles done by him.' He likewise states that S.'s 'magic books' were preserved there, but adds that they were then mouldering into dust; and Satchells (see his rhyming *History of the Right Honorable Name of Scott*) declares that he examined a huge tome which was held to be the wizard's, at Burgh-under-Bowness in 1629. According to the Scottish legend, he was buried in the Abbey of Melrose, and the Border was the scene of many of his most wonderful exploits, such as the cleaving of the Eildon Hills into three separate cones, and his bridling of the river Tweed! Dante mentions him in his *Inferno* (some years before 1321), in a way that shows that already his fame as a magician had spread over the continent, and suggests the suspicion that he must have died sooner than is commonly believed, All, however, that any one who rationally looks at the legend can believe, is, that a certain Michael Scott, or Michael the Scot, flourished in the 13th c., and was mistaken by the common people of his country for a wizard or magician, probably on account of his skill as an experimentalist in natural philosophy. The writings attributed to him indicate that his studies lay in this direction.

SCOTT, SIR WALTER, the fourth child of Walter Scott, Writer to the Signet in Edinburgh, was born in that city on the 15th August 1771. He came of the old Border family, the Scotts of Harden, an offshoot from the house of Buccleuch. Though he matured into a man of robust health, and of strength nearly herculean, as a child he was feeble and sickly, and very early he was smitten with a lameness which remained with him through life. His childhood was passed for the most part at Sandyknowe, the farm of his grandfather, in Roxburghshire. Here the foundations of his mind were laid; and his early and delighted familiarity with the ballads and legends then floating over all that part of the country, probably did more than any other influence to determine the sphere and modes of his future literary activity. Between the years 1779 and 1783 he attended the High School of Edinburgh, where, despite occasional flashes of talent, he shone

considerably more on the playground as a bold, high-spirited, and indomitable little fellow, with an odd turn for story-telling, than within he did as a student. In 1783, he went to the University, and for three years he remained there, as it seemed, not greatly to his advantage. Afterwards, in the height of his fame, he was wont to speak with deep regret of his neglect of his early opportunities. But though leaving college but scantily furnished with the knowledge formally taught there, in a desultory way of his own he had been hiving up stores of valuable, though unassorted information. From his earliest childhood onward, he was a ravenous and insatiable reader; his memory was of extraordinary range and tenacity, and of what he either read or observed he seems to have forgot almost nothing.

Of Latin, he knew little, of Greek less; but a serviceable, if somewhat inexact knowledge of French, Italian, Spanish, and German he had acquired, and he continued to retain. On the whole, for his special purposes, his education was perhaps as available as if he had been the pride of all his preceptors. In 1786, he was articled apprentice to his father, in whose office he worked as a clerk till 1792, in which year he was called to the bar In his profession he had fair success, and in 1797 he was married to Charlotte Margaret Carpenter, a lady of French birth and parentage. Towards the end of 1799, through the interest of his friends Lord Melville and the Duke of Buccleuch, he was made sheriff-depute of Selkirkshire, an appointment which brought him £300 a year, with not very much to do for it. Meantime, in a tentative and intermittent way, his leisure had been occupied with literature, which more and more distinctly announced itself as the main business of his life. His first publication, a translation of Bürger's ballads, *Lenore* and *The Wild Huntsman*, was issued in 1796. In 1798 appeared his translation of Goethe's drama of *Goetz von Berlichingen;* and in the year following he wrote the fine ballads, *Glenfinlas*, the *Eve of St. John*, and the *Grey Brother*. The year 1802 gave to the world the first two volumes of his *Border Minstrelsy*, which were followed in 1803 by a third and final one. This work, the fruit of those 'raids'—as he called them—over the Border counties, in which he had been wont to spend his vacations, was most favorably received by the public, and at once won for him a prominent place among the literary men of the time. In 1804, he issued an edition of the old poem *Sir Tristrem*, admirably edited and elucidated by valuable dissertations. Meantime, *The Lay of the Last Minstrel* had been in progress, and by its publication in 1805, S. became at a bound the most popular author of his day.

During the next ten years, besides a mass of miscellaneous work, the most important items of which were elaborate editions of Dryden (1808) and of Swift (1814), including in either case a Life, he gave to the world the poems *Marmion* (1808), *The Lady of the Lake* (1810), *The Vision of Don Roderick* (1811), *Rokeby* (1813), *The Bridal of Triermain*, anonymously published (1813), *The Lord of the Isles*, and *The Field of Waterloo*. The enthusiasm with which the earlier of these works were received somewhat began to abate as the series proceeded. The charm of novelty was no longer felt; moreover, a distinct deterioration in quality is not in the later poems to be denied; and in the bold outburst of Byron, with his deeper vein of sentiment and concentrated energy of passion, a formidable rival had appeared. All this S. distinctly noted, and after what he felt as the comparative failure of *The Lord of the Isles* in 1815, with the trivial exception of the anonymous piece *Harold the Dauntless* (1817), he published no more poetry. But already in *Waverley*, which appeared without his name in 1814, he had achieved the first of a new and more splendid series of triumphs. *Guy Mannering*, *The Antiquary*, *The Black Dwarf*, *Old Mortality*, *Rob Roy*, and *The Heart of Midlothian* rapidly followed, and the 'Great Unknown,' as he was called (whom yet every one could very well guess to be no other than Walter S.), became the idol of the hour. The rest of the famous series, known as the Waverley Novels, it would be idle to mention in detail.

From this time onward, for some years, S. stood on such a pinnacle of fame and brilliant social prosperity as no other British man of letters has ever gone near to reach. He resided chiefly at Abbotsford, the 'romance in stone' he had built himself in the Border country which he loved, and thither, as 'Pilgrims of his Genius,' summer after summer repaired crowds of the noble and the distinguished, to partake the princely hospitalities of a man whom they found as delightful in the easy intercourse of his home, as before they had found him in his writings. In 1820, to set a seal upon all this distinction, a baronetcy was bestowed upon him as a special mark of the royal favor. But the stately fabric of his fortunes, secure as it seemed, was in secret built upon the shifting sands of commercial speculation, and in the disastrous crisis of the year 1826 a huge ruin smote it. In 1805, S.'s income, as calculated by his biographer, was something nigh £1000 a year, irrespective of what literature might bring him; a handsome competency, shortly by his appointment to a clerkship of the Court of Session, to have an increment at first of £800, subsequently of £1300. But what was ample for all prosaic needs, seemed poor to his imagination with its fond and glittering dreams. Already some such vision, as at Abbotsford was afterwards realized, flitted before his mind's eye, and it was the darling ambition of his heart to re-create and leave behind him, in the founding of a family, some image of the olden glories which were the life of his literary inspirations. In the year above mentioned, lured by the prospect of profit, and without the knowledge of his friends, he joined James Ballantyne, an old schoolfellow, in the establishment of a large printing business in Edinburgh. To this, a few years afterwards, a publishing business was added, under the nominal conduct of John Ballantyne, a brother of James; S., in the new adventure, becoming as before a partner.

Gradually the affairs of the two firms became complicated with those of the great house of Constable & Co., in the sudden collapse of which S. found himself one forenoon a bankrupt, with personal liabilities to the extent of something like £150,000.

'In the reproof of chance
Lies the true proof of men'—

And now, in this challenge of adverse fate, S.'s manhood and proud integrity were most nobly approved. With his creditors, composition would have been easy; but this usual course he disdained. 'God granting him time and health,' he said, he would owe no man a penny. And somewhat declined as he now was from the first vigor and elasticity of his strength, he set himself by the labor of his pen to liquidate this enormous debt.

Breaking up his establishment at Abbotsford, where the wife whom he loved lay dying, he hired a lodging in Edinburgh, and there for some years, with stern and unfaltering resolution, he toiled at his prodigious task. The stream of novels flowed as formerly; a *History of Napoleon*, in eight volumes, was undertaken and completed, with much other miscellaneous work; and within the space of two years, S. had realized for his creditors the amazing sum of nearly £40,000. A new and annotated edition of the novels was issued with immense success, and there seemed every prospect that, within a reasonable period, S. might again front the world, as he had pledged himself to do, not owing to any man a penny. In this hope he toiled on; but the limits of endurance had been reached, and the springs of the outworn brain broke in that stress of cruel and long-continued effort. In 1830 he was smitten down with paralysis, from which he never thoroughly rallied. It was hoped that the climate of Italy might benefit him; and by the government of the day a frigate was placed at his disposal in which he proceeded thither. But in Italy he pined for the home to which he returned only to die. At Abbotsford, on the 21st September 1832, he died with his children round him and the murmur of the Tweed in his ears. On the 26th he was buried beside his wife in the old Abbey of Dryburgh.

In estimate of S. as an author, a few words must suffice. As regards his poetry, there is now little difference of opinion. Its merits, if somewhat superficial, are very genuine, and continue to secure for it some portion of the popular favor with which it was at first received. Deficient in certain of the higher and deeper qualities, and in those refinements of finish which we are of late accustomed to exact, it is admirable in its frank *abandon*, in its boldness and breadth of effect, its succession of clear pictures, its careless, rapid, easy narrative, unfailing life, spirit, vigorous and fiery movement. As a lyrist, S. specially excelled; and scattered hither and thither in his works are to be found little snatches of ballad and song scarcely surpassed in the language. The rank of S. as a writer of prose fiction, it is not so easy to fix with anything like precision. So imposing to the mind is his immense *prestige* as a novelist, that even at this date it is difficult to *criticise* him coolly; but it is not without risk of awakening some undermurmur of dissent, that the absolute supremacy can now be assigned him which at one time, almost without question, used to be conceded as his due. Nor is the dissent without some just ground of reason. S., with the artistic instinct granted him in largest measure, had little of the artistic conscience. Writing with the haste of the *improvisatore*, he could exercise over his work, as it proceeded, no jealous rigor of supervision; and on its appearance he was amply pleased with it if the public paid him handsomely. Hence he is an exceedingly irregular writer; many of his works are in structure most lax and careless, and some of the very greatest of them are disgraced by occasional infusions of obviously inferior matter.

Yet, all reasonable deductions made, it may be doubtful whether in mass and stature he is quite reached by any other novelist who could be mentioned. To class him, or even to speak of him along with Shakspeare, is absurd; but it is scarcely absurd perhaps to say that, *since* Shakspeare, to no British man has such wealth in this kind been intrusted. If, as we believe, the final test of greatness in this field be the power to vitalize character, to enrich our experience by imaginative contact with beings ever after more intimately distinct and real for us than the men we daily shake hands with, very few writers can be held to surpass

Scott. Further, he invented the historical novel, and in doing so, created a distinct literature, brought life into our conceptions of the past, and revolutionized our methods of writing history itself by a vivid infusion into them of picturesque and imaginative elements. On his *Scotch* novels his fame most securely rests; the others, for the most part, being obviously inferior. S.'s was essentially a great, sagacious, *practical* intelligence; on the speculative side he was entirely defective. See Lockhart's *Life of Sir Walter S.* (1837); and the *Life* by Hutton (1878).

SCOTT, WINFIELD, American general, was born at Petersburg, Virginia, of Scottish ancestry, January 13, 1786, was educated at William and Mary College, and studied the profession of law; but in 1808, having a genius for military pursuits, he was appointed captain of light artillery in General Wilkinson's division, stationed at Baton Rouge, Louisiana, but was suspended for having accused his general of complicity with the conspiracy of Aaron Burr. At the commencement of the war of 1812, he was appointed lieutenant-colonel, and sent to the Canadian frontier. He crossed with his regiment at Queenston Heights, where the American troops were at first successful; but on the British receiving reinforcements, they were repulsed with heavy loss, and S. was taken prisoner. The following year, having been exchanged, he was appointed adjutant-general, and was wounded by the explosion which followed the assault on Fort George. In 1814, as brigadier-general, he established a camp of instruction, and from April to July drilled his raw levies in the French tactics with such effect, that on the 3d of July he took Fort Erie, opposite Buffalo, by assault; and on the 5th fought a sharp drawn battle at Chippewa, and twenty days after, the famous frontier battle of Lundy's Lane, in which he had two horses killed under him, and was twice wounded, the last time severely. He was raised to the rank of major-general, and compiled the General Regulations of the Army, and translated and adapted from the French the system of Infantry Tactics, which has since been the text-book of the American army.

In the Indian hostilities of the American frontier, in the excitement attending the threat of Nullification in South Carolina, and in the Seminole war, General S. manifested those qualities of wisdom and moderation which made him rather a pacificator than a warrior. During the Canadian revolt of 1837—1838, he displayed great tact in allaying the excited passions of the frontier. In 1841 he was appointed commander-in-chief of the U. S. army, and in 1846 directed the military operations in the war against Mexico. Taking the field in person, he, March 9, 1847, landed 12,000 men at Vera Cruz, and invested and bombarded the city, which capitulated on the 26th. April 18th he carried the heights of Cerro Gordo, on the 19th he took Jalapa, on the 22d Perote, and on May 15th Puebla, where, owing to his heavy losses, chiefly by diseases incident to the climate, he was obliged to wait for reinforcements. On the 10th of August he advanced, with 10,780 men, to encounter the larger forces and strong positions of General Santa Anna. He turned El Penon, and won the brilliant victories of Contreras and Churubusco. Santa Anna entered upon negotiations only to gain time and strengthen his defences. These were followed by the sharp and sanguinary battles of Molino El Rey and Churubusco, September 8th, strong positions skilfully and bravely defended by superior numbers; and on the 14th S. entered the city of Mexico at the head of less than 8000 soldiers. Peace was negotiated with the cession of New Mexico and California to the United States, and the victorious general was welcomed home with the liveliest demonstrations. In 1852 General S. was the candidate of the Whig party for the presidency, but was defeated by one of his subordinate officers, General Franklin Pierce. In 1855, was created for him the office of lieutenant-general.

At the beginning of the war of Secession in 1861, he foresaw more than many others its extent and serious character, and advised the calling out of a much larger force than was first brought into the field. He had even suggested the advisability of allowing the 'wayward sisters to part in peace.' Age and growing infirmities compelled him in November 1861 to retire from active command. He subsequently visited Europe and published his *Memoirs* (8vo, 2 vols., New York, 1864.) S. died May 29, 1866.

SCOTTISH LANGUAGE AND LITERATURE. As the Scots were originally Irish Celts who settled in the Western Highlands of Alban, the phrase 'Scottish language' ought to denote, and did originally denote, *Ersch* or *Gaelic;* but the gradual extension of the authority of the Scottish kings, first over their Celtic neighbors the Picts, then over the Kymry or Cymry (q. v.) of Strathclyde, and the Angles of Lothian and the Merse, led to the name 'Scottish' being given to the language of the last of these; though, in reality, the true old 'Scottish'—i. e., the Gaelic, the speech of Kenneth MacAlpin and Malcolm Canmore, is further removed from the 'Scottish' of Ramsay and Burns (which is simply a dialect of northern English than the latter is from Russian or Sanscrit.

On this point Mr. Murray remarks in a scholarly paper, or rather treatise, in the *Transactions of the Philological Society for* 1873, which bids fair to become a standard authority on the subject: 'Ethnologically speaking, the Lowland Scotch dialects are forms of the Angle, or English, as spoken by those northern members of the Angle, or English race who became subjects of the king of the Scots. . . . More particularly they are forms of the North-umbrian or northern English—"the language of the Northin lede" which up to the war of independence was spoken as one language, from the Humber to the Forth, the Grampians, and the Moray Firth; but which, since the final renunciation of attempts upon the independence of the kingdom, has had a history and culture of its own, has been influenced by legal institutions, an ecclesiastical system, a foreign connection, and a national life, altogether distinct from those which have operated upon the same language on the southern side of the Border.'

Using then, the term 'Scottish' to denote the dialect of English used north of the Tweed, and omitting all consideration of anything written in Celtic, we may divide the history of *Scottish literature* into two periods; the first extending from the date of the earliest composition to the union of England and Scotland under one king, the second from that time to the present day.

A well-known brief lament for the death of Alexander III. preserved by Wyntoun, and marked by considerable beauty and pathos, is generally supposed to be one of the earliest specimens of Scottish poetry which has come down to us. The first Scottish *poet*—in the proper sense of the word—was John Barbour (q. v.), archdeacon of Aberdeen, who was born in the first half of the 14th c., and died in 1395. His great work is the poem of *The Brus*, in which he celebrates the struggles and final victory of King Robert Bruce. Barbour is superior to any English writer of the same century, except Chaucer and Langland. His language is even purer English than that used by the great author of the *Canterbury Tales*. There are editions of *The Brus* by Pinkerton, Jamieson, and Cosmo Innes (1856), from a MS. in the Advocates' Library; and by Rev. W. Skeat, from a MS. in St. John's College, Cambridge (1878).

The 15th c., during which England produced no poetical writer of eminence, was fertile in Scottish poets. First in rank, and hardly inferior to any in genius, was James I., king of Scotland, the author of *The Kingis Quhair*—i. e., The King's Quire or Book. Before him, in point of time, was Andrew Wyntoun, prior of Lochleven, who wrote a metrical chronicle, which was edited in part by Macpherson in 1795. A complete edition, by David Laing, was published 1872–78. Another Scottish poet of this century was Henry the Minstrel, or Blind Harry (q. v.), whose poem on the life of Wallace, in a modernized text, was long a favorite in Scotland.

The closing years of this century, and the first half of the next, were distinguished by poets of still higher name. Foremost of these is William Dunbar (q. v.), author of *The Thrissill and the Rois, The Goldyn Targe*, and many smaller poems, both serious and satirical, of very high merit. The only complete edition of his works is that by Mr. David Laing, which was published in 1834. Gawin Douglas (q. v.), a son of the Earl of Angus, and bishop of Dunkeld, was contemporary with Dunbar. He wrote several original poems, but his principal work is the translation in which he first gave 'rude Scotland Virgil's page.' A magnificent edition of Douglas has just been published under the editorship of Mr. Small (Edinburgh: Paterson, 1874). The last remarkable writer of this age is Sir David Lindsay (q. v.), who died in 1555, and whose poetical works were published in 1806 by George Chalmers, and again in 1871 by David Laing. The 16th c. also produced the first Scottish prose-writers. Among these is the anonymous author of *The Camplaynt of Scotland*, recently edited by Mr. Murray, from whom we have quoted above; and John Bellenden, archdeacon of Moray, the translator of Boece's *Scotorum Historiæ*, and of the first five books of Livy.

With Lindsay ceased that succession of poets writing in the Scottish dialect which had continued without interruption from the time of Barbour. It was more than a century and a half before another made his appearance. Most of the scholars of that time wrote in Latin; but for one vernacular prose-work of great merit as a composition, *The History of the Reformatioun of Religioun within the Realme of Scotland*, we are indebted to the leader of the movement, John Knox (q. v.).

We may close our account of this first period by the statement, that down to the period of the Reformation every Lowland Scot knew that his language was 'Inglis,' and the only one who did not speak of it as such was Gawin Douglas. The accession of King James to the crown of England was unpropitious to the vernacular literature of Scotland. The parliament still met at Edinburgh, but the capital had ceased to be the residence of a court, and the language began to be looked upon as a vulgar dialect of the English. The best authors composed in the classic English of the south. It was in that language Drummond (q. v.) of Hawthornden wrote his verses, Archbishop Spottiswood (q. v.)

and Bishop Burnet their histories, and Archbishop Leighton (q. v.) and Henry Scougal their theological works, so far as they were not in Latin.

It might have been expected that the union of the kingdoms, by which Scotland was deprived of a legislature of her own, would have soon extinguished the cultivation of the native literature; but as a matter of fact, it turned out to be otherwise. There was a strong popular prejudice against the Union, and this roused a deep feeling of nationality, apart from the old religious divisions. At this time appeared the first Scottish poet of true genius since the dark age of the country's literature set in—Allan Ramsay (q. v.), author of *The Gentle Shepherd*, which was published in 1725. Ramsay had also the merit of preserving some of those songs and ballads which have since become so famous, but whose authors are quite unknown. How far these works are the productions of an earlier age, and how far they are the composition of authors living in the 18th c., has been keenly discussed. Reference may be made to *The Romantic Scottish Ballads* of Mr. Robert Chambers on the one side, and to *The Lady Wardlaw Heresy* of Mr. Norval Clyne on the other.

To the deep attachment to the exiled line of kings cherished by a large party in Scotland, and to the interest awakened by the struggles in which this resulted, we owe the exquisite Jacobite songs.

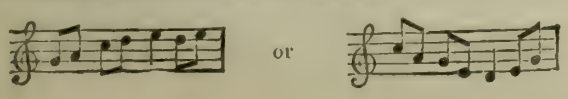
While these feelings were dying away under the influence of the mild government of George III., the close of the century was made famous by the appearance of the most illustrious of Scottish poets. It is almost needless to say a word of Robert Burns (q. v.). Admired by all ranks, he continues to be the chosen classic of the peasantry of the Scottish Lowlands. It is as an English writer that Sir Walter Scott (q. v.) is famous; but many of his lyrical pieces, and the dialogues in his novels, where the speakers use their own northern tongue, entitle him to be ranked as the last and greatest of Scottish writers.

There is, however, no doubt that in spite of the fine and various manifestation of literary genius in the Scottish dialect during the 18th and 19th centuries, that dialect has for the last 200 years been going through a process of uninterrupted decay. The introduction of southern English as the standard or classic form of speech after the union of the crowns, and still more after the union of the parliaments, slowly but surely ruined the old Anglian tongue of Scotland, till most of its peculiarities disappeared, and a jargon grew up that was neither pure English nor pure Scotch, but of which nevertheless Scotchmen are curiously proud. Mr. Murray has happily characterized this jargon in which Ramsay, Fergusson, Burns, Scott, Hogg, and Tannahill, wrote as '*fancy* Scotch.'

See Craik's *History of English Literature and the English Language* (1864); David Irving's *History of Scottish Poetry* (Edin. 1861); Cosmo Innes' preface to his edition of Barbour's *Brus* (1856); and Murray's Essay in the *Transactions of the Philological Society* (1873).

SCOTTISH MUSIC. Scotland is famed for a class of national airs of a peculiar style and structure, possessing a wild, dignified, strongly marked, and expressive character. They are generally considered to be of great antiquity; the few notes on which the oldest of them turn, and the character of the modulation, lead to the inference, that they originated at a time when the musical scale and musical instruments of the country were in a rude state; but there is a deficiency of evidence regarding their early history. No musical MS. of Scottish airs is now known to exist of an older date than 1627; and we have no knowledge when and by whom the early Scottish melodies were composed, or how long they continued to be handed down traditionally from generation to generation. They may not improbably have been committed to notation in the 15th and 16th centuries; and their disappearance is not wonderful, when we take into account, first, the strong measures resorted to, about 1530, by both civil and ecclesiastical authorities, to put down all ballads reflecting on the Roman Catholic hierarchy, and afterwards the ill-will shown by the now dominant Presbyterians towards worldly amusements, including not a few that were entirely innocent. The most valuable of now existing early collections of Scotch melodies is the Skene MS., in the Advocates' Library, noted down by Sir John Skene of Hallyards about the year 1630. It contains a number of native airs, mixed with some foreign dance-tunes—upwards of a hundred in all. Many of the Scotch melodies differ considerably from the more modern versions, presenting in general a ruder outline; but often exhibiting beauties which the changes these airs have subsequently undergone have only tended to destroy.

Among the peculiarities which give its character to the music of Scotland, the most prominent is the prevalent omission of the fourth and seventh of the scale, and consequent absence of semitones, giving rise to such melodic forms as



Passages of this kind occur in all the airs of Scotland which have any claim to popularity, and form one of their most recognizable features. Another characteristic is the substitution of the descending for the ascending sixth and seventh in the minor scale, as at the beginning of the air called *Adew, Dundee*, in the Skene MS.—

A very prevalent course of modulation is an alternation between the major key and its relative minor, the melody thus ever keeping true to the diatonic scale of the principal key, without the introduction of accidentals. An air will often begin in the major key, and end in the relative minor, or the reverse. The closing note is by no means necessarily the key-note, a peculiarity especially remarkable in the Highland airs, which, if in a major key, most frequently terminate in the second; if in a minor, on the seventh. Closes are also to be found on the third, fifth, and sixth. The peculiarities of modulation of the music of Scotland have something in common with the modes of ancient ecclesiastical music, to which it may be more correctly said to belong, than to the modern major and minor keys; and the avoidance of the fourth and seventh may have originated in the imperfection of the ancient wind instruments; yet these peculiarities are not to be found in the national airs of other countries where ecclesiastical music may be supposed to have had the same influence, and the early instruments to have been equally imperfect.

Among the more modern printed collections of Scottish melodies with words, the most important are George Thomson's collection, with symphonies and accompaniments by Pleyel, Kozeluch, Haydn, Beethoven, Hummel, and Weber (vols. i.—iv., 1793—1805; vol. v. 1826; and vol. vi. 1841), one distinguishing feature of which was the appearance of Burns's words conjoined with the old melodies of the country; and a more recent collection in 3 vols., published by Messrs. Wood & Co., and edited with historical, biographical, and critical notes by Mr. G. F. Graham (1848—1849).

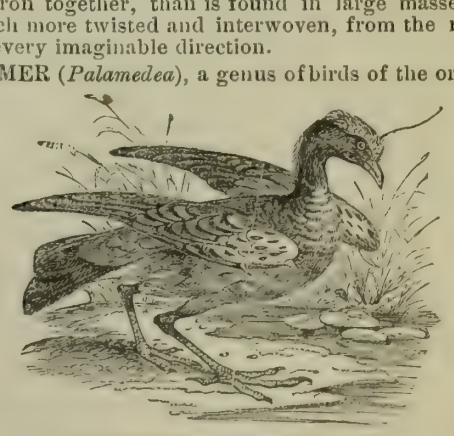
On the subject of Scottish music generally reference is made to Dauney's *Ancient Scottish Melodies, with Introductory Inquiry* (Edin. 1838).

SCOTUS AND SCOTISTS. See DUNS SCOTUS.

SCRANTON, a city of Pennsylvania, U. S., 105 m. N.-by-W. of Philadelphia. It lies in an important anthracite basin, and is the center of five railways. Its trade in coal and mining supplies is enormous. It became a city in 1866. Pop. (1870) 35,092; (1880) 45,850.

SCRAP-METAL, a term applied to fragments of any kind of metal which are only of use for remelting. Copper and brass scrap consist of the turnings from the lathe, and all useless and worn pieces, whether old or new. They are readily remelted. Scrap-tin consists of the clippings and fragments of tinned iron and worn-out tinned vessels; these are frequently dipped into hydrochloric acid, to dissolve off the tin-coating from the iron; and the muriate of tin so formed is of commercial value for dyeing purposes. Scrap-iron consists of any waste pieces of iron, although the term is usually held to mean malleable iron only; and for many purposes it is particularly valuable, as it is found that a greater strength can be obtained by welding small fragments of iron together, than is found in large masses, the fibre being much more twisted and interwoven, from the mingling of pieces in every imaginable direction.

SCREAMER (*Palamedea*), a genus of birds of the order *Grallæ*,



Horned Screamer (*Palamedea cornuta*).

allied to the Jacanas (q. v.). The bill is rather short, conical, curved at the extremity; there is a bare space around the eyes; the toes are long; each wing is furnished with two strong spurs. The HORNED S., or KAMICHI (*P. cornuta*), inhabits swamps in Brazil and Guiana, and feeds on the leaves and seeds of aquatic

plants. It is of a blackish-brown color, nearly as large as a turkey, and has somewhat the appearance of a gallinaceous bird. It receives its name from its loud and harsh cry. From the head, a little behind the bill, there rises a long, slender, movable horn, of which no use has been conjectured. The spurs of the wings are supposed to be useful in defence against snakes and other enemies.—Closely allied to this genus is the genus *Chauna*, or *Opistolophus*, to which belongs the CHAUNA, or CRESTED S. (*C.* or *O. chavaria*), a native of Brazil and Paraguay, the head of which has no horn, but is adorned with erectile feathers. The plumage is mostly lead-colored and blackish. The wings are armed with spurs. It is very capable of domestication, and is sometimes reared with flocks of geese and turkeys, to defend them from vultures, being a bold and powerful bird.

SCREEN, in Architecture, an enclosure or partition of wood, stone, or metal work. It is of frequent use in churches, where it shuts off chapels from the nave, separates the nave from the choir, and frequently encloses the choir all round. Such screens are often much ornamented, the lower part being solid, and the upper very often perforated. The Rood-screen (see ROOD) is that on which most labor is usually bestowed. In England, many beautifully carved screens in stone, enriched with pinnacles, niches, statues, &c., remain, such as those of York, Lincoln, Durham, &c.; and specimens in wood, carved and painted, are common in parish churches. In France, the screen round the choir is sometimes the subject of beautiful sculptures, as at Amiens and Paris. In Halls (q. v.) there was usually a wooden screen at one end to separate the entrance-door and a passage from the hall. Over this was a gallery. The term 'Screen of Columns' is also applied to an open detached colonnade.

SCREW, one of the Mechanical Powers (q. v.), is a modification of the Inclined Plane (q. v.), as may be shown (fig. 1) by

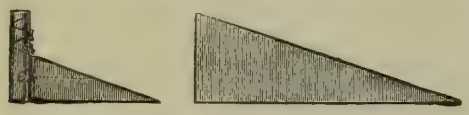


Fig. 1.

wrapping a piece of paper in the form of an inclined plane round a cylinder. In the screw, the spiral line, formed by the length or slope of the plane, is raised up in a ridge, and a lever is attached for the purpose of working it, so that the screw is really a compound machine, combining the lever and the inclined plane. It may be used as an instrument for penetration, as in the auger, gimlet, &c., or as a means of producing pressure, the latter being its most important application as a mechanical power. For this purpose, it is made to work in a 'female screw' or *nut* (a hollow cylinder grooved on the inside, so as to correspond to the threads of the screw); the nut is then firmly fixed in a massive frame (fig. 2), and the revolution within it of the screw causes the lower extremity of the latter to advance or recede. The principle of the screw's application is the same as that of an inclined plane pushed further and further under a heavy body so as to raise it up. Now in the inclined plane, P, the power or force, is to W, the weight raised or the pressure overcome, as the height of the plane to its base; that is, in the screw, as the distance between two threads is to the circumference of the cylinder. But as the twist is not applied at the circumference of the cylinder directly, but by means of a lever, it follows that the power applied, P, is to W, as the distance of two threads to the circumference described by P at the end of the lever.

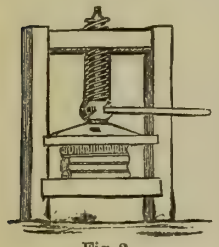


Fig. 2.

We see, then, that the power of the screw is increased by diminishing the distance between the threads; but as this cannot be effected without weakening the instrument, there is an evident limit to the increase of power in this way. The power can also be increased by lengthening the lever; but the best mode is that proposed by Mr. Hunter (in the *Phil. Trans.* vol. 17), in which are employed two screws of different fineness, the coarser of them hollow and grooved, to act as a nut for the other. The outer and coarser screw is the one to which the power is applied by a lever, and it is adjusted in the manner before described; the inner is so fastened as to be capable of vertical motion only. When the outer screw is turned so as to move its extremity downwards, the inner screw moves upwards, but not to the same amount; thus, if the outer screw have 6 threads to the inch, and the inner one 7, one turn of the outer screw depresses it $\frac{1}{7}$th of an inch, but as the inner one rises $\frac{1}{6}$th of an inch, the whole descent of the point which produces pressure is only $\frac{1}{6} - \frac{1}{7}$, or $\frac{1}{42}$ of an inch; hence the pressure applied is 7 times greater than could be given by the outer, 6 times greater than could be given by the inner screw, and equal to what would be given by a screw with 42 threads to the inch, with the same power applied. The advantage of Hunter's screw is that the threads may be any thickness, and consequently each screw any strength, we please, provided the difference be small enough. The screw is one of the most powerful of mechanical powers, but the friction generated by it amounts to about $\frac{1}{3}$d of the force applied.

SCREW-DRIVER, a chisel-shaped tool, used for turning round, and so driving in or drawing out the common joiners' screw-nails, the heads of which have a cleft made to receive the edge of the screw-driver.

SCREW PINE (*Pandanus*), a genus of plants of the natural order *Pandanaceæ*, natives of the tropical parts of the east and of the South Sea Islands. Many of them are remarkable for their adventitious roots, with large cup-like *spongioles*, which their branches send down to the ground, and which serve as props. Their leaves are sword-shaped, with spiny edges, and are spirally arranged in three rows. In general appearance, when unbranched, they resemble gigantic plants of the pine-apple, whence their popular name. *P. odoratissimus* is a widely diffused species; a spreading and branching tree of 25 feet high, much used in India for hedges, although it takes up much ground. In the south of India, it is called the Kaldera Bush. It grows readily in a poor soil, and is one of the first plants to appear on newly-formed islands in the Pacific. The male flowers are in long spikes, the female flowers in shorter branches. The flowers are frequently gathered before expanding, and boiled with meat. Their delightful and very powerful fragrance has made the plant a favorite everywhere, and it is the subject of continual allusions in Sanscrit poetry, under the name *Ketaka*.

Oil impregnated with the odor of the flowers, and the distilled water of them, are highly esteemed East Indian perfumes. The seeds are eatable; and the fleshy part of the drupes, which grow together in large heads, is eaten in times of scarcity, as is the soft white base of the leaves. The terminal buds are eaten, like those of palms. The spongy and juicy branches are cut into small pieces as food for cattle. The leaves are used for thatching, and for making a kind of umbrella common in India, and their tough longitudinal fibres for making mats and cordage. The roots are spindle-shaped, and are composed of tough fibres; they are therefore split up by basket-makers, and used for tying their work.—More valuable, however, as a fibrous plant is an allied species, *P. sativus* or *P. Vacoa*, the VACOA of Mauritius, which, if permitted, grows to a height of about 30 feet, but from continual cropping of its leaves, is usually dwarfed to six or ten feet. The fibres of its leaves are used for making the *Vacoa bags*, which constitute so considerable an article of export from Mauritius, rivalling in cheapness and usefulness the Gunny Bags of India. The leaves are cut every second year, and each plant yields enough to make two large bags. Immediately on being cut off, the leaves are split into fillets, which are nearly an inch broad at the base, but taper to a point, and are three or four feet long. One of these will support a bag of sugar, of about 140 pounds, without breaking. The aërial roots of the Vacoa are so fibrous as to be used for making paint-brushes for coarse purposes.

SCREW-PROPELLER, THE, is of the same construction as the common Screw (q. v.), but with the narrow thread exaggerated into a broad, thin plate, and the cylinder diminished to a mere spindle. One complete turn of such a screw is shown in fig. 1. Now, if a screw of this form were turned round in an unyielding substance, as wood, it would for each turn advance as much as the center of the blade (or thread) had moved along the spindle in forming the screw, i. e., the distance *ab*. If, on the other hand, the screw itself were prevented from moving longitudinally, and the piece of wood *not* fixed, the latter would be compelled to advance along the screw the same distance *ab*. When the screw is fixed beneath a ship, and made to revolve in the water, the case lies between the two just supposed, the screw moves forward, and with it the ship, and the water in which it has been working

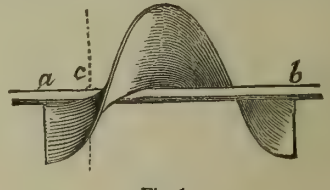


Fig. 1.

moves backward. The backward motion should only be small proportionately, and the ratio between it and the sum of the backward motion of the water and the forward motion of the ship is called the *slip*, which in well-designed vessels has a value of from 0·1 to 0·25

It is obvious also that on the same spindle there may be more than one blade, provided that all the blades have the same pitch or rate of progression along the spindle (in fig. 1, *ab* is the *pitch* of the screw). Screws have thus been formed with two, three, four, and six blades or arms, but the form most commonly used is two blades for ships-of-war, and three or four blades in the merchant-service.

If the screw be cut off before attaining the length *ab* of a whole convolution, as at *c*, the portion *ac* will still retain all the properties of the screw. In the earlier attempts, screws were tried of the length of a whole convolution, or even two whole turns; but experiment has since shown that this length is a disadvantage. The best results are obtained when the sum of the lengths, measured parallel to the center line of the shaft, of all the blades, is equal to about 0·4 of the pitch. This holds equally good for two, three, or four-bladed propellers, so that if n equals the number of blades, then the length of one blade, or *ac*, would be expressed by the equation $ac = \frac{0{\cdot}4\ ab}{n}$. A four-bladed screw of this kind, and of a form very generally used in the merchant navy, is shown in fig. 2.

The following are the technical terms applied to the screw-propeller: The *shaft* is the cylindrical axis on which the screw revolves, and is the medium for communicating to it the power of the steam-engine; the *blade* is the thread of the screw; the *pitch*,

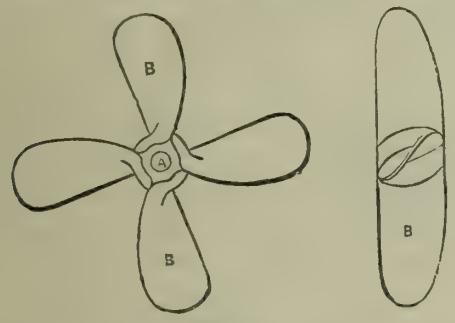


Fig. 2

the length of shaft on which the blade would make one complete turn; the *diameter* is the distance between the tips of opposite blades; and the *length* is the distance from the front to the back edge of blade projected upon a fore and aft plane.

The application of the screw to the propulsion of a vessel through the water is not new. In 1802, Dr. Shorter, an English mechanician, produced motion by its agency; but his discovery was valueless, as the steam-engine had not then been practically applied to navigation. Those who first employed Watt's engine on board ship adopted the paddle-wheel, the success of which turned attention from the screw for nearly thirty years. At length, in 1832, Mr. B. Woodcroft patented a screw-propeller with an increasing pitch; and four years later, Mr. F. P. Smith patented a screw making two whole turns, which he reduced, in 1839, to one whole turn. In 1837, he and Captain Ericsson, an American inventor, brought the matter practically forward on the Thames, where a small screw steamer, 45 feet long, 8 feet broad, and of 27 inches draught, towed the *Toronto* of 650 tons against tide at 4¼ knots an hour. In 1839, an American gentleman had the *Robert Stockton* built for him by Messrs. Laird, with which he reached America. The British Admiralty, however, refused any support to the new propeller, until the success of the *Archimedes*, built in 1838, of 232 tons and 80 horse-power, which was exhibited at the principal ports, rendered opposition no longer possible. The Admiralty, then, as an experiment, constructed the *Rattler*, from the trials of which vessel many valuable data for the screw-propeller have been derived. Meanwhile, in 1838, Mr. James Lowe had shown that the length of the screw should not exceed ⅓th of the pitch; and after actual and successive trials, the screw of the *Rattler* was cut down from 5 feet 9 inches to 1 foot 3 inches. These experiments established the screw as a rival to the paddle-wheel; and its advantage for ships of war became incontestible, as, from the entire submergence of the propeller, and consequent lowness of its engines in the ship, the chances of injury from an enemy's shot were reduced almost to nothing.

Some of the great steam-companies—notably the Peninsular and Oriental Company—also patronized it, and it was found of great value as an auxiliary in sailing-vessels. The result is that, at this time, its use in the British navy is almost universal, except in cases where want of sufficient depth of water, or other special circumstance, causes the paddle-wheel still to be employed.

Several varieties of screw have been introduced, each finding many supporters. The one which was for many years used in the British navy was invented by Mr. R. Griffiths. In it the blades, in place of rising from a small *boss*, as in fig. 2, spring from a hollow sphere occupying one-third the screw's diameter. This arrangement was adopted because experiment proved that the central portions of the blades of the ordinary screw absorb about 20 per cent. of the propelling power, while they produce little useful effect from the circumstance that at that part (especially in screws of a coarse pitch) the blade is nearly in a line with the shaft, and acts at right angles on the water, causing only a disturbance of that portion on which the outer and more powerful end of the blade operates. The globe, on the other hand, revolves with little friction. A further improvement was effected by bending the tips of the blades a little over backwards, so that the face of the blade striking the water was partly convex.

The older propellers had blades which increased in width uniformly from boss to tip. These were found to create much vibration in the ship, and the 'leading' corner is therefore rounded away as shown in fig. 2. This is also done in Griffith's propeller, but he probably carries the principle to excess in cutting away also the 'following' corner, and so lessening the effective surface of the blade. A propeller invented by Mr. Hirsch, and known by his name, has been lately successfully tried by the Admiralty, and may probably be much used by them in future.

One difficulty in the use of the screw as an auxiliary in sailing-ships is that in a good wind the screw seriously impedes the sailing. To prevent this, various devices are resorted to. In some cases, the screw is disconnected from the shaft, and left to revolve freely; in others, as in most ships of war, it is disconnected and hoisted altogether out of the water by means of an iron framework worked above the screw in a sort of well. Messrs. Maudslay have patented a 'feathering-screw,' which, by a simple apparatus, can, when the steam-power is not required, have the blades turned into a line with the ship's keel, and the screw (which must be two-bladed) fastened in a vertical position. When thus treated, the screw is out of danger, and forms no impediment to the ship's progress.

The usual position for the screw is immediately before the stern-post, the shaft on which it revolves passing, parallel to the keel, into the engine-room. Many vessels have been built, especially by Messrs. J. & W. Dudgeon of London, with two screws, one under each quarter. These have independent action, and as one can therefore be reversed, while the other goes ahead, great steering-power is imparted; so much so, that vessels constructed on this principle are said to be able to turn in their own length. For a given power, a twin-screw vessel draws less water, owing to the lessened diameter of the propellers, than an ordinary screw-steamer. As the action of the screw depends on the comparative immobility of the water in which it acts, it is necessary, for the development of its full power, that it should be completely immersed, and that there should be nearly two feet of water above the top of the upper blade. It follows from this that, *ceteris paribus*, the screw-vessel will draw more water than the paddle-steamer, for in large steamers the screw is from 15 to 18 feet in diameter, and in the *Great Eastern* it reaches 24.

It now only remains to notice the comparative advantage of the paddle and screw. Under favorable circumstances, in ships of equal tonnage and power, there is little difference in speed or force. Before the wind, the paddle has a slight advantage; with the wind ahead, the resistance offered by the paddle-boxes transfers the advantage to the screw. Fastened stern to stern, the screw-ship drags the paddle-ship; but fastened bow to bow, the same result is not found. This is, however, rather to be attributed to the loss of power in a paddle-ship when not in progress (see PADDLE WHEEL), than to any actual superiority of screw. In a long voyage, however, the gain is distinctly with the screw; because the weight of fuel borne at starting sinks the paddles too low in the water, and probably its exhaustion at the end of the voyage deprives them of their proper dip; whereas, with ordinary management, the screw will always be immersed. Again, rolling deprives the paddle of much power; while pitching deprives the screw of its proper matrix; but the balance of loss in tempestuous weather is in favor of the screw. It has been already shown that in men-of-war the screw is the most useful agent; and as an additional reason may be adduced the clear broadside which it allows for the guns. On the other hand, in point of comfort to the passengers, the advantage lies unquestionably with the paddle; for the rapid revolution of the heavy screw on a shaft extending half the ship's length, produces a continuous and very unpleasant vibration; while the lower position of the engines and screw gives the vessel a deep roll. For lakes and rivers, where the water is smooth and the voyage short, paddles are best, and more especially so when the water becomes often shallow or is choked with weeds, which would soon clog the screw.

In scientific language the motion of a vessel by means of a screw, is said to be due to the forward reaction of the water in which the propeller revolves upon the blades, and through them upon the whole vessel. In order that this useful reaction may bear the largest possible ratio to the work done by the engine, it is essential that the form of the ship aft should be such as will secure that plenty of water shall always have access to the forward side of the screw as the vessel goes along. This has been demonstrated by the experimental alterations in the after-body of the *Dwarf* (1846), and still more strikingly by placing a disc of the same diameter as the propeller in front of it. If the propeller be worked in these circumstances, the vessel will not move forward at all, although the power given out by the engines remains as before.

SCREW-WRENCH, a tool used for grasping the flat sides of the heads of large screws, such as are used in engines and other

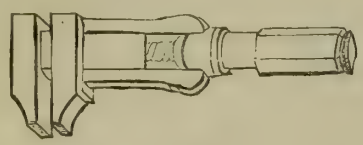


Fig. 1.

large works. The heads are usually octagonal laterally, and the wrench is made of two portions like hammers sliding one upon the other (fig. 1), so that screw-heads can be grasped of different sizes, and the handle forms the lever by which they are turned

Fig. 2.

round. The screw-key (fig. 2) is only a more simple kind of wrench, which will only act upon screws of two sizes, fitting the jaws at each end.

SCRI'BBLER. See SPINNING.

SCRIBE, AUGUSTIN EUGENE, a French dramatic writer, son of a wealthy silkmercer of Paris, was born in 1791. Educated for the legal profession, he soon deserted it for dramatic authorship. His first piece, *Les Dervis*, written by him in conjunction with Germain Delavigne (brother of Casimir Delavigne), was played in 1811, but till 1816 he cannot be said to have achieved a decided success. Since that time, pieces, chiefly vaudevilles, from his pen have followed each other with the most astonishing rapidity; and in such demand were they at the hand of theatrical managers, that S. established a sort of dramatic manufactory, in which numerous *collaborateurs* were constantly at work under his supervision. His plots are interesting, and his dialogue light and sparkling; and not a few of his pieces have been adapted for the English stage. S. also wrote various novels, and composed the *libretti* for a considerable number of well-known operas, including *Masaniello*, *Fra Diavolo*, *Rebert le Diable*, and *Les Huguenots*. He was admitted a member of the French Academy in 1834, and died February 20, 1861.

SCRIBE (Heb. *Sofer;* Gr. *Grammateus*, *Nomodidaskalos*), among the Jews, originally a kind of military officer, whose business appears to have been the recruiting and organizing of troops, the levying of war-taxes, and the like. At a later period, especially at the time of Christ, it had come to designate a learned man, a doctor of the law. Christ himself recognizes them as a legal authority (Matth. xxiii. 2); they were the preservers of traditions, and form a kind of police in the Temple and synagogues, together with the high-priests; and the people reverenced them, or were expected to reverence them, in an eminent degree. They were to be found all over the country of Palestine, and occupied the rank and profession of both lawyers and theologians. Their public field of action was thus probably threefold: they were either assessors of the Sanhedrim, or public teachers, or administrators and lawyers. Many of these teachers had special classrooms somewhere in the Temple of Jerusalem, where the pupils destined to the calling of a Rabbi sat at their feet. The calling of a Scribe being gratuitous, it was incumbent upon every one of them to learn and to exercise some trade. Those Scribes who were not eminent enough to rise to the higher branches of their profession, to enter the Sanhedrim, to be practical lawyers, or to hold schools of their own, occupied themselves in copying the Book of the Law or the Prophets, in writing phylacteries, contracts, letters of divorce, and the like. Their social position was naturally in accordance with their talents and their importance. The apostles, not learned enough, for the most part, to be Scribes, are promised to become 'Scribes' of the kingdom of God, &c. See PHARISEES, HALACHA, HAGGADA, MIDRASH, MISHNA, TALMUD.

SCRIBING, in Joinery, fitting the ends of pieces of wood together, so that the fibers may be at right angles, and the end cut away across the fibers.

SCRIP is a certificate (usually about the size and appearance of a bank-note) of a person's share or shares in a joint-stock undertaking. It is issued on the party signing a contract of copartnery, and is retained by him until an act of the legislature, or some other formality, establishes the company, and authorizes the opening of regular books for entering the names of shareholders and the transfer of stock. In many instances, scrip is unauthorizedly sold, and made an object of speculation; the party to whom it was assigned, however, remains bound by the contract which he has subscribed, until relieved of his obligations by transfer in the company's books.

SCRO'FULA, or SCROPHULA, was, until the last quarter of a century, regarded as consisting essentially of indolent glandular tumors, occurring frequently in the neck, suppurating slowly and imperfectly, and healing with difficulty. Recent pathologists, however, have given a more extended meaning to the word *scrofula*. According to them, it signifies a certain disease or defect of the constitution, in which there is a tendency to the production and deposition of a substance called *tubercle* in various tissues and organs; and tubercle must thus be regarded as the essential element of scrofula. It does not follow, however, that a deposit of tubercle should actually occur in every case of scrofula. The *tendency* is present, and the absence or presence of the deposit depends upon the extent of the affection, and is determined by various causes.

Sir James Paget, one of our most eminent pathologists, very clearly sums up what is generally understood by scrofula in the following paragraph: 'It is a state of constitution distinguished in some measure by peculiarities of appearance even during health, but much more by peculiar liability to certain diseases, including pulmonary phthisis. The chief of these "scrofulous" diseases are various swellings of the lymphatic glands, arising from causes which would be inadequate to produce them in ordinary healthy persons. The swellings are due sometimes to mere enlargement, as from an increase of natural structure, sometimes to chronic inflammation, sometimes to an acute inflammation or abscess, sometimes to tuberculous disease of the glands. But besides these, it is usual to reckon as "scrofulous" affections certain chronic inflammations of the joints; slowly progressive "carious" ulcerations of bones; chronic and frequent ulcers on the Cornea. Ophthalmia [q. v.], attended with extreme intolerance of light, but with little, if any, of the ordinary consequences of inflammation; frequent chronic abscesses; postules, or other cutaneous eruptions, frequently appearing upon slight affection of the health or local irritation; habitual swelling and catarrh of the mucous membrane of the nose; habitual swelling of the upper lip.' It is obvious that although the above-named forms of disease are often more or less coincident, they have nothing sufficiently in common to justify the general appellation of *scrofulous*. They are certainly not all tuberculous diseases, and hence Sir James Paget doubts whether the proposal to make *scrofulous* and *tuberculous* commensurate terms is practical, since the former, as generally employed, has a much wider significance than the latter.

The word is derived from the Lat. *scrofa*, a sow, it being supposed that this animal was especially liable to tumors such as occur in this disease. The Greek and Arabic names for the disease are similarly derived from the words signifying 'swine' in these languages. While *scrofula* was the popular, *struma* (supposed to be derived from *struo*, I heap up) used by Celus, Pliny, and other Latin writers, was the classical name for the disease. The vulgar English name, *The King's Evil*, is derived from the long-cherished belief that scrofulous tumors and abscesses could be cured by the royal touch. Multitudes of patients were submitted to this treatment, and, as the old historians assert, with perfect success, from the time of Edward the Confessor to the reign of Queen Anne. The writer of the article 'Scrofula' in *The English Cyclopædia*, mentions the curious historical facts that 'the old Jacobites considered that this power did not descend to Mary, William, or Anne, as they did not possess a full hereditary title, or, in other words, did not reign by divine right. The kings of the house of Brunswick have, we believe, never put this power to the proof; and the office for the ceremony which appears in our Liturgy as late as 1719 has been silently omitted. The exile princes of the house of Stuart were supposed to have inherited this virtue. Carte, in the well-known note to the first volume of his *History of England*, mentions the case of one Christopher Lowel, who, in 1716, went to Avignon, where the court was then held, and received a temporary cure; and when Prince Charles Edward was at Holyroodhouse in October 1745, he, although only claiming to be Prince of Wales and regent, touched a female child for the king's evil, who in 21 days is said to have been perfectly

cured.' The practice was introduced by Henry VII. of presenting the patient with a small coin (gold or silver).

The accompanying is an engraving of the identical touch-piece presented to Dr. Johnson (Lent 1712—when he was only thirty months old), who was one of the persons touched by Queen Anne.—The French kings also touched for the 'Evil,' the practice being traced back to Clovis, 481 A.D. On Easter Sunday, 1686, Louis XIV. is said to have touched 1600 persons, using the words: *Le roy te touche, Dieu te guerisse* (the king touches thee, may God cure thee). See Chambers's *Book of Days*, i. 82. The literature of

Touch-piece (time of Queen Anne).

this curious subject is somewhat extensive. The reader who wishes to pursue the inquiry further is referred to Tooker's *Charisma, sive Donum Sanctionis*, &c., 1597; Browne's *Charisma Basilicon, or the Royal Gift of Healing Strumæ*, &c., (1684); and Beckett's *Free and Impartial Inquiry into the Antiquity and Efficacy of Touching for the King's Evil*, 1722. The subject is also examined by Bishop Douglas in his *Criterion, or Miracles examined*, 1754; by Colquhoun, in his *Isis Revalata*, 1836 (who attributes the cure to animal magnetism); and by Howitt in his *History of the Supernatural in all Ages and Nations*, 1863.

Scrofula is a disease of early life, and when it does not exhibit any of its manifestations before the period of maturity it seldom shows itself afterwards.

In all systematic descriptions of this disease, two varieties of the scrofulous habit or diathesis are given, viz., the *sanguine* or *serous*, and the *phlegmatic* or *melancholic*. In the *sanguine*, there is a general want of muscular development, the limbs being soft and flabby; the skin is fair and thin; the features are delicate, the rosy hue of the cheeks contrasting strongly with the surrounding paleness; the eyes are gray or blue, and the eye-lashes long and silken; the hair fine and light colored or reddish; and the ends of the fingers broad and expanded, with convex nails bent over them; the intellect is lively and precocious, and there is often considerable beauty. In the *phlegmatic* variety the skin is pale or ruddy, dark, and often harsh; the general appearance dull and heavy; the hair dark and coarse; and the mind usually slow and torpid.

Children in whom the scrofulous constitution is strongly marked often present that narrow and projecting form of the chest to which the term 'pigeon-breasted' is commonly given; moreover, the abdomen is enlarged, the limbs wasted, and the circulation languid, in consequence of which they are especially liable to chilblains. The digestive organs are so commonly affected—as is evidenced by irregular action of the bowels, fetid breath and evacuations, furred tongue, capricious appetite, &c.—that, in the opinion of the late Dr. Todd, 'strumous dyspepsia presents a more characteristic feature of this habit of body than any physiognomical portrait that has been drawn of it.' In the great majority of cases the scrofulous disposition is hereditary; indeed, there is no disease which is nearly so often transmitted from parent to offspring as scrofula.

There is, however, scarcely any doubt that it may be acquired under the action of various unfavorable exciting causes, which may be ranked together 'as causes of debility.' Amongst them may be especially noticed (1.) Insufficient and improper food; (2.) Impure air; (3.) Insufficient exposure to direct sunlight; (4.) Exposure to wet and cold, and to sudden changes in temperature, especially if the clothing be insufficient; (5) Excessive and continued fatigue, whether bodily or mental; and (6.) Intense and prolonged anxiety or mental depression.

We shall first lay down the general principles of treatment to be adopted with the view of improving the health in the case of a person presenting either merely the general indications of a scrofulous habit of body, or some of its local manifestations, and we shall then conclude with a brief notice of a few of those particular forms of the disease which most frequently come under the attention of the medical practitioner.

The diet should be nutritious and sufficiently abundant, and animal food should be given at least twice daily. Dishes containing eggs and milk may usually be taken with advantage. If the patient is not very young, a little bitter ale taken at an early dinner will often promote digestion; if, however, it causes flushing or much sleepiness, it must be discontinued. A mother with scrofula should always provide a healthy wet-nurse for her child, as suckling in such a case is injurious both to parent and offspring. Flannel should always (both in summer and winter) be worn next the skin during the day, and the clothing must always be sufficient to keep the extremities warm. Constant residence in pure and dry air should be enforced as far as possible.

Unfortunately, the climate of Great Britain is by no means favorable to those possessing the scrofulous habit, and it is often very difficult for the physician to decide as to the choice of the most suitable residence. On this subject, Mr. Savory, in his essay on 'Scrofula' in Holmes's *System of Surgery*, vol. i., 1860, remarks that 'it is surely a mistake to suppose that a warm climate is the best adapted to all cases of scrofula. It is doubtless so in the great majority in which the disease [in the form of pulmonary consumption] is far advanced; but in many cases at an earlier stage, its further development is more satisfactorily arrested and the general health improved by a more bracing air. Children with tuberculous glands, but whose general health appears otherwise tolerably good, would perhaps profit less by transportation to Madeira or Egypt than by residence in the south-west coast of England, where the atmospheric changes are less frequent and sudden than in other parts of the kingdom, and the winter is comparatively mild. Delicacy of constitution is sometimes increased, and mischief encouraged, by dread of exposure.' Free exercise of the muscles and lungs in the open air should be insisted on in fine weather, and if this cannot be taken, the best substitute is friction over the surface of the body with the flesh-brush. Patients who can bear cold sea-bathing during the summer and autumn months will derive great advantage from it; but if a short immersion is not rapidly followed by a genial glow after drying the skin, such bathing is injurious, in which case warm salt-baths will be found useful.

Too much stress cannot be laid upon the fact that in the case of children the mind should be cheerfully occupied, but not overtasked. The medicines most esteemed in the treatment of scrofula are iodine and its compounds, the salts of iron, bark, sarsaparilla, the alkalies and mineral acids, and, above all, cod-liver oil. As the choice of the individual remedy must be left to the physician, we will merely remark that iodine and iron may often be advantageously prescribed together either in the form of the syrup of the iodide of iron, or of a well-known French preparation known as Blancard's Iodide of Iron Pills; and that to derive full benefit from cod-liver oil, it must be taken for a long time. As Mr. Savory remarks, the oil should be regarded as an article of diet rather than a medicine. A tablespoonful may be considered as a full dose for an adult; but this quantity should be gradually arrived at, the dose commencing with a teaspoonful. It is most easily taken when floating on a mixture of orange wine, or some other pleasant bitter fluid, with water. The lightest and clearest oil is probably the best, and in cold weather it should be slightly warmed before it is taken, for it is thus rendered more liquid and more easily swallowed. If what are commonly known as 'bilious symptoms' supervene, the use of the oil should be suspended for a couple of days, and a few gentle aperients should be prescribed.

Excluding pulmonary consumption, in which the leading pathological feature is the deposit of scrofulous matter or tubercle in the lungs, one of the forms of scrofula which most frequently presents itself is in the *lymphatic glands*, especially of the neck. The gland or glands may first become enlarged, either from an attack of acute inflammation, or from an indolent and painless deposit of tubercle. They may remain in this state either stationary or slowly enlarging for years, till from some accidental local irritation, or from some constitutional disturbance, they inflame and suppurate. After the discharge of the matter, the ulcerated skin usually heals with an ugly puckered cicatrix, which generally remains as a disfiguring mark through life. The local treatment consists in attempting to disperse the tumor, if it is hard and painless, by painting it with tincture of iodine, or by the application of iodine ointment. If it is soft, and likely to suppurate, the process may be facilitated by the application of warm water dressing or emollient poultices. When there is undoubted fluctuation, indicating the presence of pus or matter, it is usually regarded as the best practice to open the abscess with a narrow-bladed bistoury; but some surgeons still prefer allowing the matter to make its own way to the surface. The necessary internal treatment is that which has been already described. The *skin*, especially behind the ears, about the mouth, nostrils, and eyelids, and on the scalp, is liable to pustular diseases of a scrofulous origin. The free use of soap and water, followed by the application of black wash or zinc ointment, and proper constitutional treatment, will generally effect a cure, except in the horrible form of scrofulous ulceration of the skin of the face known as *Lupus* (q. v.).

Amongst other well-known and very serious scrofulous affections must be mentioned *Acute Hydrocephalus* and *Mesenteric Disease*, to which special articles are devoted. There is a peculiar and very intractable form of ulceration known as the *scrofulous ulcer*, which will be noticed in the article on ULCERS. The phys-

ical, chemical, and microscopical characters of the peculiar morbid deposit, to which reference has frequently been made in this article, will be found under the head of TUBERCLE and TUBERCULOSIS.

SCROFULOUS or Tuberculous Diseases are common amongst cattle, sheep, and pigs. In early life the tubercle is laid down in the mesenteric glands and occasionally about the joints. Along the exposed eastern coasts of Britain, scrofulous swellings are also met with about the head and neck; in some of the great grazing districts, the mucous membrane of the bowels is affected, constituting dysentery; but, as in man, the lungs are the most common site of tubercle, which here gives rise to pulmonary consumption. Scrofula in all its forms is hereditary, hence animals with any such taint should be rejected as breeding stock. It is induced and fostered by 'breeding in and in.' It may be developed, and is always aggravated, by debilitating influences, such as bad food, or exposure to wet or cold. Prevention is indured by breeding only from healthy vigorous, parents, and allowing the stock at all times adequate food and shelter.

SCROLL, an ornament of very common use in all styles of architecture. It consists of a band arranged in convolutions, like the end of a piece of paper rolled up. The Greeks used it in their Ionic and Corinthian Styles (q. v.); the Romans in their Composite; and in medieval architecture, and all styles which closely copy nature, it is of constant occurrence as in nature itself.

SCROPHULARIA'CEÆ, or SCROPHULARI'NEÆ, a natural order of exogenous plants, consisting chiefly of herbaceous and half-shrubby plants. The calyx is inferior, persistent, divided into five (sometimes four) unequal divisions. The corolla is monopetalous, more or less irregular, often two-lipped, exhibiting great variety of form; in the bud it has five (sometimes four) segments. The stamens are usually four, two long and two short, sometimes two, rarely five. The ovary is 2-celled, with many ovules; the style simple, the stigma generally 2-lobed. The lobes of the stigma sometimes display much irritability. The fruit is a capsule, or rarely a berry.—This order is a very large one, containing almost 2000 known species, which are distributed over the whole world, both in cold and warm climates. Acridity and bitterness are prevalent characteristics, and many species are poisonous. Some are root parasites. Some are admired and cultivated for their flowers; some are used medicinally. *Digitalis* or Foxglove, *Calceolaria*, *Mimulus*, Mullein, *Antirrhinum*, or Snapdragon, *Gratiola*, *Scrophularia* or Figwort, *Veronica* or Speedwell, and *Euphrasia* or Eyebright, are familiar examples. Very different from these humble herbaceous plants is *Paulownia imperialis*, a Japanese tree, 30 to 40 feet high, with trunk two or three feet in diameter, and flowers in panicles, about as large as those of the Common Foxglove.

SCRUPLE (Lat. *scripulum*, *scriplum*, or *scrupulum*) was the lowest denomination of weight among the Romans, and with them denoted the 24th part of an ounce (*uncia*), or the 288th of a pound (*libra*). As a measure of surface it was also the 24th part of the *uncia*, and the 288th of an acre (*jugerum*); seeming, in fact, to be the 24th of the 12th part of any unit. In later Roman times it became the name of the 60th part of an hour, and corresponded to our 'minute.' The 'minute' being the *scrupulum*, the 60th part of a minute was called a *scrupulum secundum* (whence the derivation of our word 'second'), the 60th part of this a *scrupulum tertium*, and so on. Lexicographers define 'scrupulum' to be a small pebble, such as would be likely to find its way between the sandal and the foot, whence the use of the term to signify a small difficulty or objection.—The term at the present time is a denomination in that modification of Troy weight which is used by apothecaries; it contains 20 Troy grains, is the third part of a drachm, the 24th of an ounce, and the 288th of a Troy pound.

SCUDERY, MADELEINE DE, a once notable French novelist, was born at Havre in 1607. Left an orphan at the age of six, she, along with a brother named Georges, was carefully educated by one of her uncles. While still young, she left Normandy for Paris, was admitted to the Hôtel Rambouillet (see RAMBOUILLET), and soon became one of the oracles of the brilliant society that assembled there. It was in this famous but showy circle that Mademoiselle S. gathered that immense fund of watery sentimentalism, platonic gallantries, 'polished' conversation, dull ceremonial incidents, affectations of moral purism, &c., which make up the tedious contents of her romances—*romans de longue haleine* (long-winded romances), as they have been felicitously nicknamed. Their popularity for a brief period was painfully wide. Everybody with the slightest pretensions to 'taste,' except the Port-royalists, Bossuet, and a few critics of the stricter sort, professed a boundless admiration for them. The bishops in general as Camus, Mascaron, Huet, Godeau, Fléchier, Massillon—were in raptures, and studied the stately trash with an ardor that considerably diminishes our respect for their understanding. When the troubles of the Fronde had broken up the gatherings at the Hôtel Rambouillet, Mademoiselle S. organized a literary circle of her own, which met every Saturday at her house in the Rue de Beauce. These 'Saturdays' began very well; but gradually they degenerated, and became ridiculous—pedantic and blue-stocking-ish they had been from the very first.

Nothing further in Mademoiselle S.'s life calls for notice. She died at Paris, 2d June 1701, at the advanced age of 94, honored and respected to the last; and it is but fair to admit that she seems to have been worthy of the regard in which she was held, being herself a perfect pattern of those watery virtues and superfine excellences of demeanor that she loved to depict. Her principal works (never again to be read in this world) are: *Ibrahim, ou l'Illustre Bassa* (Par. 4 vols. 1641); *Artamène, ou le Grand Cyrus* (Par. 10 vols. 1649—1653); *Clélie, Histoire Romaine* (Par. 10 vols. 1656); *Almahide, ou l'Esclave Reine* (Par. 8 vols. 1660); *Les Femmes illustres, ou les Harangues Héroïques* (Par. 1665); 10 vols. of *Conversations Nouvelles*, *Conversations Morales*, and *Entretiens de Morale* (1680—1692); besides *Lettres*, and *Poésies légères*, &c.—See Victor Cousin's *La Société Francaise au Dixseptième Siècle*.

SCU'DO (Ital. shield), an Italian silver coin, corresponding to the Spanish *piastre* (q. v.), the American dollar (q. v.), and the English crown (q. v.). It was so called from its bearing the heraldic shield of the prince by whose authority it was struck, and differed in value in the different states of Italy. In Rome, where it was called the *scudo Romano* or *scudo nuovo*, it was equal to 4*s.* 3*d.* sterling; and was subdivided into 10 *paoli* or 100 *bajocchi*. The Venetian scudo, or *scudo della croce*, was of higher value than the Roman one; while on the other hand, the old scudi of Bologna, Genoa, and Modena are inferior to it in value. Scudi are now gradually disappearing from the provinces of the Kingdom of Italy before the new decimal coinage, but the name is sometimes given to the piece of 5 lire, equivalent to a 5 franc-piece in the French coinage. Scudi of gold were also struck in Rome, the *scudo d'oro* being equivalent to 10 *scudi di argento*. See PIASTRE.

SCULL, SCULLING. A scull differs from an oar in size only. It is shorter, and less heavy. A man can only manage one oar; but he can pull with a pair of sculls, the ends of which lap over very little, or else do not meet within the boat.

Sculling has two senses, a river sense and a sea sense. In its freshwater acceptation, sculling is the act of propelling a boat by means of sculls in pairs. Among seafaring men, however, to scull is to drive a boat onward with one oar, worked like a screw over the stern.

SCU'LPTURE, the process of graving or cutting hard materials; from the Lat. *sculpo*, in Gr. *glypho*. Its common application is to artistic carving or cutting. Sculpture is the art of expressing ideas or images in solid materials. In this sense processes which do not, strictly speaking, involve the cutting of hard substances are included in the term. Sculpture, as in art, includes the moulding of soft materials as well. Clay, and even wax, have been in all ages of the art employed, sometimes for the purpose of sketches or models for reproduction in marble or metal, sometimes as the material of the finished work. The art of sculpture is as old as any that has been handed down to us. The Scriptures allude to the working of brass and other metals in the beginning of human society, and we read of the images of Laban carried off by his daughter. The great nations of antiquity all practised it, though only Nineveh and Egypt have left us anything like a fair representation of the state of the art in those early times. From the nature of this art its productions have proved more durable than those of painting, and have come down to us in more numerous instances even than works of architecture. While the latter have been destroyed, and their materials used up, works of sculpture, being smaller, have remained buried, and from time to time have been reproduced for the instruction and enjoyment of modern nations.

As an art, or means of recording facts and representing ideas, sculpture has many disadvantages as compared with painting, neither color nor picturesque backgrounds being properly admissible in sculpture. To this rule, however, we shall find exceptions in the works of Ghiberti in the 15th century.

Sculptures are distinguished by different terms, according to the nature and completeness of the work. Groups or figures completely represented are said to be 'in the round.' Those only partially detached from the mass or background are said to be 'in relief.' This, again, is called 'high' or 'low relief,' according as the figure stands fully or slightly above the mass behind it. The ancient Egyptians employed another kind of relief, their figures being sunk below the surface, and only the prominent portions remaining level with it. In this case the background or unoccupied space is not cut away, but the figures are worked downwards into it. Another process is called 'intaglio,' the whole figure being regularly designed and moulded, but 'cut into' the material and inverted. This is usually applied to the making of gems and seals. Another sculptural process is that used in the treatment of metals. As metals are both harder than stone and more valuable, it is not possible to cut or grave works out of

masses of metal as is done in stone or gems. The metal is fused by heat, and the form is given it while in that state. This is done by first forming or moulding the design in clay or other soft material. Round the model thus formed, a mould is formed of sand, which is prepared and pressed round it in a wet state till it takes the complete form of the model, which is then removed, and the liquefied metal poured in. It takes the exact shape of the model by this means. These are said to be 'cast,' because of the casting of the liquid metal into the mould.

Other processes, however, have, in the finer works, to be applied. The metal retains the rough surface of the sand in which it has chilled. It is therefore worked over with a graving tool, to give it a final surface, and express every delicacy of form intended by the artist. In some cases this 'engraving' is in the form of ornamental design, such as dress, &c. Sometimes the whole design is engraved without any previous casting. In this case the metal has had its form given by 'hammering' or 'beating.' The metal, hot in the case of iron or bronze, or cold in the case of silver and gold, softer metals, is beaten on the anvil into its form. A coarser and deeper method of engraving is called 'chasing,' where deeper sinkings and bolder prominence are given to the different parts of the design.

Of moulding we have already spoken. We may now remark on the materials in use for these various purposes. In sculpturing, or cutting designs or figures, we generally find marbles have been employed; the most famous having been the 'Parian,' from the Isle of Paros, and the Pentelic, from the mountain of that name in Attica. Besides these, the ancients used numerous marbles—white, and latterly colored: the late classical sculptors sometimes employing both white and black, or colored, in lumps on the same work, the colored marble being used for the dress or hair as it might be. The Egyptians, besides the use of these materials, and various kinds of fine and coarse-grained stone, employed porphyry, purple and black, an exceedingly hard and difficult material to handle.

The modern sculptors have used the white marble of Carrara in Italy, an excellent material, but liable to veins and discolorations which are unfavorable to the art. 'Terra Cotta,' or burnt clay, was extensively in use both in ancient and modern times; the clay being moulded to the utmost delicacy while soft, and then baked to a red color. Singularly fine reliefs remain to us from the Etruscans and Greeks, as well as from Egypt and elsewhere, as may be seen in the British Museum. It has also been extensively used in modern times. The Egyptians modelled little figures in porcelain clay, and colored and enamelled them after the fashion of porcelain, and vast numbers of such are in most of our museums. The word 'toreutic,' from the Greek word *toreuo*, to pierce or bore, is usually applied to sculpture in metal. For this the metal most appropriate, and most generally used both in ancient and modern times, is 'bronze,' a mixture of copper and tin. It is also known as 'brass.' Other metals, in small quantities, were also introduced, and various kinds of bronze have resulted from this variety, as well as from the proportions of the two principal metals, the method of fusion, &c. Egina, Delos, and Corinth made different kinds of bronze, each of excellent quality. Besides this favorite metal, gold, silver, copper, and even lead, and mixtures of lead and tin, 'pewter,' have been used for artistic sculpture. In the celebrated period of Greek sculpture, gold and ivory were used together. These statues, two of which were made by Phidias, were called 'chryselephantine'—that is, of gold and ivory.

The ordinary modes of proceeding in sculpture have been very various; whether the more celebrated sculptors of ancient times cut out their designs at once without the previous rehearsal of a model, we do not know. It is, however, very probable. The Egyptian bas-reliefs may still be seen in some of their tombs, lined out, and corrected afterwards by a master's hand previous to execution. Michael Angelo, the most powerful of modern sculptors, is known to have worked many of his statues, without the use of any model, out of the blocks. Florence, and the Louvre (Paris), contain marble sketches or unfinished figures thus roughed out. The length and size of the chizel-marks show how boldly this great master went to work to within $\frac{1}{8}$th of an inch of his final surface. As, however, there can be no putting on of any of the substance of stone once reduced by inadvertence, the artist commonly makes his sketch or design, in small, in clay. This is subsequently enlarged, and then studied from 'the life;' that is, men, horses, draperies, &c., the most suitable to the artist's present purpose are selected, and with these before him, he corrects his design and perfects it while the material is soft. A mould is then taken, as in the case already described, and with a plaster instead of a metal cast before him, the artist proceeds to work on his marble. The cast being placed on one block, and the marble on one precisely similar, workmen proceed to place a needle on a measuring-rod, the rod resting against the block till it touches a point of the cast. The needle is then applied to the block on which the marble stands, and this is bored into till the needle touches it as it did the cast. In this way the distance of the various surfaces of the future figure from the outside of the unshaped marble are ascertained, and the workmen rough out the figure down to those measurements. The sculptor then gives the final and delicate touches that finish it, himself. Finally, it is brought smooth with pumice-stone or sand. Michael Angelo and some of the ancients actually polished their statues. This, however, is generally objected to, as the sharp points of reflected light injure the general effect of the form.

We must notice one other question relative to sculpture before proceeding to a short review of the art historically, that is color. The ancients—that is, Egyptians, Ninevites, and others—did color their statues, intending, probably, to de so up to 'life'—that is, to a direct imitation. The Greeks, too, employed color on their statues, certainly on their architecture. To what extent they colored their statues, it is not very easy to determine. Partly, indeed, time has so altered, and partly so obliterated the coloring material, that we can only form an approximate judgment. It seems probable that the coloring was conventional, that is, that color was used to add to the splendor and distant effect of the work, rather than to attempt any positive imitation of real life. A head in the Elgin Room of the British Museum has been colored, the hair full red. The eyes are completely cut out, so as to show dark and shadowy hollows, even with the face colored. Gilding, too, was used for the hair. Color was extensively used in the middle ages. Many, if not most, interior sculptures were colored during that period. Quite in our own days Mr. Gibson has colored female statues. It is open to doubt whether they can be called successful as far as the color goes. Other means, however, were used to give color in late classic times, as may be seen in the Vatican, where a bust retains both enamelled eyes and black eyelashes inserted into the marble. To the mixture of marbles to obtain the effect of color we have already alluded.

Speaking of sculpture generally, we may say that a great deal has come down to us. Of the best work known, that of Phidias, our readers will see notices under the head of the ELGIN MARBLES. The majority of portable works are statues. Of these, some calculations reckon as many as 60,000 of one kind and another.

Fragments of these have various terms applied to them. 'Busts' are heads, or heads and chests; a 'torso' is a figure without head or limbs. These are perhaps fragments. Horace, however, is supposed to allude to a recognized form of such pieces of sculpture in the words 'mediam minervam.' Statues are called 'terminal' when they consist of a head only made out, the body being represented by a square post. These were set up as boundary marks, to invoke favorite deities for the owner's prosperity, and hence the name 'terminal.'

We now proceed to a very summary survey of the history of sculpture. We have said that ancient nations, both of profane and sacred history, were well used to sculpture. Of these, the Egyptian and the Ninevite are best known. The Egyptian sculpture goes back as far as 1700, or even in the case of the Pyramids, to 2000 years before Christ (Gardner Wilkinson, *Ancient Egyptians*). Both sculptured the human form, the Egyptians with most knowledge and refinement; both were restricted by religious traditions from arriving at a full representation of the human form; both used mixed forms of man-headed bulls, or man-headed and ram-headed lions. Usually these were colossal. The Egyptians, besides this, covered the walls of their sepulchres and temples with spirited and amply detailed historical representations.

The next great nation of whose productions we can judge was the Etruscan. They were of Greek origin. There is a great oriental influence or character in their work. It is also to some extent conventional, but often full of sublimity, and the figure quite correct in outline. This also is illustrated by their pottery, covered with figure designs, of which great abundance has been excavated in various parts of Italy. All these schools, including the Etruscan, are stiff and dry in execution—that is, wanting in the ease, fulness, and movement of the human form. They are called 'archaic,' meaning by that term unformed and undeveloped, belonging to an age uninstructed in technical knowledge.

Beginning with the early Egyptian times, this first period, called Archaic, may be concluded with those of the Etruscans, and brings us down to about 600 B.C. From this time a rapid growth in the art took place; schools were formed in the great cities of Greece, Sicyon, Egina, and Corinth; and we read of Callon, Onatas, Glaucias, and other names, culminating in Agcladas of Argos. These men sculptured on a colossal scale, and we have already alluded to the bronze for which the Greek cities had long been famous. These schools produced the famous works known as the Egina Marbles, found in 1812, as well as those of Selinus, in Sicily. Casts of the former may be seen in the British Museum. The originals are at Munich.

The great period of sculpture began about 484, when Phidias was born. Ageladas was his master, as also of Polycletus and Myron, of whose works copies are now in the Vatican and elsewhere, made by Greek artists in the times of the Roman empire.

Of the great work of Phidias we will not here treat, as it is described elsewhere. Pericles did much to encourage the arts both of sculpture and painting.

For a century and a half, or for two, sculpture continued very slowly to decline. This great school ended in Praxiteles, a sculptor of consummate powers. He carried the representation of the human form further than Phidias and his scholars, and draperies in his hands lost their severe character, and clung to the rounded limbs, which they no longer concealed. His work may be seen in the casts of the Nike Apteros, or sculptors of the temple of unwinged Victory, in the British and other museums. He is said to have been the first to represent the female form quite nude, and to have contributed by such sculptures to the enervation and gradual sensualizing of the art.

During the 5th and 4th centuries B.C., we have Agoracritos of Paros; Alcamenes of Athens; Scopas, the author of the famous Niobe group now at Florence; Lysippus of Sicyon, the favorite of Alexander; Chares, the author of the famous Colossus of Rhodes; Agasias, who sculptured the 'Fighting Gladiator;' Glycon of the Farnese Hercules; and many others.

The Roman conquest of Corinth under Mummius in the 2d c., and afterwards of Athens, brought this old art to an end. Thenceforth, Greek artists were found all over the Roman empire, and the famous works of these former sculptors were reproduced by them for their new masters. The Roman sculpture, indeed, is included in this phase of Greek art—the last remarkable work that we shall notice of classic times being the famous column of Trajan, in the early part of the 2d c. A.D. This is, in fact, a tower over 100 feet high, of white marble, entirely covered with bas-reliefs representing the Dacian wars of Trajan. We here see the expiring effort of classic art. Skilful and correct as the design is, it is, as a whole, graceless, stiff, and without beauty, compared with the old work.

Constantine, in the 4th c. of our era, carried off to Byzantium, his new seat of government, all the sculpture he could remove.

The art revived in Italy. As early as the 10th c., sculpture exhibited both design and grandeur, though wholly different from that of older times. Absolute freedom from old conventionalities, vigor, dignity, and childlike freshness of mind, distinguishes modern sculpture down to the 15th century. The most noted names we will mention here are those of Niccolo of Pisa, in the 13th c., who executed the bas-reliefs at Orvieto; after him, his son Giovanni. Andrea Pisano made one of the bronze gates of the baptistery of Florence. Ghiberti, the author of the more famous doors of the same baptistery, is next to be named; then Donato di Betto Bardi, or Donatello. Some of his works are in the church of Or san Michele, which the famous Orcagna, sculptor, painter, and architect, had built and decorated.

We begin the next period with Verocchio, in the 15th c., and the more famous Michael Angelo in the 16th. A host of great names followed: Cellini, Torregiano (who made the monument of Henry VII. at Westminster), Della Porta, Giovanni di Bologna, and Luca della Robbia, who also worked in enamelled terra-cotta on a large scale. These are Italian names. We may add Jean Goujon and Germain Pilon in France. In our own country, splendid medieval works are to be seen in the noble sculptures of Wells' Cathedral, and of that of Lincoln, coeval with those of the Pisani. Cibber, who sculptured in England, was a Dane. Thorwaldsen, a native of Iceland; Canova, an Italian; and, lastly, Flaxman, bring us down to our own days. Of the latter, the finest work is perhaps the Wellington Shield, after the Homeric description of that of Achilles. See the works of Winckelmann and Kugler, Westmacott's *Handbook of Sculpture*, and Murray's *History of Greek Sculpture*.

SCULPTURED STONES. In Norway, Denmark, the Isle of Man, Wales, Ireland, and Scotland, a class of monuments is to be found decorated with rude sculpture, and belonging to the early periods of Christianity—sometimes, indeed, showing the symbols of paganism in conjunction with those of Christianity. By far the most remarkable stones of this description are those found in Scotland, which, with some points common to them with the rest, possess the distinguishing feature of a class of characters or symbols of mysterious origin, whose meaning yet remains an enigma to antiquaries, and which yet recur with such constancy in different combinations, that it is impossible to suppose their form to be the work of chance. Along with these symbols the figure of the cross is often found on one side.

Neither in Ireland, in Wales, nor anywhere else, are the symbols in question to be met with. These monuments all occur within a circumscribed part of Scotland. None are to be found either within the ancient Dalriada, or south of the Forth; their limit seems to be the eastern lowlands from Dunrobin to Largo Law, or the part of Scotland inhabited by the Pictish race. From 150 to 200 of them are known to exist. The most interesting as well as the most numerous specimens are in Strathmore, at Glammis, Meigle, and Aberlemno. Among the various theories which have been formed regarding these stones, one is, that they were boundary stones, the cross denoting the possession of the church, and the mysterious figures having reference to the lay lord; but those antiquaries who have devoted most attention to the subject, including Mr. John Stuart, have come to the conclusion that they are sepulchral. The practice of erecting stones to commemorate deceased persons of note, existed in Scotland in pagan times, and, like other pagan practices, it was turned to Christian purposes by the earliest preachers of Christianity. Most of these monuments are of unhewn stone, and more or less oblong in shape; a very few have the form of a cross. A sculptured cross is met with on about half of them, the class without crosses belonging chiefly to Aberdeenshire, though a few of them are to be found in the country north of Spey.

Among the symbols to which we have alluded, one of the most frequent, which has been likened to the letter Z, consists of a diagonal line, from whose extremities are drawn two parallel lines terminating in some sort of ornament. This Z symbol is often traversed with what has been called the *spectacle ornament*, consisting of two circles decorated within with foliated lines, and united by two reversed curves or occasionally intertwined with a serpent. Another prevalent symbol is a crescent, sometimes appearing by itself, more frequently with two lines drawn through it, diverging diagonally from a point below its center, and terminating in a floral or other ornament. A mirror and comb, a horse-shoe arch, a fish, and a figure like a fibula, are also all occasionally met with. Similar devices to the above have been found engraved on certain silver ornaments discovered on Norrie's Law,

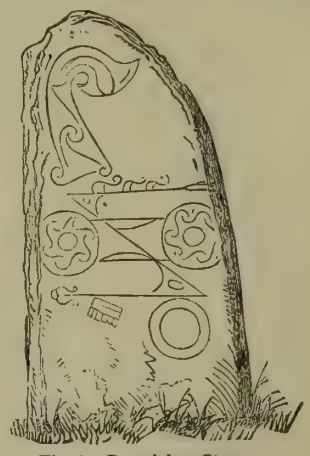


Fig. 1.—Dunnichen Stone.

Fig. 2.—Part of Sculptured Stone—Island of Ellanmore, Argyleshire.

including a figure occurring on the Dunnichen Stone, which had been taken by ingenious theorists for the high cap of the Egyptian Osiris, surmounted by a lotus, but which, as engraved on one of those silver relics, appears to be the head of a dog or some other animal.

The earlier of the Scottish sculptured stones, such as the Maiden Stone in Aberdeenshire, and the older of the stones at Aberlemno, have no sculptures except of the class above described; the later combine these with devices of a more intelligible kind. An elephant is not unfrequent, represented in such a fashion, that it is obvious that the artist could never have seen one; and fabulous and grotesque figures abound, often drawn with considerable spirit. We have centaurs, lions, leopards, deer, beasts of chase, men shooting with a bow and arrow, men devoured by animals, processions with men and oxen, and priests in their robes with books. Many of these figures are highly interesting illustrations of the manners, customs, and dress of the period. On a stone near Glammis is a man with a crocodile's head. On the cross at St. Vigeans, a hybrid, half-bird half-beast, appears in the midst of a border of entwining snakes and fantastic creatures. A stone of great interest at Meigle contains a representation of a chariot. At Farnell is a group of figures that seems to be meant for the temptation. In but two instances have inscriptions been known to accompany these sculptures; in the one case the letters are so worn away as to be undecipherable; in the other instance, at St. Vigeans, a few letters can be traced of the same Celtic character which has been found on the earliest Irish monuments and the oldest tombs at Iona.

The general style of ornamentation of these stones, judging by a comparison with Anglo-Saxon illuminated MSS., has led to the conclusion that they were erected in the 8th or 9th c., a period when Christianity had but lately supplanted paganism among the Scottish Picts.

A stone differing in character from those described, now erected near the House of Newton in Aberdeenshire, in the same neigh-

borhood in which it was found, has been a notable puzzle to archæologists. It is not sculptured, but inscribed in a character which seems unique. Besides the principal inscription, there is another running along the edge, consisting of groups of short lines, and apparently in the Ogham (q. v.) character.

The crosses in Ireland are the likest to these Scottish monuments. They are chiefly found near churches and graveyards, and are generally cruciform, with a halo or circle binding the arms and stem together. They usually taper to the top, on which a conical capstone is fixed, and they are inserted in pedestals of stone, which are frequently covered with sculpture. Most of their subjects are from Scripture history, without anything like the Scotch symbols.

The Welsh crosses are, for the most part, in the form of a small cross within a circle, set on the top of a long shaft, the latter having at times interlaced ornaments in compartments. Many of them have inscriptions in the Romano-British character, relating to the persons in memory of whom they were erected.

The sculptured crosses of Scandinavia and Man somewhat resemble the Scotch monuments in their general style of ornamentation, though altogether destitue of the peculiar Scottish symbols. On some of them are Runic inscriptions. One inscription on a Manx cross indicates that Gaut (probably a Norwegian) made this cross and all on Man. Another is to the effect that ——— erected this cross to his father Ufag, but Gaut Bjornson made it. Professor Munch, from the character of the Runes on these crosses, assigns them for date the middle or end of the 11th century. See RUNES.

A hundred and fifty of the sculptured stones of Scotland have been carefully engraved and described in a very valuable work contributed to the Spalding Club by Mr. John Stuart. Some of those belonging to the county of Angus had been previously illustrated by the late Mr. Chalmers of Auldbar, in a volume forming one of the Bannatyne Club series.

SCUPPERS are holes, lined with lead, in a ship's side, intended to carry off rain or other water which may be shipped.

SCURVY, or SCORBU'TUS, is a disease which is characterized by a depraved condition of the blood. In consequence of this morbid state of the blood, there is great debility of the system at large, with a tendency to congestion, hæmorrhage, &c., in various parts of the body, and especially in the gums. It is a disease that has probably existed from the earliest times, but the first distinct account of it is contained in the history of the crusade of Louis IX., in the 13th c., against the Saracens of Egypt, during which the French army suffered greatly from it. In the 16th c. it prevailed endemically in various parts of the north of Europe, and it seems only to have abated about a century ago. It was in badly-fed armies, in besieged cities, and on board ship, that its ravages were most appalling, and it is believed that more seamen perished from scurvy alone than from all other causes combined, whether sickness, tempest, or battle. Whole crews were prostrated by this scourge, as in the well-known case of Lord Anson's memorable voyage.

Scurvy so closely resembles purpura in its general symptoms that it will be sufficient for us to refer to the article on that disease, and here merely to indicate the leading points of difference between the two diseases, which, notwithstanding their similarity, are essentially different. Scurvy is caused by a privation, for a considerable time, of fresh succulent vegetables, while purpura often makes its appearance when there has been no deficiency of this food, or special abstinence from it. Scurvy is most common in winter or the early spring, while summer and autumn are the seasons for purpura. In scurvy the gums are invariably swelled and spongy, and bleed readily; in purpura this is not necessarily the case. In scurvy there is extreme debility and depression of spirits, venesection and mercury do positive harm, while a cure is rapidly effected by the administration of lemon-juice, or of fresh fruits and vegetables; whereas in purpura there is little or no mental or bodily depression, venesection and mercury often give relief, while no marked and certain relief follows the administration of the lemon-juice and fruits that are all powerful in scurvy.

Although the virtues of lemon-juice in scurvy were known in this country as far back as 1636, when John Woodhall, Master in Surgery, published *The Surgeon's Mate, or Military and Domestic Medicine*, this invaluable medicine was not made an essential element of nautical diet till 1795. The effect of this official act may be estimated from the following numbers. In 1780 the number of cases of scurvy received into Haslar Hospital (a purely naval hospital) was 1457, while in 1806 there was only one case, and in 1807 only one case. Many naval surgeons of the present day have never seen a case of the disease. The potato possesses almost equally great antiscorbutic properties, and, fortunately, potatoes when cooked are as active as when taken raw. The late Dr. Baly, to whom we are indebted for this discovery, states that 'in several prisons the occurrence of scurvy has wholly ceased on the addition of a few pounds of potatoes being made to the weekly dietary.' The salutary action of potatoes is probably owing to their containing a considerable amount of tartaric acid, partly in combination with potash and lime, and partly free. In addition to the dietetic treatment, which should include easily-digested animal food, potatoes, such ripe fruits as can be procured, and an abundance of lemonade, little further need be prescribed. If necessary, constipation must be relieved by mild laxatives, such as rhubarb, and castor-oil; the appetite may be stimulated by bitter tonics, and opiates given to procure rest in cases of pain or obstinate wakefulness. When the gums are very troublesome, solutions of tannin, chloride of lime, or of nitrate of silver, may be applied to them. For an excellent account of this disease, the reader is referred to the article 'Scurvy' by Dr. Budd, in *The Library of Practical Medicine*.

SCURVY-GRASS (*Cochlearia*), a genus of plants of the natural order *Cruciferæ*, having small white flowers, and turgid many-seeded pouches; the cotyledons accumbent. The species are annual or biennial, rarely perennial, plants; of humble growth, with branched smooth stems, smooth simple leaves, and terminal racemes of flowers. They have an acrid biting taste, containing the same pungent volatile oil which is found in horse-radish, and are valued for their antiscorbutic properties. COMMON S. (*C. officinalis*) is sometimes a foot high; the root-leaves are stalked and heart-shaped; the pouches globose, ovate, or elliptical. It is a variable plant, and some of the other species described by botanists are probably not essentially different. They possess the same properties. S. is very common on the shores of Britain, growing both on rocks where there is little soil, and in muddy places. It is also found on high mountains. It is a very widely-distributed plant, and being found on the shores of almost all parts of the world, has often been of the greatest benefit to sailors, in times when the modern precautions against sea scurvy were unknown.

SCU'TAGE, or ESCUAGE, (Lat. *scutum*, shield), a pecuniary fine or tax sometimes levied by the crown, in feudal times, as a substitute for the personal service of the vasal. No scutage seems at any time to have been levied in Scotland.

SCU'TARI (Italian or Levantine form of the Turkish *Uskûdar*), a town of Asiatic Turkey, on the eastern shore of the Bosporus, immediately opposite Constantinople, of which it may be considered a suburb. It is built on the sides and summit of a hill, sloping irregularly upwards from the water's edge, and bears, both externally and internally, a great resemblance to the Turkish capital. It contains several mosques, bazaars, and baths, a college of howling dervishes, manufactories of silks and cotton fabrics, corn warehouses, and *imarets* or kitchens for the poor. It has long been famed for its extensive cemetries, adorned with magnificent cypresses, the chosen resting-place of many of the Turks of Constantinople, from attachment to the sacred soil of Asia, and the traditionary belief that their race will one day be driven out of Europe. The population is variously estimated at from 40,000 to 60,000 or 100,000. This town accidentally acquired great notoriety in connection with the English army during the Russian War (1854—1856), when the enormous barracks built by Sultan Mahmud, on the southern outskirts of the town, were occupied as barracks and hospital by the English troops, and formed the scene of Miss Nightingale's labors. A little to the south of the General Hospital, on the cliffs bordering the Sea of Marmora, is the densely-filled English burial-ground, where Baron Marochetti's monument in honor of the troops has lately been erected. —S. is a place of considerable traffic, and is the rendezvous and starting-point of caravans and travelers trading with the interior of Asia. It occupies the site of the ancient *Chrysopolis;* and about two miles to the south, lies the village of Kadikôi, the ancient *Chalcedon*.

SCUTARI (Turkish *Iskandere*, the anc. *Scodra*), a considerable town of European Turkey, in Northern Albania, capital of a sanjak of the same name, situated at the southern end of the Lake of Scutari, at the point where the Bojana, issuing from it, is joined by the Drinassi. The lake is about 20 miles long, and abounds in fish. S. is a fortified town, with a citadel on a commanding height. It has manufactories of arms and cotton goods, a bazaar, and yards for building coasting-vessels. It carries on a considerable trade. The population is estimated at about 40,000, of whom about one half are Roman Catholics.

SCU'TCHEON, in Carpentry, is the small metal plate used to form the protection and ornament to the keyhole for locks; it is usually of brass, but in ornamental cabinet-work, is often of ivory, mother of pearl, &c. See SHIELD.

SCY'LLA AND CHARY'BDIS. Scylla (Gr. *Skullaion*), a rocky cape on the west coast of South Italy, jutting out boldly into the sea so as to form a small peninsula just at the northern entrance to the Straits of Messina. About the beginning of the 5th c. (B.C.), a fort was built upon the rock (which is about 200 feet high, and much hollowed out below by the action of the

waves), and in course of time a small town grew up, straggling down the slopes towards the sea. The navigation at this place was looked upon by the ancients as attended with immense danger, which, however, seems to have been much exaggerated, for at the present day the risk is not more than attends the doubling of any ordinary cape. The rock, according to the Homeric legend, was the abode of a monster called Scylla, possessing 12 feet, 6 long necks and mouths, each with three rows of sharp teeth, and who barked like a dog.

There are other accounts of Scylla, one of which represents her as having once been a beautiful maiden, beloved by the sea-god Glaucus, but who, by the jealousy of Circé, was changed into a monster having the upper part of the body that of a woman, while the lower part consisted of the tail of a fish or serpent surrounded by dogs. The modern Scilla or Sciglio is a fortified town in the province of Reggio-Calabria, having large silk-works, the pop. being upwards of 7400, mostly seafaring people.

Charybdis (modern name *Galofaro*), is a celebrated whirlpool in the Straits of Messina, nearly opposite the entrance to the harbor of Messina in Sicily, and in ancient writings always mentioned in conjunction with Scylla. The navigation of this whirlpool is, even at the present day, considered to be very dangerous, and must have been exceedingly so to the open ships of the ancients. A modern writer describes it as being 'an agitated water of from 70 to 90 fathoms in depth, circling in quick eddies.' Homer places it immediately opposite to Scylla, probably taking advantage of the poetic license to exaggerate the danger of the navigation, although it is not improbable that the whirlpool may have changed its situation since his days. The myth connected with it is, that under a large fig-tree, which grew out of a rock opposite Scylla, dwelt the monster Charybdis, who thrice every day sucked down the water of the sea, and thrice threw it up again.

SCYTHE. See REAPING.

SCY'THIA, a name employed in ancient times to denote a vast, indefinite, and almost unknown territory north and east of the Black Sea, the Caspian, and the Sea of Aral. But the term is not so much *geographical* as *ethnological*, and the only interest attaching to the barren catalogue of tribes and nations which we meet with in the classical writers, springs from the hope of connecting these with a recognized race of modern times. Latham argues—successfully, as it appears to us—for the Scythians being the ancestors of the later *Turks*, and maintains their central and primitive abode to have been Independent Tartary, whence they spread west round the Caspian into Russia, Transylvania, and perhaps even Eastern Hungary. Niebuhr and Neumann favor the hypothesis of a Mongol origin for the Scythians; while others regard them as Finns or Circassians. In their mode of life they were mainly nomadic and pastoral, though we read of some trans-Danubian and Euxine tribes that followed agriculture. Many of them were *Hippemolgi* ('mare-milkers').

SEA, in its general signification, denotes that large expanse of salt water which covers the more depressed portion of the earth's surface, fills up each hollow and rift to a certain uniform level, completing as far as possible the spheroidicity of the globe, and divides its surface into two great and innumerable smaller portions—the Old and New Worlds and their islands. This immense body of water is not distributed with the least approach to regularity, but here forms a huge basin, there becomes a long and tortuous inlet or strait, which narrows or widens as the configuration of the land-surface on each side permits; nor is it placed symmetrically to the earth's axis of rotation; for the hemisphere of which the south-west corner of England is the center or pole contains the whole of the land-surface, if we except the triangular portion of South America, south of Uruguay, Australia, New Zealand, the most of the East Indian Islands, and the land around the south pole (of unknown extent). The other hemisphere is, with these exceptions, wholly water. From this irregular distribution of the sea over the earth's surface, and from the specific gravity of water being about $\frac{1}{4}$th of that of the land, it necessarily follows that the center of gravity of the whole globe does not correspond accurately with its center of figure. The extent of sea-surface is estimated at 144,712,850 English sq. m., or nearly $\frac{3}{4}$ths of the whole of the earth's surface, and its mass, on the supposition of an average depth of 2 miles, is about $\frac{1}{4000}$ of that of the whole globe; such estimates, however, can be considered at best as only rough approximations. One of the most remarkable features of the sea is its continuity or oneness; for in spite of the fact, that numerous large stretches of salt-water, as the Sea of Azof, Black, Mediterranean, and Baltic Seas, the Gulf of Mexico, and others, have barely avoided becoming detached lakes, very few such are found on the earth's surface; and with the exception of the Caspian and Aral Seas, they are of small size.

Composition, Specific Gravity, and Temperature of the Sea.—The ocean consists of salt water, and from its continual motion, under the influence of currents and waves, preserves, generally speaking, uniform saltness. Under special circumstances, however, we find the saltness increased, as by the excess of evaporation over the fresh-water influx in the Mediterranean and Red Seas, and about the northern and southern limits of the tropical belt; and decreased, by the contrary cause, in the Sea of Azov, Black Sea, Baltic Sea, and in the polar regions. See TRADE-WINDS. The origin of the saltness of the sea is sufficiently accounted for when we consider, that the chloride of sodium and other soluble salts which form constituent ingredients of the globe, are being constantly washed out of the soil and rocks by rain and springs, and carried down by the rivers; and as the evaporation which feeds the rivers carries none of the dissolved matter back to the land, the tendency is to accumulate in the sea. The principal ingredients found in sea-water are chloride of sodium, or common salt, together with salts of magnesia and lime. A more exact analysis will be given under WATER. The average specific gravity of the sea, out of reach of the exceptional action of the melting of snow, rain, or river-water is (at 62° F.) 1·02655. The slight variations in the saltness of the sea must necessarily produce corresponding changes in its specific gravity; accordingly, on the northern and southern limits of the torrid zone, the mean specific gravity of the sea is, in different longitudes, 1·02785, 1·0268; while at the equatorial calm belt, it is 1·0252, 1·0267; and on the whole shows a tendency to diminish as the latitude increases, Beechey having found it to be 1·0258 in lats. 55°—60° N. and S. in the Pacific, and King 1·0255 in the corresponding latitudes of the Atlantic. It is considerably diminished near the mouths of rivers, and in those inlets or semi-lacustrine arms which are the depositories of more river-water than compensates for their evaporation, as in the Black Sea, where it is 1·0143, and in the Baltic, only 1·0086.

The temperature of the sea, where it is not affected by currents from a warmer or colder region, necessarily corresponds to the normal temperature of the latitude; but this is true only of the water at and near the surface, for it has been recently proved by the observations made on deep-sea temperature by Carpenter, Wyville, Thomson, and others, that the temperature rapidly diminishes with the depth, particularly in tropical and temperate regions, till at great depths ice-cold water is everywhere found. Thus, from the extensive observations made by H.M.S. *Challenger* in the North Atlantic during 1873, it is shown that at the equator, where the surface temperature is about 80°, the decrease with the depth is so rapid, that at 60 fathoms from the surface the temperature is only 61°·5; at 150 fathoms it is 50°; at 700 fathoms, the temperature has fallen to 40°; at about 1600 fathoms, to 36°. Below this it diminishes at a much slower rate, till it falls nearly to freezing at all great depths which are connected by under-currents with the Antarctic or Arctic Seas. The sea-water of the upper 60 or 80 fathoms is affected by the solar heat. Immediately beneath this sun-heated upper stratum, it is remarkable that all the water in the North Atlantic, as far as lat. 40°, is warmer than that at the same depth under the equator. The mean temperature of the upper 1500 fathoms in the North Atlantic is 4°·5 warmer than the same upper stratum at the equator.

As regards the temperature of the water at the bottom, at all stations between Bermuda and the equator on the east side of the Atlantic, the temperature is remarkably uniform at 35°·2; in the Bay of Biscay, to north-east of this line, it is 1° warmer; south-west of the same line, 1° colder; whereas, further south at the equator, on the western side of the Atlantic, it is 32°·4, or 2°·8 colder. This last fact is of very great importance, since, from the circumstance that at the equator the bottom temperature is 32°·4, and that at all stations to the north of it the bottom temperature is warmer, it follows that the cold water at the bottom of the Atlantic, as far north as the Azores and Bay of Biscay, equally with that at the equator, is derived from an Antarctic, and not from an Arctic source. This cold Antarctic current entering the North Atlantic, is found between 1700 fathoms and the bottom, a total thickness of 700 fathoms. Ice-cold water has also been found at the bottom in the Arabian Sea. In land-locked seas, such as the Mediterranean, whose deep water is not in communication with that of the Atlantic, owing to the shallowness of the sea at the Straits of Gibraltar, the bottom temperature does not fall so low as that of the ocean. Thus the temperature of the Mediterranean at 1508 fathoms, is 55°, whereas at this depth in the ocean, it is so low as 36°. See ISOTHERMAL LINES.

The highest surface-temperature does not correspond with the equator, but owing to the disturbing influence of currents in the following regions: Between Sumatra and the Zanzibar Coast; east of the Philippine Islands, to long. 170° E.; east of Cuba and Florida; and north-east of Cape St. Roque.

Color and Phosphorescence of the Sea.—The color of the ocean, when free from admixture of foreign substances, as animalcules, vegetable organisms, excessive rain, or the tinted waters of swollen rivers, is a pure deep blue, which becomes less marked where the water is of less depth. A 'different' color of sea-water is due to the presence of some foreign substance, e. g., the red, brown, and white patches of the Pacific and Indian Oceans, to the presence of swarms of animalcules, and the colors of the

Red and Yellow Seas, to matters of vegetable origin. The Rhone, at its emergence from the lake of Geneva, and the lake itself, exhibit an intensity of blue far surpassing that of any sea. The phosphorescence of the sea is due to the presence of myriads of invertebrata, especially rhizopoda, tunicata, &c. See LUMINOSITY OF ORGANIC BODIES.

Depth of the Sea.—Till very recently, it might be said that, with the exception of the more frequented strips along the coast, and such other portions as afforded anchorage-ground, our knowledge of the depth of the ocean amounted to nothing. It is true that deep-sea soundings had been frequently made, but from the necessary defectiveness of the ordinary 'lead,' and inattention to the effect of under-currents in destroying the perpendicularity of the line, little dependence could be placed on the results obtained.

It is chiefly in the Atlantic that the new and trustworthy method of Sounding (q. v.) has been practised, and the contours of its bottom may now be considered as fairly ascertained. The greatest depth measured by the *Challenger* (in N. lat. 19° 41′, W. long. 65° 7′) was 3875 fathoms, or 23,250 feet (about 4·4 miles). Over a great extent of the area, the depth ranges between 2000 and 3000 fathoms. Along the middle runs an irregular ridge, on which the depth is less than 2000 fathoms, and north of 50° a plateau of similar depth extends, with little interruption, from Ireland to Newfoundland, on which the telegraph cables are laid. Nowhere round the British Isles is the sea above 400 feet deep. In the Pacific, several tracks of soundings were obtained during the *Challenger* expedition (1873–5). From the numerous islands which stud this ocean, one might be led to assume its comparative shallowness; but this is far from being the case, for the islands rise abruptly from the bottom, and very deep soundings have been obtained near their shores. Over a great part of the area, the depth is over 2000 fathoms; in the deeper parts, it ranges from 3000 to over 4000 fathoms. The deepest sounding got was 4475 fathoms (26,850 feet, or above 5 miles), in N. lat. 11° 24′, E. long. 143° 16′, near the Ladrone Islands. From the remarkable gentleness of slope of the bed of the Arctic Ocean to the north of Siberia, the line giving only 14—15 fathoms at 150 miles from the shore, and from its configuration on the north of America, it is generally concluded to be by far the shallowest of the oceans. Of the depth of the Antartic Ocean, little is *known*, but it is supposed to be deeper than its antipodal kinsman. Near the Antarctic Circle, south-east from Kerguelen, the *Challenger* took a few soundings varying from 1300 to 1975 fathoms. From all that has hitherto been observed, it would seem as if the land-surface under water were the counterpart as regards eminences and hollows, chasms, valleys, plateaus, &c., of the land-surface above.

Motion of the Sea.—The sea is in a state of perpetual restlessness, its motion being either a vertical oscillation, or an actual transference of its waters from one place to another. The first motion, which constitutes *waves*, is due either to the attraction of the sun and moon on such a mobile body as the sea (see TIDES), or to the impulsive action of the winds which blow over its surface (see WAVES); the second arises from the sun, which, directly through its heat, and indirectly by scorching dry winds, produces evaporation to a great extent, of the parts most exposed to its influence, and by its similar action on the atmosphere (see TRADE-WINDS), causes a transference of this vapor to remote latitudes, where it descends as rain, and, destroying the equilibrium of the sea, gives rise to *currents*. The nature of these currents is described under GULF STREAM, and the chief currents of each ocean are found under its own head. This constant motion of the sea is of great service in tending to equalize the temperature of different parts of the globe; it also produces remarkable changes in the form of coasts, eating into rocks, converting low-lying lands into shoals and sand-banks, or carrying away the earthy materials, and depositing them in some distant region. The erosive action of the sea is generally almost imperceptible during several years, but in course of two or three centuries, the magnitude of the changes effected by it is almost incredible.

On the economic value of the sea as a purifier, and as a commercial highway, it is unnecessary to dilate. For some of the peculiar phenomena of the sea, see ICEBERGS, AURORA BOREALIS, WHIRLPOOLS, the five great OCEANS (q. v.), CORAL, &c.

The term *Sea* is also applied in a more limited though indefinite sense, to an offshoot of one of the oceans, as to the Black, Baltic, Okhotsk Seas, to any portion of an ocean which from its position or configuration is considered deserving of a special name, and to the two great inland salt lakes of Central Asia, the Caspian and Aral Seas.

SEA, SOVEREIGNTY OF THE. Blackstone lays it down that the main or high seas are part of the realm of England, as the Courts of Admiralty have jurisdiction there; but adds that they are not subject to common law. But the law of nations, as now understood, recognizes no dominion in any one nation over the high seas, which are the highway of all nations, and governed by the public law of the civilized world. Such a right has, however, long been claimed over the four seas surrounding the British Isles. It was strongly asserted by Selden, and denied by Grotius, and measures were taken to vindicate the right in the reign of Charles I. Every nation has undoubtedly a right to the exclusive dominion of the sea within a certain not very well-defined distance from the shore, depending on the usage of the country. This right of lordship includes the right to free navigation, to fishing, to taking wrecks, the forbidding passage to enemies, the right of flag, of jurisdiction, &c. By the law of England, the main sea begins at low-water mark; and between low and high water mark the common law and admiralty have a divided jurisdiction, one on land when left dry, the other on the water when it is full sea. By the law of Scotland, the sea-shore is not considered to extend beyond the point which the sea reaches in ordinary tides. See BLOCKADE, NEUTRALS.

SEA CUCUMBER. See HOLOTHURIA.

SEA GRAPE (*Ephedra*), a genus of plants of the natural order *Gnetaceæ*, a natural order consisting of a small number of species, closely allied in botanical characters to the *Coniferæ*, and by many botanists united with that order, although differing much in appearance. The *Gnetaceæ* are small trees, or twiggy shrubs, with opposite or clustered branches and jointed stems, whence they are sometimes called JOINT-FIRS. They secrete not resinous but watery matter. The development of the ovule is very peculiar; it has a projecting process formed from the intimate covering of the nucleus.

SEA'HAM HARBOR, a seaport in the county of Durham, 6 miles south of Sunderland. Its excellent harbor is furnished with wharfs, quays, and jetties, and the town contains bottle-works, blast furnaces, an iron foundry, and chemical works. It communicates by railway with collieries in the vicinity, and the principal articles of export are coals and agricultural produce. The population of this thriving little seaport town was, in 1871, 7132. The population in 1851 being 3538, it has accordingly more than doubled meantime.

Sea-horse.

SEA-HORSE, in Heraldry, a fabulous animal, consisting of the upper part of a horse with webbed feet, united to the tail of a fish. A scalloped fin is carried down the back. The arms of the town of Cambridge are supported by two sea-horses, proper finned and maned or.

SEA-KALE (*Crambe maritima;* see CRAMBE), a perennial plant with large roundish sinuated sea-green leaves, found on the sea-shores in various parts of Europe, and in Britain. The blanched sprouts have become a very favorite esculent in Britain, although as yet little known on the continent. The common people, on some of the shores of England, had long been in the practice of watching them when they came through the sand, and using them as a pot-herb, but the cultivation of the plant in the kitchen garden became general only at a comparatively recent date. It requires a deep rich soil, and the care of the gardener is bestowed upon the blanching, without which the sprouts are not tender and agreeable, but even acrid. The blanching is accomplished in various ways, by earth, sand, boards, earthenware pots, &c. Sea-kale is generally raised from seed, although, also sometimes propagated by offsets or by cuttings of the roots. The seedlings do not yield a crop till the third year; but a plantation of sea-kale remains productive for many years. It is planted in rows, four to six feet apart. It sends its tap-root very deep into the ground.

SEAL (Lat. *sigillum*, Fr. *sceau*), an impression on wax or other soft substance made from a die or matrix of metal, a gem, or some other material. The stamp which yields the impression is sometimes itself called the seal. In Egypt, seals were in use at an early period, the matrix generally forming part of a ring (see GEM, RING). Devices of a variety of sorts were in use at Rome, both by the earlier emperors and private individuals. The emperors, after the time of Constantine, introduced *bullæ* or leaden seals, and their use was continued after the fall of the Western Empire by the popes, who attached them to documents by cords or bands.

On the earlier papal seals are monograms of the pope; afterwards the great seal contained the name of the pope in full, and a cross between the heads of St. Peter and St. Paul, while the papal privy seal, impressed not on lead but on wax, known as the *Seal of the Fisherman*, represented St. Peter fishing. In the 9th and 10th centuries we find Charlemagne, the Byzantine emperors and the Venetian doges, occasionally sealing with gold, and we have an instance as late as the 16th c. of a gold seal appended to the treaty of the Field of the Cloth of Gold, between Henry VIII. and Francis I.

Seals were not much used in England in Anglo-Saxon times, but they came into general use after the Norman Conquest. On

the royal great seals was the king in armor on a caparisoned horse galloping, his arms being shown on his shield after the period when arms came into use; and the reverse represented the king seated on a throne. The great seals of Scotland begin with Dun-

Great Seal of William the Conqueror.

can II. in the end of the 11th c., and have also for subject the king on horseback; the counterseal, with the seated figure, being used first by Alexander I., and the earliest appearance of the arms of Scotland being on the seal of Alexander II. In both countries there were also the privy seals with the royal arms only.

Ecclesiastical seals first appear in the 9th c., and attained great beauty in the 13th and 14th. They are of the pointed oval form known as *Vesica piscis;* and have for subjects, a figure of the bishop, sometimes of the Trinity, the Virgin, or a patron saint, seated under an elaborate architectural canopy. The arms of the bishop are often added.

Under the Norman monarchs of England, sealing became a legal formality, necessary to the authentication of a deed; and from the 13th c. onwards, the seals of all persons of noble or gentle birth represented their armorial ensigns. The seal was generally appended to the document by passing a strip of parchment or a cord through a slit in its lower edge; and the ends being held together, the wax was pressed or moulded round them a short distance from the extremity, and the matrix impressed on it. Occasionally the seal was not pendant, but the wax was spread on the deed. The colored wax with the impression was sometimes imbedded in a mass of white wax forming a protective border to it. In England, a seal is still an essential to all legal instruments by which real estate is conveyed; but since subscription has also become necessary, the practice of sealing has degenerated into a mere formality. The custom was gradually introduced of covering the wax with white paper, on which the impression was made, and latterly wafers have been considered a sufficient substitute for seals.

In Scotland, every freeholder was obliged by statutes of Robert III. and James I. to have his seal of arms, an impression of which was kept in the office of the clerk of court of the shire; and among the Scottish armorial seals of the 14th and 15th centuries are some of wonderful beauty of execution. Act 1540, c. 117, for the first time made subscription an essential formality to deeds; but sealing still continued to be necessary till 1584, when it was dispensed with in the case of deeds containing a clause of registration, and soon afterwards the practice was altogether laid aside.

The use of corporate seals by towns and boroughs, dates as far back as the 12th century. The earlier corporate seals bear the town gates, city walls, or some similar device; the use of corporate arms did not begin till the latter half of the 14th century.

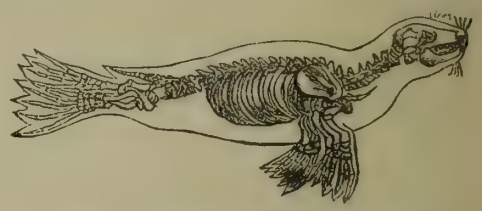
The principal use of seals in the present day is in closing letters, and even for this purpose they have of late years been less used than formerly, owing to the fashion of using stamped adhesive envelopes

The study of medieval seals is of great importance and interest in connection with many branches of archæology, including heraldic and genealogical investigations. See GREAT SEAL; PRIVY SEAL.

SEAL (*Phoca*), a carnivorous Mammal, the type of the family *Phocidæ*. The old Linnæan genus *Phoca* included the Morse (q. v.) or Walrus. The *Phocidæ* or seals proper, the *Otaridæ* (see OTARY), and the walrus, constitute the section *Pinnigrada* or *Pinnipedia* of the order *Carnivora* (q. v.). Their structure is most perfectly adapted to an aquatic life, and they live chiefly in water, but spend part of their time on shore, reposing and basking in the sunshine on rocks, sand-banks, ice-fields or beaches; and they bring forth their young on shore. The body is elongated, and tapers from the chest to the tail; the head somewhat resembles that of a dog, and in most of the species the brain is large; the feet are short, and little more than the paw projects beyond the skin of the body; all the feet are thoroughly webbed, and five-toed; the fore-feet are placed like those of other quadrupeds; but the hind-feet are directed backwards, like a prolongation of the body, and between them is a short tail. The toes, particularly those of the hind-feet, are capable of being spread out very widely in swimming, so as to give great propulsive power.

The movements of seals in the water are very rapid and graceful; on land, they are very peculiar; even the fore-feet being little used or not at all, but the body contracted by an upward bending of the spine, and so thrown forward by a succession of jerks; in which way, however, a S. makes its escape very rapidly from an assailant. The flexibility of the spine in seals is very remarkable, and depends on the very large intervertebral cartilages, formed of fibrous concentric rings. The muscles, which are connected with the spine on all sides, are of great strength.

The teeth differ considerably in the different genera, but in all are adapted for the seizure of slippery prey, the chief food of seals



Skeleton of Seal, with outline of the figure.

being fishes, although they do not reject other animal food, and are said even to feed in part on vegetable substances. Their incisors are either six in the upper jaw and four in the lower, or four in the upper and two in the lower; they all have large and strong canine teeth; and the molars, usually five or six on each side in each jaw, are either sharp-edged or conical, and beset with points. Seals have a remarkable habit of swallowing large stones, for which no probable reason has yet been conjectured. Their stomachs are very often found to be in part filled with stones. The stomach is quite simple; the gullet (*œsophagus*) enters it at the left extremity; the cœcum is short, the intestinal canal long.

The respiration of seals is extremely slow, about two minutes intervening between one breath and another, when the animal is on land and in full activity. A S. has been known to remain twenty-five minutes under water. Their slowness of respiration, and power of suspending it for a considerable time, is of great use, as enabling them to pursue their prey under water. The fur of seals is very smooth, and abundantly lubricated with an oily secretion. There is generally an inner coating of rich fur, through which grow long hairs, forming an outer covering. Another adaptation to aquatic life and cold climates appears in a layer of fat immediately under the skin—from which *Seal Oil* is obtained—serving not only for support when food is scarce, but for protection from cold, and at the same time rendering the whole body lighter. The nostrils are capable of being readily and completely closed, and are so whilst the S. is under water; and there is a similar provision for the ears; whilst the eye, which is large, exhibits remarkable peculiarities, supposed to be intended for its adaptation to use both in air and water. The face is provided with strong whiskers, connected at their base with large nerves.

Seals produce their young only once a year; sometimes one, sometimes two at a birth. Not long after their birth, the young are conducted by the mother into the sea. Many, if not all, of the species are polygamous. Terrible fights occur among the males.

Seals are very much on their guard against the approach of man, where they have been much molested; but where they have been subjected to no molestation, they are far from being shy, and approach very close to boats, or to men on shore, as if animated by curiosity. They are much affected by musical sounds.

a flute is said to attract seals to a boat, where they have not learned caution from sore experience; and the ringing of the church bell at Hoy, in Orkney, has very often caused the appearance of numerous seals in the little bay. Seals possess all the five senses in great perfection.

The Common S. and some of the other species are very intelligent; but there is considerable difference in this respect among the species. The Common S. and some others have often been tamed, and are capable of living long in domestication, if freely supplied with water. They become very familiar with those who attend to them, are very fond of caresses and of notice, recognize their name like dogs, and readily learn many little tricks, of which advantage has been taken for exhibitions.

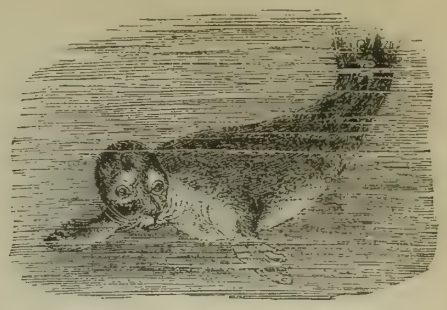
Seals are found in all the colder parts of the world, most abundantly in the arctic and antarctic regions; some of them also in temperate climates, as far south as the Mediterranean, and as far north as the La Plata. Some of them ascend rivers to some distance in pursuit of salmon and other fish. They are found in the Caspian Sea, and even in the fresh-water Lake Baikal.

The species are numerous, but in no group of Mammalia does more remain for further investigation. Seals are divided into two principal groups—*Seals*, more strictly so called, and *Otaries* (q. v.); the former distinguished by the complete want of external ears, which the latter possess, and by their dentition. The true seals have been further subdivided into genera chiefly characterized by their dentition. In the restricted genus *Phoca*, or *Calocephalus*, the incisors are pointed and sharp-edged, six above and four below. The Common S. (*Phoca vitulina*) is found in the northern parts of the Atlantic Ocean, and in the Arctic Ocean. It is common on the wilder and more unfrequented parts of the British coasts, particularly in the north. It is remarkably distinguished, even among its nearest congeners, by the oblique position of the molar teeth. The fur is yellowish, variously spotted, and marked with brown. The whole length is from 3 to 5 feet. Its love of salmon is so great that it has been known to haunt the neighborhood of a salmon-net for a long time, and to take the fish after they were entrapped in it. The Common S. is generally seen in small herds. Its skin and oil are of considerable mercantile importance. The skin is dressed with the fur on, to make caps, &c., or is tanned and used as leather. The oil, when made before decay has begun, is colorless and nearly inodorous; it is much superior to whale-oil. The flesh is much used for food in very northern countries, as is that of all the other species which they produce. It is not easy to shoot a seal. Whilst flint-locks were in use, the S. always dived so quickly on seeing the flash as generally to escape the ball.

The popular name SEA-CALF, and the specific name *vitulina* have reference to a supposed resemblance of the voice to that of a calf.—The HARP S. (*P. Grœnlandica*) receives its popular name

Harp Seal (*Phoca Grœnlandica*), attitude on land.

from a large, black, crescent-shaped mark on each side of the back. It is sometimes seen on the British coasts, but belongs chiefly to more northern regions. It is from 6 to 8 or even 9 feet in length.—THE GREAT S., or BEARDED S. (*P. barbata*), also found on the British coasts, and plentiful on the coasts of Greenland, is generally about 9 or 10 feet long, sometimes more.—The ROUGH or BRISTLED S. (*P. hispida*) frequents quiet bays on the coasts of Greenland, where many thousands are annually killed for their skins and oil. It is the smallest of the northern species.—The GRAY S. (*Halichœrus griseus*), which has a very flat head, and attains a size nearly equal to the Great S., occurs on the British coasts, but is much more common in more northern latitudes, and in the Baltic Sea.—The CRESTED S. (*Stemmatopus cristatus*) is remarkable for the elevation of the septum of the nose of the adult male into a crest, which supports a hood covering the head, and capable of being distended and elevated or depressed at pleasure. The use of this appendage is not known. This S. is plentiful on the coasts of Greenland and the northern parts of North America.—The seals of the southern seas are quite distinct from those of the northern. One of them is the SEA LEOPARD, or LEOPARD S. (*Leptonyx Weddellii*), so called from its spotted fur. It is found on the South Orkneys and other very southern



Common Seal (*P. vitulina*), attitude when swimming.

islands. By far the largest of all the seals is the ELEPHANT S., or Sea Elephant of the southern seas.

Seals are to some extent migratory, although their migrations no not extend to very great distances, and are probably regulated by the abundance or scarcity of food. The time of the return of certain species to certain coasts, is very confidently reckoned upon by the natives of the north and by seal-hunters.

Seal-hunting—or *fishing*, as it is often called—requires great patience and skill. Most of the seals, if not all, are gregarious, and one seems to be always placed on the watch, where danger is to be apprehended from bears or from hunters. They climb up through holes in the ice-fields of the polar seas, even when there is a height of several feet from the water, but it is difficult for the hunter to get between and the hole. Nor is seal-hunting unattended with danger, an enraged S. being a formidable antagonist, at least to the inexperienced.

Seal-hunting is the great occupation of the Greenlanders, but it is also extensively prosecuted in other northern parts of the world, as Newfoundland; whale-fishers kill seals as they find opportunity; and vessels are fitted out expressly for the purpose. The rich fur called the seal-skin of commerce is produced, not by the seals proper, but by some of the otaries (see OTARY).

SEALING-WAX. A composition of hard resinous materials used for receiving and retaining the impressions of seals. Simple as it may appear, its manufacture is one of great importance, and formerly was far more so than at present—the use of gummed envelopes having to a great extent superseded it. Common beeswax was first used in this country and in Europe generally, being mixed with earthy materials to give it consistency. Nevertheless, it was difficult to preserve it, as a very small amount of heat softened it.

The Venetians, however, brought the Indian sealing-wax to Europe, and the Spaniards received it from the Venetians, and made it a very important branch of their commerce. The great value of the Indian wax consisted in the fact that it was made only of shell-lac, colored with vermilion or some other pigment, and this has been found superior to all other materials. In addition to the shell-lac and coloring-material, there is always added to the wax made in Europe a portion of Venetian turpentine (see TURPENTINE), and of resin.

SEA-LION. See OTARY.

SEA-LION, in Heraldry, a monster consisting of the upper part of a lion combined with the tail of a fish.

SEAL ISLANDS, or LOBOS ISLANDS. See PERU.

SEALKOTE, a town in the Punjab, near the left bank of the Chenab, 65 miles north-north-east from Lahore. It contains (1868) 25,337 inhabitants, and carries on the manufacture of paper. S. was formerly a military station, and at the period of the outbreak of the Indian mutiny, there was a rifle-practice dépôt here. All the European troops had been removed in July 1857 to repress disturbances that had broken out elsewhere, and on the 9th of that month the native troops fired on their officers. A considerable number of Europeans were killed, and the survivors suffered great privations until the sepoys, having plundered the station, started off in the direction of Delhi.

SEAL OF CONFESSION. See CONFESSION and CONFIDENTIALITY.

SEAMEN are technically those persons below the rank of officer, who are employed in navigating decked vessels on the high seas—men working on lakes and rivers being usually styled 'watermen.' Two opposite conditions are essential to the well-being of the vessel—first, the absolute subordination and perfect obedience of the crew to the master; and secondly, their protection against tyranny or caprice on his part. For this purpose the law of England is extremely minute in the rules laid down for both masters and seamen.

By an act of 1845, specially levelled against pimps and swindling agents, no person may hire seamen except the owner or master of a ship, and individuals licensed for that purpose by the Board of Trade. Under the Mercantile Marine Act of 1850, a written agreement must be made when a man is engaged, setting forth the nature and length of voyage, the capacity in which the man is to be employed, wages, fines, provisions, punishments, &c. If the ship be going abroad, this agreement must be attested before a shipping-master, who has a power of periodical inspection over the agreements of all seamen in vessels in his port. Any clause in the agreement would be inoperative which deprives the sailor of a lien upon his ship, or of other recovery for his wages, or of rights of salvage. In virtue of this agreement the seaman is bound to do his utmost in the service of the vessel; and consequently, if a master of a ship in distress promise his men extra pay for extraordinary exertions, the men cannot compel him to fulfil his promise.

In the event of disobedience or insubordination the master may administer correction, the law holding him responsible that such correction is reasonable. Desertion from the ship is punishable by imprisonment; and deserters may be apprehended on the information of the master without warrant. In case of open mutiny, the master may adopt the most stringent measures.

The mariner's wages are not due in case of loss of the ship, unless he duly exerted himself, and only up to the date of loss. It is a misdemeanor for the master to leave a sailor on shore in foreign parts, unless through the man's wrongful act.

SEA MOUSE (*Aphrodite*), a genus of dorsibranchiate annelida, of the family *Aphroditidæ*, to all of which the popular name is extended. They are readily distinguished by two longitudinal ranges of broad membranous scales covering the back, under

Sea Mouse (*Aphrodite aculeata*).

which are the gills in the form of little fleshy crests. The scales move up and down as the animal respires; and are concealed by a substance resembling tow or felt, which permits the access of water but excludes mud and sand. The head is furnished with tentacles; some have two eyes and some four. The body is edged with spines. Besides all this, its sides are covered with flexible bristles or silky hairs, which give to these creatures a wonderful beauty of color, unsurpassed by that of humming-birds or the most brilliant gems. Each hair, even when viewed singly, and moved about in the sunshine, reflects all the hues of the rainbow. Yet sea-mice are generally to be found concealed under stones, and dwell amongst the mud at the bottom of the sea. Storms frequently throw them on the beach in great numbers. A very beautiful species, *A. aculeata*, of an oval form, about 6 or 8 inches long, and 2 or 3 broad, is the Common S. M. of the British coasts.

SEA PIKE (*Centropomus undecimalis*), a fish, which, notwithstanding its popular name, belongs to the perch family. Its form, however, is elongated like that of the pike. The body is compressed; there are two dorsal fins; the mouth is not very large; and the teeth are numerous, small and equal. The color is silvery-white, tinged with green on the back. It is found on the western coasts of tropical America. It attains a large size, and is a valuable fish. On the British coasts, the name S. P. is sometimes given to the Garfish.

SEA PINK. See THRIFT.

SEARCH OF ENCUMBRANCES means the inquiry made by a purchaser or mortgagee of lands as to the burdens and state of the title, in order to see whether his purchase or investment is safe. Owing to the want of any general system of registration of deeds affecting land in England, it is not possible by any search to find out with certainty all these burdens; nevertheless, there are some special registers which are usually included in such searches, such as judgment debts, bankruptcies, disentailing deeds, annuity deeds, &c. The search usually goes back for 60 years. In Scotland, where all the deeds affecting land rights are registered, it is easy to discover the exact state of the title and burdens on the land. The usual search is made only for 40 years. The registers are subdivided into various kinds—as the general and particular register of Sasines, the Record of Abbreviates of Adjudications, Register of Inhibitions, &c. See RECORDS.

SEARCH-WARRANT is an authority granted to a constable by a justice of the peace to enter the premises of a person suspected of secreting stolen goods, in order to discover, and if found to seize the goods; and similar warrants are granted to discover property in respect of which other offences are committed. Before such a warrant can be issued, a credible witness must on oath prove a reasonable cause to suspect that the party proceeded against has the property in his possession or in his premises. The name of the person whose premises are to be searched must be correctly described in the warrant.

SEA-SERPENT, the name given to gigantic animals presumedly of serpentine form, which are believed by many naturalists to exist in the sea-depths, especially in tropical oceans. The question of the existence of a sea-serpent has long formed one of the knotty problems of zoological science. But it seems reasonable to conclude that there exists a certain basis for the supposition that undescribed marine forms do exist in the sea-depths, and that the most reliable tales of sea-serpents take origin from appearances of such animals. Of such tales, possessing a warrantable basis of fact, and emanating from authoritative sources, that of Captain M'Quhae is one of the best known. This account was published in 1848. Captain M'Quhae commanded H.M.S. *Dædalus*, and encountered the serpentine form in lat. 24° 44′ S., and long. 9° 20′ E., and therefore in the South Atlantic Ocean, near the Tropic of Capricorn, and not very far from the coast of Africa. It was not, as in other cases, in bright and fine weather, but in dark and cloudy weather, and with a long ocean swell. The animal was swimming rapidly, and with its head and neck above water.

Captain M'Quhae, in his Report to the Admiralty, describes it with confidence as 'an enormous serpent, with head and shoulders kept about 4 feet constantly above the surface of the sea;' and he adds: 'As nearly as we could approximate by comparing it with the length of what our maintopsail-yard would show in the water, there was at the very least 60 feet of the animal *à fleur d'eau*, no portion of which was, to our perception, used in propelling it through the water, either by vertical or horizontal undulation. It passed rapidly, but so close under our lee-quarter, that had it been a man of my acquaintance, I should have easily recognized his features with the naked eye; and it did not, either in approaching the ship or after it had passed our wake, deviate in the slightest degree from its course to the south-west, which it held on at the pace of from 12 to 15 miles per hour, apparently on some determined purpose. The diameter of the serpent was about 15 or 16 inches behind the head, which was, without any doubt, that of a snake; and it was never, during the twenty minutes that it continued in sight of our glasses, once below the surface of the water; its color a dark-brown, with yellowish-white about the throat. It had no fins, but something like the mane of a horse, or rather a bunch of sea-weed, washed about its back.'

Regret has been very naturally expressed that Captain M'Quhae did not bestow a shot on it. Figures prepared from a sketch by him were published in the *Illustrated London News* of 28th October 1848. About the same time, the testimony of another witness, Lieutenant Drummond, appeared, and was found to differ in some important points from the account of the animal given by Captain M'Quhae, and the figures published with his approbation, particularly in ascribing a more elongated form to the head, in the mention of a back-fin, whereas Captain M'Quhae expressly says that no fins were seen; and in a lower estimate of the length of the portion of the animal visible. Lieutenant Drummond's words are: 'The appearance of its head, which, with the back fin, was the only portion of the animal visible, was long, pointed, and flattened at the top, perhaps 10 feet in length; the upper jaw projecting considerably; the fin was, perhaps, 20 feet in the rear of the head, and visible occasionally; the captain also asserted that he saw the tail, or another fin about the same distance behind it; the upper part of the head and shoulders appeared of a dark-brown color, and beneath the under jaw a brownish-white. It pursued a steady and undeviating course, keeping its head horizontal with the water, and in rather a raised position, disappearing occasionally beneath a wave for a very brief interval, and not apparently for the purposes of respiration. It was going at the rate of perhaps from 12 to 14 miles an hour, and when nearest was perhaps 100 yards distant. In fact, it gave one quite the idea of a large snake or eel.' Lieutenant Drummond's account is the more worthy of regard, as it is derived from his log-book, and so gives the exact impressions of the hour, whilst Captain M'Quhae's was written from memory after his arrival in England. Into the discussion which arose concerning this case, it is out of our power to enter.

In 1875, a battle between a sea-serpent and a whale was viewed from the deck of the good ship *Pauline* of London, Captain Drevar, when proceeding with a cargo of coals from Shields to Zanzibar, destined for Her Majesty's ship *London*. When the *Pauline* reached the region of the trade-winds and equatorial currents, she was carried out of her course, and after a severe storm, found

herself off Cape Roque, where several sperm-whales were seen playing about her. While the crew were watching them, they suddenly beheld a sight that filled every man on board with terror. Starting straight from the bosom of the deep, a gigantic serpent rose and wound itself twice in two mighty coils round the largest of the whales, which it proceeded to crush in genuine boa-constrictor fashion. In vain did the hapless whale struggle, lash the water into foam, and even bellow, for all its efforts were as nothing against the supernatural powers of its dreadful adversary; whose strength may be further imagined, from the fact that the ribs of the ill-fated fish were distinctly heard cracking one after the other with a report like that of a small cannon.

Of no less a ship than Her Majesty's yacht the *Osborne*, the captain and officers, in June 1877, forwarded an official Report to the Admiralty containing an account of a sea-serpent's appearance off the coast of Sicily on the 2d of that month. 'The time was five o'clock in the afternoon. The sea was exceptionally smooth, and the officers were provided with good telescopes. The monster had a smooth skin, devoid of scales, a bullet-shaped head, and a face like an alligator. It was of immense length, and along the back was a ridge of fins about *fifteen* feet in length and *six* feet apart. It moved slowly, and was seen by all the ship's officers.'

This account was further supplemented by a sketch, from the pencil of Lieutenant W. P. Hynes of the *Osborne*, who to the above description adds, that the fins were of irregular height, and about forty feet in extent, and 'as we were passing through the water at ten and a half knots, I could only get a view of it "end on."' It was about fifteen or twenty feet broad at the shoulders, with flappers or fins that seemed to have a semi-revolving motion. 'From the top of the head to the part of the back where it became immersed, I should consider about fifty feet, and that seemed about a third of the whole length. All this part was smooth, resembling a seal.'

These instances are but examples of the many cases, in which narratives of the most circumstantial character have been recorded regarding the appearance of serpentine animals, usually in tropical seas.

As will readily be admitted, the chief point at issue is that of the zoological determination of the forms reported to have been seen. Gigantic cuttle-fishes, now proved to have a veritable existence, might in many cases imitate an elongated marine form, swimming near the surface of the sea. Certain fishes, such as the Basking Shark (*Selache maxima*) would also under certain circumstances appear as unusual marine forms; and as Dr. Andrew Wilson, of the Edinburgh Medical School, has pointed out, the well-known Tape-fishes (*Gymnetrus Banksii*) would very accurately reproduce the features of a marine snake, especially when these fishes, as is well-known, are developed to an immense size. The marine snakes or *Hydrophidæ* of the Indian Ocean would also serve to personate the 'great unknown,' if largely developed, and indeed as Dr. Wilson has pointed out, in the idea of the immense development of ordinary marine animals may be found a probable clue to the sea-serpent mystery. Cases of mere serpentine appearances assumed by certain animals are not to be confused with cases in which a single animal has presented a serpentine aspect. Flocks of shags swimming close to the water's edge might personate a sea-serpent swimming along the top of the water (see *Nature*, Sept. 1878); but a flock of birds would have been readily detected by Captain M'Quhae, and by many other observers who have beheld the unknown form from a near distance. The reader who wishes for a full discussion of the scientific aspects of this question may consult a paper entitled 'The Sea-Serpents of Science,' in Dr. Andrew Wilson's volume *Leisure-Time Studies* (Chatto & Windus, London, 1878).

SEA-SHORE, or land bordering on the sea, belongs partly to the crown, and the public have certain rights in relation thereto. The soil or property in the sea-shore is vested in the crown, and the limit on the land side is defined to be the medium line of high-water of all the tides in the course of the year, or the height of the medium tides in each quarter of a lunar revolution during the whole year. But though the crown is *prima facie* the owner of the sea-shore, the owner of the adjoining manor has sometimes a grant of it, and he proves this grant by ancient use—such as gathering sea-weed, &c. The public have a right to walk on that part of the shore vested in the crown, which holds it as a trustee for them. But the public have no right to trespass on the adjacent lands in order to get at the shore, so that it is only where a highway leads to the shore, or the public land from seaward, that the right can be made available. Thus it has been decided that the public have no legal right to trespass on the adjoining lands in order to get to the shore for purpose of bathing. The public have a right to fish on the sea-shore if they get legal access to it, and may take all floating fish, but not oysters or mussels which adhere to the rock, if the soil belongs to an individual. The public have no right to gather sea-weed or shells, though, as regards the latter, it is of so little consequence that nobody prevents them. Nor have fishermen a right to go on that part of the sea-shore which is private property to dig sand for ballast, or to dry their nets, or similar purposes, though in a few cases local customs permitting this have been held valid. In Scotland, the right to the sea-shore is also vested in the crown, but when a crown grant gives land bounded by the sea-shore, this is held to give to the grantee the fore-shore also.

SEA-SICKNESS is a variety of vomiting deserving of special notice. It is often preceded by premonitory symptoms, which appear almost immediately after a susceptible person is exposed to the motion of rolling water in a vessel or boat, and are as distressing as the vomiting itself. Amongst these symptoms may be mentioned vertigo and headache, with a peculiar feeling of sinking and distress about the pit of the stomach. Vomiting, however, in general, soon comes on, accompanied with convulsive heaving of the stomach, and such an indescribable feeling of prostration as to render the patient utterly regardless of what is going on around him, and almost indifferent to life. Moreover, a deadly pallor, a profuse cold sweat, and diarrhœa, are more or less commonly present. The susceptibility to this troublesome affection varies extremely in different persons. Some never suffer from it, others only on their first voyage, and others, again, in every voyage they undertake; with some it continues but a few hours, while others suffer almost continuously throughout a long voyage. In the great majority of cases, the sickness disappears in a few days, unless the weather be very boisterous. It almost always ceases on landing, although more or less giddiness may prevail for some hours, the patient when walking, feeling as if the earth were rising up under his feet. Infants and aged persons are supposed to possess a comparative immunity from sea-sickness, while, as a general rule, women suffer more than men.

According to Dr. Althaus, persons with a strong heart and a slow pulse generally suffer little from sea-sickness; while irritable people, with a quick pulse and a tendency to palpitation, are more liable to be affected; and he thus accounts for different liability of different nations to this affection; 'for, as a rule, the French and Italians, being of a more irritable temper, suffer most from the disorder, the Germans less, and the English least. ('On Sea-sickness as a form of Hyperæsthesia,' in *Proceedings of the Medico-Chirurgical Society*, vol. v. p. 23.)

The primary cause (or rather condition) of sea-sickness is the motion of the ship; and the *pitching* of a vessel, or alternate rising and falling of the bow and stern, is especially apt to produce it. It is less felt in large and heaviiy ballasted vessels, because the movements referred to are least perceptible in them. How this cause operates is a subject regarding which there has been much discussion; and without entering into the history of the views of different physicians on this subject, we may give as widely accepted that of Dr. Chapman, who holds that the motions of the vessel cause the accumulation of an undue amount of 'blood in the nervous centers along the back, and especially in those segments of the spinal cord related to the stomach, and the muscles concerned in vomiting.'

This condition is induced, as he maintains, in three different ways, viz., (1.) by the movements of the brain, which are much greater in a pitching vessel than on land; (2.) by the corresponding movements of the spinal cord; and (3.) by the excessive movements of the viscera within the abdominal and pelvic cavities. In one person the brain may be mainly responsible in causing that preternatural afflux of blood in the spinal cord, on which (according to Dr. Chapman's hypothesis) sea-sickness depends; in another, the spinal cord may be the main agent; and in a third, the abdominal viscera; although each is always concurrent in some degree. Hence, the only scientific and really effective remedy for this disorder, must be one which has the power of lessening the amount of blood in the whole of the nervous centers along the back, and this can be done by lowering the temperature of the spinal region by the local application of ice. For a description of Dr. Chapman's 'spinal ice-bags' (which may be obtained from any respectable surgical instrument-maker), and for the method of applying them, we must refer to his work *On Sea-sickness; its Nature and Treatment*, p. 37 (Lond. 1864). He gives the details of 17 cases in which the ice-bags were of greater or less benefit; in most of the cases, the result was perfectly successful. Besides Dr. Chapman's evidence we have that of Captain White, commander of one of the Newhaven and Dieppe boats, who states that 'in ordinary weather it [Dr. Chapman's remedy] is a success. I had some difficulty in persuading passengers to try it, but those who did were benefited.'

Mr. Bradley, surgeon in the Cunard Service, in a letter to *The Lancet*, December 3, 1864, writes as follows: 'I have tried this remedy *in severe cases when other remedies have failed* (chloroform, iced champagne, effervescing draughts, fresh air, &c.), and have very generally found it do great good. In no case does it do harm, but in the great majority of instances it soothes the nervous irritability which so commonly accompanies severe sea-sickness,

induces sleep, and consequently relieves exhaustion.' We are permitted to publish the following extract of a letter from Dr. Hayle of Rochdale, to Dr. Chapman, dated June 3, 1865: 'I recommended a patient about to cross the Atlantic, to try one of your ice-bags for sea-sickness. The result was most satisfactory. He was never sick when wearing the bag. Once he went without it, and then, and then only, was he sick. His friend, who had no ice-bag, was frequently sick.' As an ancillary remedy the drinking of iced water, or the swallowing of small lumps of ice, may be recommended. Dr. Chapman prefers the ice, which, 'brought in contact with the peripheral ends of the nerves of the stomach, will act on the same principle as it does when applied to the spinal region.'

Those who are susceptible to this distressing affection, and have not the opportunity of trying the ice-bags, may, at all events, diminish the severity of the vomiting by assuming, and as long as possible retaining, the horizontal position, as nearly as possible in the center of the ship's movement, and keeping the eyes closed. The compression of the abdomen, by means of a broad tight belt, sometimes gives relief. A few drops of chloroform on a lump of white sugar will sometimes check the tendency to vomiting in persons who only suffer slightly. A little arrowroot, flavored with brandy or sherry, is usually a kind of food that will most easily remain on the stomach, when the severity of the symptoms is abating. Dr. Wood, one of the most eminent of the American physicians of the present day, asserts that he has found 'nothing under such circumstances so acceptable to the stomach as raw salt oysters.'

SEASIDE GRAPE (*Coccoloba uvifera*), a small tree, of the natural order *Polygoneæ*, a native of the West Indies. It grows on the sea-coasts; has orbicular, cordate, leathery, shining, entire leaves, and a pleasant, subacid, eatable fruit, somewhat resembling a currant, formed of the pulpy calyx investing a bony nut. The extract of the wood is extremely astringent, and is sometimes called JAMAICA KINO. The wood itself is heavy, hard, durable, and beautifully veined.

SEA SLUG. See HOLOTHURIA.

SEASONING, a term in Cookery for the materials used to add flavor to food. They are chiefly salt, the spices, and pot-herbs. Salt is the most important, for it not only increases the sapidity of most kinds of food, but also adds to their wholesomeness.

SEASONS. In the article EARTH, the motions of the earth on which the changes of the seasons ultimately depend, are explained. The chief cause of the greater heat of summer and cold of winter is that the rays of the sun fall more obliquely on the earth in the latter season than in the former. See CLIMATE. Another concurrent cause is the greater length of the day in summer, and of the night in winter. Within the tropics, the sun's rays have at no time so much obliquity as to make one part of the year very sensibly colder than another. There are therefore either no marked seasons, or they have other causes altogether, and are distinguished as the *Wet* and *Dry* seasons. This is explained in the article RAIN. But in all the temperate parts of the globe, the year is naturally divided into four seasons—*Spring*, *Summer*, *Autumn*, and *Winter*. In the arctic and antarctic regions, spring and autumn are very brief, and the natural division of the year is simply into summer and winter, the winter being long, and the summer short; and this is very much the case also in regions of the temperate zones lying near the arctic and antarctic circles.

In subtropical regions, the distinction of four seasons is, in like manner, very imperfectly marked. This distinction is everywhere arbitrary as to the periods of the year included in each season, which really vary according to latitude; and partly according to the other causes which influence climate; the seasons passing one into another more or less gradually, and their commencement and close not being determined by precise astronomical or other phenomena. The greatest heat of summer is never reached till a considerable time after the summer solstice, when the sun's rays are most nearly vertical, and the day is longest; the greatest cold of winter is in like manner after the winter solstice, when the day is shortest, and the sun's rays are most oblique; the reason in the former case being, that as summer advances the earth itself becomes more heated by the continued action of the sun's rays; in the latter, that it retains a portion of the heat which it has imbibed during summer, just as the warmest part of the day is somewhat after midday, and the coldest part of the night is towards morning. The four seasons of temperate regions are distinguished by the phenomena of nature which characterize them, and which are of the greatest importance in relation to the wants and labors of man. But the renewal of vegetative activity in spring is not to be ascribed entirely to the increasing warmth of the sun's rays. Plants are so constituted that a period of rest is followed by new activity, and this new activity very generally begins in the fresh circulation of sap and enlargement of buds, whilst the cold of winter still continues unabated, or before it has reached its greatest intensity. A similar remark may be made with regard to some of the phenomena of animal life, which may as well be said to herald the approach of spring as to attend its first days of genial weather.

SEA URCHIN. See ECHINIDÆ.

SEAWEED and SEA WRACK. See FUCACEÆ and WRACK.

SEBASTIAN, SAINT, a very celebrated martyr of the early church, whose memory is venerated in both branches of the church, east as well as west (although the scene of his martyrdom was the city of Rome), and whose story has formed one of the most popular themes of Christian artists from the earliest times. His history is contained in the so-called acts of his martyrdom, which, although partaking of the legendary tone, are regarded as authentic, not only by Baronius and the Bollandists, but also by Tillemont and others of the more stringently critical schools of ecclesiastical history. S., according to this narrative, was born at Narbonne and educated at Milan. Although a Christian, he entered the Roman army, without, however, revealing his religion, and with the view of being enabled, by his position, to assist and protect the Christians in the persecution. In this way he supported and comforted many of the martyrs in Rome; and he even converted Nicostratus, the keeper of the prison in which the martyrs were confined, and his wife, Zoe, to whom he miraculously restored the use of her speech, after she had been dumb for six years. Still unrecognized as a Christian, S. rose to high favor under Diocletian, while at the same time the grateful pontiff, Caius, named him 'Defender of the Church.' At length came the time for his open profession of his faith.

Diocletian used every effort to induce him to renounce the Christian creed, but in vain; and in the end he was condemned to be put to death by a troop of Mauritanian archers, who transfixed him with numberless arrows, and left him as dead. But a Christian lady, Irene, finding that life was not extinct, had the body removed to her house, where life was restored; and although the Christian community desired to conceal his recovery, S. again appeared in public before the emperor, to profess his faith in Christianity. Diocletian condemned him to be beaten to death with clubs in the amphitheater; and his body was flung into one of the sewers of the city, in which it was discovered, according to the Acts of Martyrdom, by means of an apparition, and carried by a Christian lady, Lucina, to the catacomb, which is still called by his name. The date of his martyrdom was January 20, 288. By the Greeks the feast is held on the 20th December. The festival was celebrated with great solemnity in Milan as early as the time of St. Ambrose; and it was observed in the African Church in the 4th century. There is another saint of the same name, who is said to have suffered martyrdom in Armenia.

SEBASTIANI, FRANCOIS-HORACE-BASTION, marshal of France, was born November 10, 1772, at Porta d'Ampugnano, a village near Bastia, in Corsica. He was the son of a tailor, but his extreme vanity led him to declare himself of noble descent and a distant relative of the Bonapartes. He entered the army as a sub-lieutenant of infantry, August 27, 1789. His rise, due to his bravery in the field, was no doubt somewhat aided by his splendid physique, graceful manner, and facile diction. He became *chef-d'escadron* in 1797, and brigadier in 1799, and was one of Napoleon's most devoted partisans. He fought at Marengo, executed some important diplomatic service in Turkey in 1802—1803, after which he became general of brigade (August 1803), and was wounded at Austerlitz. On May 2, 1806, he was again deputed to Turkey, this time to break the alliance of the Porte with Russia and England; and before he had been seven months at Constantinople, his mission had obtained complete success, and war was declared. The English fleet forced a passage through the Dardanelles, and cast anchor before Constantinople, their presence causing such terror among the sultan's ministers that a total reversal of foreign policy was imminent, but S. coming to the rescue, revived with his seducing eloquence their failing resolution, and assuming an authoritative superintendence of the preparations for defending the coast, put the batteries in a state fit for action.

In five days, he had the coast batteries manned with 600 guns. 100 small gunboats afloat, a line of vessels laid along shore, each with a broadside ready to be discharged on the English fleet, which at last gallantly ran the gantlet, losing two ships and 700 men. But the death of the sultan, and the treaty of Tilsit, put an end to the French intrigues in Turkey, and S. was recalled June 1807, and decorated with the grand cordon of the Legion of Honor. He subsequently commanded the fourth corps-d'armée in Spain. He distinguished himself in the Russian campaign of 1812, and at Leipzig. On the exile of Napoleon to Elba, he gave in his adherence to the Bourbon government, but joined his old master on his return. After the revolution of 1830, he held for brief periods the portfolios of naval (1830) and foreign affairs, and the embassies to Naples (April 1833) and London (January 1835); but was more distinguished for his elegance, and graceful de-

meanor in the Parisian salons, than as a politician or administrator. He died at Paris, July 20, 1851.

SEBASTIANI'STAS, the name given in Portugal and Brazil to persons who believe in the future return to earth of the king Dom Sebastian, who fell in the battle of Alcazarquebir, 1578 A.D., while leading on his army against the Moors. This belief has continued to be entertained by many in Portugal; but the S. are said to be now most numerous in Brazil. On the return of Dom Sebastian, they expect Brazil to enjoy the most perfect prosperity and happiness.

SEBASTO'POL, or, as it is sometimes written, in accordance with modern Greek pronunciation, SEVASTOPOL (*Sebastopolis*, the 'august city'), a Russian seaport, fortress, and arsenal in the Crimea, in the government of Taurida. It is situated near the south-west extremity of the Crimea, on the southern side of the magnificent harbor or roadstead of S., one of the finest natural harbors in the world. This harbor is an inlet of the Black Sea, stretching inland for about four and a half miles from west to east, about half a mile wide at the entrance, but immediately opening out to the width of a mile, with an average width of about half a mile up to the eastern end. It is sheltered on the north and south by lofty limestone ridges shutting it completely in, with a depth of water varying from 3 to 11 fathoms, and sufficient in several places to allow ships of the largest size to lie close to the shore. At the eastern end, under the heights of Inkermann, the river Tchernaya enters the harbor through low marshy ground. The South Bay, or Dockyard Harbor, as it is also called, extending about one and a half miles from north to south, forms the harbor proper of S.; and between it and Quarantine Bay, occupying rather more than half the peninsula thus formed, is built the chief portion of the town of S., on ground sloping irregularly upwards. The town previous to its destruction in the siege of 1854—1855, was well and substantially built of stone, with lines of streets running from north to south, and smaller ones intersecting them at right angles, containing several handsome public edifices.

The docks, constructed for the Russian government by Colonel Upton, an English civil engineer, were among the most important works at S.; the dock basin, docks, and quays were formed in the most substantial way, being partly cut in the solid rock, and lined with cement, partly built of limestone and granite. From the Dockyard Creek, ships were admitted into the Dock Basin by means of three locks, the bottom of the docks being above the sea-level, and the basin was supplied with water by a canal some 12 miles in length from the Tchernaya above Inkermann—itself a work of no inconsiderable magnitude. For the defence of town and harbor from attack by sea, several forts were erected. These forts were works of immense strength, built of limestone faced with granite, on which artillery was found to make but little impression; they mounted a very large number of guns, and by their cross-fire completely protected every spot accessible to a hostile fleet. On the land side, with the exception of a slight loopholed wall extending partially round the western side, the town, previous to the siege, was entirely undefended; but the earthworks and fortifications then successively extemporized by the genius of General Todleben, which for so many months kept the armies of France and England at bay, and of which the Malakoff and the Redan were the most formidable, are now of historic fame.

The siege of S. by the allied English and French armies will rank among the most famous sieges in history; it lasted for 11 months, from October 1854 to September 1855; the place sustained repeated bombardments, the first of which took place October 17, 1854; and the capture of the Malakoff and Redan, on September 8, 1855, at length forced the Russians to evacuate it, and retired to the north side. The town was completely ruined; the docks and forts still standing were blown up by French and English engineers, and by the treaty of Paris (1856) were not to be restored; but the restrictions were removed by the abrogation of the neutrality of the Black Sea by the Conference of London (1871). Before the siege, the population of S., including the garrison, amounted to about 40,000. Since, the town has been partially rebuilt, but the population in 1880 was only 15,000. S. was intended to be the station of the Russian Black Sea fleet, and as such to form a standing menace to Turkey; during the siege, the fleet was almost entirely destroyed, many of the ships having been sunk by the Russians across the entrance of the harbor by way of defence. The great disadvantage of S. as a naval station arises from the ravages of the *Teredo navalis*, which soon render wooden vessels unseaworthy.

S. was founded on the site of a small Tartar village called *Akhtiar*, immediately after the Russian conquest of the Crimea in 1783, under the orders of the empress Catharine II. The promontory on which S. stands is a spot of considerable classical and historical interest. Here, perhaps on the site now occupied by the Greek convent of St. George, west of Balaclava, stood the temple of the Tauric Artemis, in which, according to the legend, Iphigenia, daughter of Agamemnon was priestess. In later times the promontory was colonized by Greeks from Heraclea, in Asia Minor, and became known as the Heracleotic Chersonese. Two cities, successively built a few miles apart on the sea-coast to the west of S. have left remains existing to the present day. In after times, the Chersonesus fell into the power of the Genoese, who established their headquarters at Balaclava, where the remains of the 'Genoese castles' on the heights still bear witness to their rule. See Kinglake's *Invasion of the Crimea*.

SEBE'NICO, a small port on the coast of Dalmatia, 42 miles south-east of Zara. It is built on a steep slope, and rises in terraces, and was formerly defended by walls and towers. Its cathedral, a fine edifice with a bold dome, was built 1443—1536. Its excellent harbor is defended by several forts. Pop. (1880) 6876; of commune, 18,104.

SEBE'STEN, SEBESTAN, SEPISTAN, or S. PLUM, the fruit of the *Cordia Myxa*, a tree of the natural order *Cordiaceæ*, a native of the East Indies. The tree has ovate leaves, and an egg-shaped fruit, which is succulent, mucilaginous, and emollient, with some astringency, and was formerly an article of the European Materia Medica, being employed for the preparation of a lenitive electuary and of a pectoral medicine. It is believed to be the *Persea* of Dioscorides. It has a sweetish taste, and is eaten by the natives of the Northern Circars of India, where it grows.

SE'CALE. See RYE.

SE'CANT. See TRIGONOMETRY.

SECE'DERS AND SECESSION KIRK. See UNITED PRESBYTERIAN CHURCH.

SECLU'SION (of the insane). This term has recently been narrowed so as to apply to the removal of the violent insane from the ordinary wards and fellowship of an asylum to an airing court, gallery, or room so situate and furnished that its solitary occupant can neither injure himself, nor injure nor disturb others. Since the abolition of physical restraint by chains and straitjackets, seclusion has become a favored and useful mode of repression and treatment. That it should be resorted to exclusively as a remedial agent, and by the medical attendant, are now received as axioms.

In 1854, the Commissioners in Lunacy in England ascertained, by circular, the opinions of almost all those intrusted with the care of the insane in that country, as to the employment of such means of cure; when it appeared that it was generally considered beneficial, if used for short periods and during paroxysms of epileptic and violent mania. Even when not absolutely required for the tranquillization of the individual, seclusion may become expedient in order to secure the quiet, comfort, or safety of the patients with whom he is associated. That such an instrument may be abused and adopted from the parsimony, timidity, or ignorance of those around, is obvious. One of the lunatics liberated by Pinel, in 1792, had been incarcerated or *secluded* in his dark cell for forty years; and occasionally even now the duration of the isolation may be unduly prolonged even under medical sanction; but the instances of gross and cruel seclusion in garrets and cellars, and outhouses, are now chiefly to be found in private families, and where, as in the 'Flushing case,' no better course is known to be practicable.—*Eighth Report of Commissioners in Lunacy to Lord Chancellor*, App. C, p. 123; Bucknill and Tuke, *Psychological Medicine*, p. 562; Browne, *What Asylums Were, Are, and Ought to be*, p. 137.

SECOND (for the derivation of which see SCRUPLE) is the sixtieth part of a minute, whether of time or of angular magnitude. See MINUTE. In old treatises we find seconds distinguished as *minutæ secundæ*, from minutes, or *minutæ primæ*. The sixtieth part of a second was called a third, but instead of this and succeeding subdivisions, decimal fractions of seconds are now employed.

SE'CONDARY, in Geology, is the designation given to that large section of the fossiliferous strata which includes the Triassic, Oolitic, and Cretaceous rocks. It is synonymous with Mesozoic. The strata grouped under this title are separated from the inferior and superior deposits more by their organic contents than their petrological structure, and this separation is more evident between them and the older rocks, than between them and the newer; and yet recent discoveries have shown that the St. Cassian Beds form a connecting link between the Permian and Triassic epochs. They contain a series of fossils which are partly Palæozoic and partly Mesozoic in their facies.

The appearance of the great types of all subsequent organisms in the Secondary rocks, has suggested the grouping of the fossiliferous strata in respect of their fossils into only two great divisions—viz., the Palæozoic and the Neozoic—this last term including the Secondary and Tertiary periods.

SECONDING is a temporary retirement to which officers of Royal Artillery and Royal Engineers are subjected when they accept

civil employment under the crown. After six months of such employment the officer is seconded, by which he loses military pay, but retains his rank, seniority, and promotion in his corps. After being seconded for ten years, he must elect to return to military duty or to retire altogether.

SECOND SIGHT, a superstition or belief once common in the Scottish Highlands and Isles, where it is known by the Gaelic appellation *Taibhsearachd*, signifying a spectral or shadowy appearance. Certain persons, called seers or wizards, were supposed to possess a supernatural gift, by which they involuntarily foresaw future events, and perceived distant objects as if they were present:

> As the sun,
> Ere it is risen, sometimes paints its image
> In the atmosphere, so often do the spirits
> Of great events stride on before the events,
> And in to-day already walks to-morrow.
>
> WALLENSTEIN.

This is to depict the lofty and poetical view of the subject, as illustrated in classic fable and early history. The Highland seer, however, was chiefly conversant with the scenes and occurrences of ordinary life. 'A man on a journey far from home falls from a horse; another who is perhaps at work about the house, sees him bleeding on the ground, commonly with a landscape of the place where the accident befalls him. Another seer, driving home his cattle, or wandering in idleness, or musing in the sunshine, is suddenly surprised by the appearance of a bridal ceremony or funeral procession, and counts the mourners or attendants, of whom, if he knows them, he relates the names, if he knows them not he can describe the dresses. Things distant are seen at the instant when they happen' (Johnson's *Journey to the Hebrides*).

With respect to things future, Johnson thought there was no rule for determining the time between the sight and the event; but Martin, whose account of the Western Islands was first published in 1703, furnishes data of this kind in his classification of the visions. If an object was seen early in the morning, the event would be accomplished a few hours afterwards; if at noon, the same day; and if at night, the accomplishment would take place weeks, months, and sometimes years afterwards, according to the time of night the vision was beheld. The appearance of a shroud was an infallible prognostic of death, and the nearness or remoteness of the event was judged by the amount of the body that was covered by the ghastly sheet; if it was not seen above the middle, a delay of a twelvemonth might be hoped for, but if it ascended high towards the head, the mortal hour was close at hand. 'The vision makes such a lively impression upon the seers,' says Martin, 'that they neither see nor think of anything else except the vision, as long as it continues; the eyelids of the seer are erected, and the eyes continue staring until the object vanish.' The power of the seer was involuntary and painful—it was no source of gain. The gradation of symbolical appearances we have mentioned, strikes the imagination and gives something like a system to the supernatural phenomena. But if we turn to the cases described by the historians of the second sight, we do not find such regular order and exactness. The evidence is vague and confused, and the incidents are often of the most trivial character. The revelations, indeed, were commonly made to poor illiterate men, predisposed from the very nature of the country—wild, dreary, and remote—and from their half-idle, solitary life, to melancholy and superstition. These causes must have led very early to belief in the second sight.

We find it coloring portions of the story of Wallace and Bruce, and associated with the tragic fate of the accomplished James I. of Scotland. A Scottish seer is said to have foretold the unhappy career of Charles I., and another the violent death of Villiers, Duke of Buckingham. In 1652, a Scottish lawyer, Sir George Mackenzie, afterwards Lord Tarbat, when driven to the Highlands by fear of the government of Cromwell, engaged himself in making inquiries concerning this supposed supernatural faculty, and wrote a minute account of its manifestations addressed to the celebrated Robert Boyle, which, with other relations on the same subject, is published in the correspondence of Samuel Pepys. Next came Martin's copious description; then a Highland minister, the Rev. John Fraser of Tyree, collected *Authentic Instances*, which were printed in 1707; and in 1763, appeared the ambitious treatise of *Theophilus Insulanus*, or MacLeod of Hamir, which contained the narratives of Fraser, of Aubrey the English antiquary, and other authorities, with the addition of a great number of cases—nearly a hundred—gathered by himself from various sources, and also numerous letters from Highland ministers. This work exhausted the subject, but the wretched vanity, credulity, and weakness of Theophilus covered it with ridicule. A fresh revival took place after the memorable *Journey to the Hebrides* by Dr. Johnson, whose work was published in 1775. The second sight was sure to interest a melancholy, meditative 'rambler' like Johnson. He had read of it in his youth in Martin's History. He was naturally superstitious. He had a stout courageous heart and strong nerves in all mundane matters and positions, but he had a morbid fear of death, and an almost childish eagerness to pierce the darkness of futurity, and to believe in the possibility of messages from the other world.

Johnson anxiously questioned the clergy and others respecting the supernatural communications made to the seers, and would gladly have believed them real. The evidence, however, was not complete or invincible; and with that love of truth, which was one of the strongest virtues of the sage of Bolt Court, he confessed that he never could 'advance his curiosity to conviction, but came away at last only willing to believe.' On one occasion we find Johnson enunciating the true doctrine in such cases. He observed, as Boswell reports, that 'we could have no certainty of the truth of supernatural appearances unless something was told us which we could not know by ordinary means, or something done which could not be done but by supernatural power; that Pharaoh, in reason and justice, required such evidence from Moses; nay, that our Savior said: "If I had not done among them the works which none other man did, they had not had sin."' Undoubtedly works or facts, not merely appearances, are required for conviction. Spectral sights may be caused by dreams or disease (see APPARITIONS), by accidental optical illusions, or by the workings of a vivid imagination. It seems degrading to the idea of divine power to suppose that special miracles were wrought to announce the marriage or death of a Highland peasant, the wreck of a boat, or the arrival of a stranger in a remote island of the Hebrides.

Ignorance is a great ally of superstition, as solitude is of gloomy egotism and melancholy; and since education has penetrated into the Highlands and Isles, and intercourse with other parts of the kingdom has been facilitated by increasing trade and improved means of communication—to say nothing of the effects of that passion for Highland scenery and sport which every year takes crowds of visitors to the country—the belief in second sight, as in astrology and witchcraft, has almost wholly disappeared from the land. It never had the cruel, hard, and revolting features of witchcraft—formerly prevalent in the Lowlands when scarcely known in the Hebrides—and it still seems picturesque enough to serve for the purposes of poetry and romance.

SECRET (Lat. *secreta*, i. e., *oratio*, the secret prayer), one of the prayers of the Mass (q. v.), of the same general form with the 'Collect,' but recited by the priest in so low a voice as not to be heard by the people, whence the name *secreta* is derived. It follows immediately after the oblation of the Eucharistic bread and wine. This use of silent prayer in the public service is one of the subjects of controversy between Catholics and Protestants.

SECRET, DISCIPLINE OF THE (Lat. *Arcani Disciplina*), a discipline of the early church, founded upon the words of Christ, 'Give not that which is holy to dogs,' Matt. vii. 6, in virtue of which Christians fully initiated in the doctrine and practice of the church withheld from pagans and catechumens in the preparatory stage the knowledge of certain doctrines, and the liberty of presence at certain rites connected with the most solemn mysteries of the Christian religion. This practice originated in the obloquy which was drawn upon the doctrines of the church from the false and monstrous conceptions of these doctrines which were circulated among pagans. Against these calumnious misconceptions the earliest of the so-called 'Apologies' are addressed; and it seems certain that at the time at which Justin wrote his first Apology, the middle of the 2d c., no objection existed against speaking openly of the mystery of the Eucharist.—(See *Justini Apol.*, i. 66). Very soon after this, however, the 'Secret' is clearly traceable. The first reason for its adoption was that assigned above—namely, to guard the more sacred and mysterious doctrines from popular misconception and blasphemy among the pagans. This precaution of concealment was extended to catechumens, partly in order to avoid shocking too suddenly their half-formed convictions by the more startling improbabilities of Christian belief; partly also, no doubt, to guard against the danger of the betrayal of these mysterious doctrines to pagan spies approaching in the false garb of catechumens.

The Discipline of the Secret appears in several forms—(1.) Both unbelievers and catechumens were removed from the church at the commencement of that portion of the liturgy which specially relates to the celebration of the Eucharist—the so-called *Missa Fidelium*. See MASS. (2.) The lectures addressed by the presiding teacher to the great body of the catechumens in general were confined to the general doctrines of Christianity. The more mysterious doctrines, those which regarded the sacraments of Baptism and the Eucharist, called 'Mystagogic,' were only communicated at the close, and to those only who had undergone the preliminary probation. (3.) The Eucharist, if referred to at all in the presence of the uninitiated, was spoken of in words so conceived as to conceal its nature. Many curious examples of this concealment might be cited. Origen, alluding to the Eucharist (Hom. 8, in Exod. 4), says merely: 'The initiated know what I mean.' When Chrys-

ostom was writing to Pope Innocent I. an account of a tumult in the church at Constantinople, in which the sacred cup was overset, and the consecrated elements spilled, he says, without reserve, 'The blood of Christ was spilled.' But Palladius, the deacon, in his Life of Chrysostom, which was designed for the pagans as well as for the Christians, takes the precaution to use the words, 'The symbols which are known to the faithful.' Still more curiously, Epiphanius, in citing the well-known words of the Eucharistic formula, 'This is my body,' suppresses the word under which the mysterious idea is contained, and writes, 'This is my *that thing*.' *Touto mou esti tode*. A very curious example of this amphibological language regarding the Eucharist will be seen in a Greek inscription discovered some years since at Autun, in France.—(See *Edin. Rev.*, July 1864).

There is some uncertainty as to the period during which this discipline lasted in the church. It commenced most probably in the time of Justin, as his contemporary, the heretic Marcion, is known to have protested against it as an innovation (Neander's *Kirchen-geschichte*, i. 540). It is even thought not impossible by some that Justin's mode of writing was an exceptional one, and that the Secret may have been in use before his time. On the other hand, it is certain that it outlived the period out of the condition of which it arose, and was maintained long after the ages of persecution. The traces of it had not entirely disappeared in the 6th century.—(See Schelstrate, *Diss. de Discip. Arcani*, 1685; Scholliner, *Diss. de Discip. Arcani*, 1756; and on the Protestant side, Tenzel, *De Discip. Arcani* (in reply to Schelstrate); Rothe *De Disc. Arcani*. Heidelberg, 1831).

SE'CRETARY, SECRETARY FALCON, SECRETARY BIRD, or SERPENT-EATER (*Gypogeranus*), a genus of birds of prey, which has been variously placed by naturalists among the *Falconidæ* and the *Vulturidæ*, and has been also constituted into a distinct family, *Gypogeranidæ*. The legs are very long, as in the

Secretary Bird (*Serpentarius secretarius*).

Grallæ, to which, however, there is no other resemblance. The *tibiæ* are completely feathered, but the *tarsi* and toes are destitute of feathers. The tarsi are covered in front with long, large scales. The toes are armed with sharp claws; but they are short, and the feet are not formed for grasping. The hind-toe is very short. The neck is much longer, and the whole form of the bird more slender than in the Falconidæ. The wings are long, and armed with a blunt spur at the shoulder. The tail is very long. The best-known species is an inhabitant of the arid plains of South Africa. It is about three feet in length; the plumage bluish gray. It has an occipital crest of feathers without barbs at the base, which can be raised or depressed at pleasure, and the name Secretary was given to it by the colonists at the Cape of Good Hope from their fancied resemblance to pens stuck behind the ear. It feeds chiefly on reptiles of all kinds, which it devours in great numbers, and is so highly valued on account of the constant war which it wages against serpents, that a fine is inflicted in the Cape Colony for shooting it. It fearlessly attacks the most venomous serpents, stunning them with blows of its wing, also seizing and carrying them into the air to such a height that they are killed by the fall. It uses its feet also to overpower its prey, striking violent blows with them. Small serpents are swallowed entire; the larger ones are torn to pieces.

The S. is most frequently seen in pairs, or solitary. It is tamed as a protector of poultry-yards; but if not sufficiently fed, is apt to help itself to a chicken or duckling. An attempt has been made to introduce this bird into Martinique, in order to reduce the number of venomous serpents in that island.—Another species of S. appears to exist in more northern parts of Africa, as about the Gambia; and a third, more widely different, in the Philippine Islands.

SECRETARY OF THE NAVY is the conventional title of the parliamentary secretary to the Board of Admiralty. This post is conferred on a ministerial supporter, in the House of Commons, in which, when the First Lord of the Admiralty is a peer, he is the exponent of naval policy. He changes of course with the ministry, of which he is a subordinate member; and receives a salary of £2000 a year. There is also a permanent secretary, who holds office for life, and receives £1700 a year. He is responsible for the discipline of the Admiralty Office. This appointment is of long standing, and was held by the celebrated Mr. Secretary Pepys.

SECRETARY-AT-WAR, formerly a high officer of the British ministry, had the control of the financial arrangements of the army, and was the responsible medium for parliamentary supervision in military affairs. In the times of the Tudors, the war business of the country appears to have been transacted by the department of the Secretary of State. The formation of a war office proper took place about 1620. The office rose in importance as the army increased; but was limited to financial authority, neither the commander-in-chief nor master-general of the ordnance being subject to it. At length, during the Russian war, the evils of this divided authority led to the creation of a Secretary of State for War, to control all the military departments. The secretaryship-at-war was merged in this superior office in 1855, and though for some years preserved technically as a separate appointment held by the Secretary of State, was abolished by act of parliament in 1863.

SECRETARY OF EMBASSY, or of LEGATION, the principal of the persons belonging to the suite of an ambassador or envoy. Secretaries of Embassy or Legation hold their commission immediately from the sovereign, who nominates them in general only to ministers of the first and second rank. They are therefore considered a species of public minister; and independently of their attachment to an ambassador's suite, they enjoy in their own name all the privileges and protections of the diplomatic character. They are generally presented in person to the foreign sovereign at whose court they are accredited. The functions of a secretary of embassy or legation consist principally in assisting the chief in the business of the embassy. Moser (*Versuch Th.* iii. p. 94) says: 'An ambassador is often only like the hands of a watch, while his secretary resembles the works.' Secretaries of embassy and legation occupy the post of ambassadors and envoys during the absence of their ministers. A secretary of embassy or legation must not be confounded with the private secretary of an ambassador appointed and paid by him, who has none of the privileges and immunities above mentioned.

SECRETARY OF STATE, an ancient and important office in the government of England. The oldest record of its existence is in the reign of Henry III., when John Maunsell is described as 'secretarius noster.' Prior to the Restoration, the holder of this office was generally styled the 'king's chief' or 'principal secretary;' he had the custody of the king's signet, and discharged his duties with the assistance of four clerks. Two secretaries are said to have been first appointed towards the close of the reign of Henry VIII. The office, always one of influence, gradually grew in importance. On the Union of 1707, Anne added a third secretary of state for Scotland, which office, however, was soon done away with. In the reign of George III. there were at first but two secretaries; for a time there was a third for America, but his office was abolished by statute in 1782. While the secretaries were two in number, both equally directed home affairs; to the one were committed the foreign affairs of the northern, to the other of the southern department. Irish affairs belonged to the province of the elder secretary.

There are now five principal secretaries of state, who are respectively appointed for home affairs, foreign affairs, war, the colonies, and India. They are all appointed by the sovereign by the mere delivery of the seals of office, without patent, and are always members of the Privy Council and of the Cabinet. Though each has his own department, he is considered capable of discharging the duties of the others; a member of the House of Commons, if removed from one secretaryship to another, does not thereby vacate his seat.

The Secretary of State for the Home Department has the charge of the maintenance of the internal peace of the United Kingdom, the security of the laws, and the administration of justice, so far as the royal prerogative is involved in it. He directs the disposal and employment of the regular troops at home, and provides for the suppression of riots. The militia, yeomanry, and volunteers are entirely under his control. He has the ultimate supervision of all that relates to prisons and criminals; and numerous statutory powers have been given him regarding police, sanitary matters, the regulation of labor, &c. All patents, licenses, dispensations, charters of incorporation, commissions of the peace and of inquiry, pass through his office. He recommends persons to the Sovereign for civil knighthood, and is

empowered to grant certificates of Naturalization (q. v.) to foreigners. He is the organ of communication between the cabinet and the viceregal government of Ireland, for which he is responsible, and is informed of and advises all the graver measures adopted in that country. His patronage is very considerable, including the nomination to a large number of judicial offices. Among the powers of the Secretary of State is that of committing persons on suspicion of treason, a function which, though its legality has been called in question, has been often exercised.

The Secretary of State for Foreign Affairs is the responsible adviser of the crown in all communications between the government and foreign powers. He negotiates treaties, either directly with the foreign ministers resident in the country, or through the British ministers abroad. It is his duty to inquire into the complaints of British subjects residing in foreign countries, to afford them protection, and to demand redress for their grievances. The Foreign Secretary recommends to the Sovereign all ambassadors, ministers, and consuls to represent this country abroad. He grants Passports (q. v.) to British subjects and naturalized foreigners.

The Secretary for the Colonial Department has the supervision of the laws and customs of the colonies, watches over their interests, directs their government, apportions the troops necessary for their defence or police, appoints the governors of the colonies, and sanctions or disallows the measures of the colonial governments, rarely, however, prescribing measures for their adoption.

Each of these four secretaries of state is assisted by two under secretaries of state nominated by himself—one usually permanent, while the other is dependent on the administration in power.

The Secretary of State for India, whose office dates from the abolition, in 1858, of the double government of India by the Court of East India Directors and Board of Control, has the same control over the government of India which was formerly exercised by these bodies, and countersigns all warrants and orders under the sign-manual relating to India. He is assisted by an under-secretary, who is also a member of the legislature, and loses office with the cabinet, and by a permanent under-secretary and assistant-secretary, as also by a council of fifteen members, over whom he presides. Every order sent to India must be signed by the secretary, and all dispatches from governments and presidencies in India must be addressed to the secretary.

There is also a Chief Secretary for Ireland, resident in Dublin, except during the sitting of parliament, and under the authority of the Lord-lieutenant. His office resembles that of a secretary of state, but he is generally called Secretary to the Lord-lieutenant. He is assisted by an under-secretary.

The Secretary of State for War (see SECRETARY-AT-WAR) has the superintendence of all matters connected with the army, assisted by the commander-in-chief, and is responsible for the amount of the military establishment. He prepares for the royal signature and countersigns commissions in the army, and recommends to the sovereign for the order of Knighthood of the Bath.

SECRE'TION is the term employed in Physiology to designate the process of *separation* of those matters from the nutritious fluids of the body which are destined not to be directly applied to the nutrition and renovation of its organized fabric, but (1.) to be either at once removed as injurious to its welfare, or (2.) to be employed for some ulterior purpose in the chemical or physical processes of the economy itself, or to exert some kind of action upon other beings. For this definition of secretion considered as a process we are indebted to Dr. Carpenter; but the reader must bear in mind that the term is also very commonly used in another sense—namely, to designate the *products* which are thus secreted. In this latter sense, it is customary to speak of the biliary, urinary, or cutaneous secretion, when the bile, urine, and sweat are indicated.

Although it is impossible to divide with strictness the secreted products (as many physiologists have attempted to do) into the *excrementitious* and the *recrementitious*—that is to say, into (1.) those which have no further function to discharge in the animal body, and which, if not excreted, would act as poisons, and (2.) those which are subservient to further uses in the system—yet we may group them according to the preponderance of their excrementitious or recrementitious character. Dr. Carpenter approves of this mode of arrangement, and proposes that those secretory processes should be arranged in the first division in which the depuration of the blood is obviously the chief end, while those should be classed under the second in which the ulterior purpose of the separated fluid would seem to be the principal occasion of its production; and he further suggests a subdivision of this second group, according as this ulterior purpose is connected with the operations of the economy itself, as in the case of the tears, the saliva, the gastric juice, &c., or is destined to act on some other organism, as is the case with the secretion of the testes, the milk, &c.

The organs which yield the various secretions are termed Glands (q. v.); but neither the form nor the internal arrangement of the parts of a gland have any essential connection with the nature of its product; the true process of secretion, under whatever form it may present itself, being always performed by the intervention of Cells (q. v.). For a notice of the mode in which the cells are arranged in various glandular structures, the reader is referred to the articles GLAND, LIVER, KIDNEY, MUCOUS MEMBRANE, &c.

We shall now briefly notice the causes which render the due performance of the functions of secretion essential to the well-being of every animal. 1. Nearly all the solids and fluids of the body are liable to continuous decomposition and decay in consequence of their peculiar chemical composition. There is an obvious necessity that the products of incipient decomposition should be carried off and replaced by newly-organized matter. 2. The exercise of the various animal functions is essentially destructive to the structures by which they are accomplished: every operation of the muscular or nervous system appearing to require, as a necessary condition, a disintegration or breaking up of a certain portion of their tissues, probably by an act of oxidation. Hence, for the due preservation of health, the disintegrated or effete matters must be removed, and their place supplied. 3. When more food is taken than the wants of the system require, all that is not appropriated to the reparation of the waste, or to the increase in the weight of the body, must be thrown off by the excretory organs without ever having become converted into organic tissue. If this excess were not speedily removed by the excretory organs, the current of the blood would speedily become poisoned.

The following may be regarded as a tolerably complete list of the substances which are produced within the organisms of man and the lower animals by the disintegration of its various tissues, and which are met with in one or other of the products of secretion: 1. Products of secreting processes, including *a*, the biliary acids and the products of their disintegration; *b*, the pigments of the bile; *c*, pigments allied to those of the bile and blood, viz., hæmatoidin and melanin; *d*, cholesterin and its allies; *e*, the sugars and allied bodies. 2. Products of the actual regressive metamorphosis of tissues—*a*, nitrogenous amide-like bodies, such as leucine, tyrosine, creatine, creatinine, allantoin, cystin, guanine, sarcine, xanthin, and urea; *b*, nitrogenous acids, as hippuric, uric, and cynuric acids; *c*, indifferent nitrogenous bodies, such as the pigments occurring in the urine; and excretine; and *d*, non-nitrogenous acids, as acetic, benzoic, butyric, carbonic, formic, lactic, oxalic, succinic, and valerianic acids. Some of these products, however, only occur in the secretions in cases of disease.

SECRETIONS, VEGETABLE. In the vegetable kingdom, the term *secretion* has a wider application than in the animal kingdom, and all substances which have been formed by the action of cells upon the compounds taken up as food (such as carbonic acid, water, and ammonia)—whether these substances form a part of the tissue of the plant, or are thrown out upon its surface—are equally considered as secretions. All the important vegetable secretions are compounds of carbon, hydrogen, oxygen, and nitrogen; sulphur being also present in some cases; and according to their functions they may be classed in two great divisions—viz., (1.) nutritive or assimilable secretions, and (2.) non-assimilable or special secretions.

1. The *nutritive* secretions are those substances which, having been formed within the plant, are used in forming its structures and constructing its general mass. The chief substances in this class are cellulose, the varieties of starch, the varieties of sugar, the oils, and the so-called protein or albuminous bodies. The composition of these substances is extremely varied; thus, many of the volatile oils or essences contain only carbon and hydrogen; the sugars, starches and cellulose, contain carbon, hydrogen, and oxygen, and are named ternary compounds; while the protein bodies contain carbon, hydrogen, oxygen, and nitrogen, and, in some cases, sulphur.

2. The *non-assimilable* secretions are only found in certain parts of the plant, and they receive their name from their never being converted into the nutritive secretions. The principal members of this class are the coloring matter of plants (chlorophyle and its modifications); the substances which, when extracted from plants are of service as dye-stuffs (the *chromogens* or color-formers of recent chemists); the organic acids, which constitute a somewhat numerous group, and of which oxalic acid (occurring in rhubarb, sorrel, &c.), tartaric and racemic acids (in the grape), malic acid (in the apple and gooseberry), citric acid (in the orange, lemon, lime, and red currant), gallic acid (in the seeds of the mango), meconic acid (in the opium poppy), and tannic acid (in the bark of the oak, elm, &c.), may be taken as well-known examples; the vegetable alkalies or alkaloids, such as morphia, strychnia, quinia, &c.; the volatile oils; and the resins.

SECRET WRITING, or SYMPATHETIC INK. See INK.

SECRO'LE, a small town of British India, in the N.-W. Provinces, 3 m. N.-W. of Benares, contains most of the civil estab-

lishments, the military cantonments, and the residences of most of the British population connected with Benares. The residences or bungalows are handsome and substantial, but are scattered about among the groves and gardens which surround the military cantonments. The latter, which are capable of containing three or four regiments, are traversed by a small stream, the Burnah Nuddee. Among the public buildings are a Christian church and chapel, a court of justice, the treasury, the jail, and a mint. S., which may be considered as the British quarter of Benares, was the headquarters of the Benares division of the Bengal army, and here, on the 4th June 1857, the 37th Bengal Native Infantry, the 13th Irregular Cavalry, and a portion of the Loodianah Sikhs, in all 2000 men, mutinied; but being charged by Colonel (afterwards Brigadier-general) Neill at the head of 240 men of the Madras and Queen's armies, and a few faithful Sikhs and Irregulars, they were compelled to take to flight with the loss of about 200 men, after killing two of their own British officers and two privates of Neill's force.

SECTION, in Architecture, the delineation of buildings on a vertical plane through any part of them—as a *plan* is the horizontal projection. Sections are of great use in practice in showing the thickness of walls, the construction of floors, roofs, &c., and the forms and dimensions of every part of the interiors of buildings. Sections may also be used to show the furniture, drapery, &c., of rooms. These are called furnished sections. All mouldings, cornices, &c., are drawn in section or profile, full size, for the guidance of the workmen.

SECTOR, in *Geometry*, is a portion of a circle included between two radii and the intercepted arc of the circumference. The area of a sector is equal to that of a triangle whose base is equal in length to the intercepted arc, and whose perpendicular height is equal to the length of the radius.

SECTOR, in *Practical Mechanics*, an instrument of considerable utility in rough mathematical drawing, consists of two strips of wood, ivory, or metal jointed together like a carpenter's foot-rule.

Sector.

It is absolutely necessary for the correctness of the instrument that the center of the axle of the joint should be accurately at the inner corner of each slip (as shown in the figure), so that it will always be the vertex of a triangle of which the inner edges (and consequently any of the corresponding pairs of lines drawn from the joint obliquely along the rule) form the two sides. These oblique lines, which are drawn on both sides of the instrument, and converge from the extremities of the two strips to the center of the joint, are graduated in different ways, so as to give, on each limb, a line of equal parts, a scale of chords, scales of sines, tangents, and secants, a line of polygons, &c. (all of which are graduated from the center of the hinge, which is their zero point), besides a number of common scales on the blank portions of the sector. The special use of this instrument is in the finding of a fourth proportional to three given quantities, and the operation is performed as follows:

If the fourth proportional to 18, 16, and 81 is required, find the graduation indicating 18 on each limb; then obtain, by means of a pair of compasses, the length from 0 to 16, and open out the instrument till the two 18 points are as far apart as the distance given by the compasses; then, by measuring with the compasses the distance of the two graduations indicating 81, and applying the compasses to the scale, we obtain the fourth proportional required. It will be seen that this instrument merely supplies a mechanical mode of constructing two similar isosceles triangles, one of which has all its sides, and the other has only its equal sides given, the other side or base, which is formed by the sector, and read off by aid of the compasses and scale, being, from the very nature of similar triangles, the fourth proportion required. This instrument becomes more inaccurate as the angle formed by the limbs increases. The sector is said to have been invented by Guido Ubaldi about 1568, though Gaspar Mordente of Antwerp describes it in 1584, and attributes its invention to his brother Fabricius in 1554. It was described by several German and English writers in the same century, and again by Galileo, who claimed to have invented it in 1604.

SE'CULAR CLERGY. See CLERGY.

SE'CULARISM is the term applied to a system of ethical principles begun to be advocated about 1846 by G. J. Holyoake. As the system has a considerable number of adherents, and comes not seldom into public notice, a brief account of its leading doctrines is here given. As in similar cases, we allow a believer in the doctrines to speak for himself.

The Secular is defined as that which pertains to this life, and is treated as a thing apart; as independent of, rather than as necessarily opposed to, any other mode of thought and duty. Secularism, as regards opponents, claims that to ignore is not to deny. As the geometrician ignores chemistry or metaphysics, without a thought of denying them, so secularism, which concerns itself with this world, refuses to be held as conflicting with that 'other-worldiness,' which, if demonstrable, must be based on an experience to which secularism makes no pretension, and towards which it considers itself to incur no responsibility. Secularism commences by laying down the proposition that intelligent sincerity is sinless. It does not maintain that even intelligent sincerity is errorless, but that it is without conscious guilt, even when it is, as it may be, dangerously mistaken. The conscience thus educated, Thought may be intrusted to inquire, and the search for Truth may be begun.

Secularism takes the term Free Thought as expressing the central idea which it inculcates. It defines Free Thought as the unrestricted application of the powers of the intellect to any subject—the absence of any threat or penalty, legal, spiritual, or social, for the exercise of thought. The Free Thought it inculcates is not lawless thought; it is guided by methods of logic, limited by evidence checked at every step by experience, which is omnipresent, and corrected by the results of science. Free Thought is not the rebellion, but the judicial action of the understanding. Reason—the faculty of following the path of facts—does not despise intuition, nor instinct, nor the voice of nature, nor authority; it uses, but revises them; it does not pretend to be infallible, but to be the best arbiter we have. To the conception of Free Thought is also necessary the Free Publication of Opinion; for no one could profit by the thought of other minds unless it was freely communicated. Hence the diffusion of thought becomes an obligation on each thinker, and silence or supineness a social crime. Again, Free Thought that would command respect must be submitted to Free Criticism. Thought is often foolish, often mischievous, and sometimes wicked, and he alone who submits it to free criticism gives guarantees to society that he means well, since by criticism comes the exposure of false or foolish opinions; and the right of criticism is the sole protection of the public from error. Free Thought must end in the Free Action of opinion, since he thinks to no purpose whose thought is inapplicable to conduct; and he withholds the sign of his own sincerity who does not unite his thought with action. Such is that education in Free Thought which secularism attempts.

It holds that Scepticism is the pathway to affirmative truth. So far from being a crime, scepticism is scrutiny. So far from being the end, it is the beginning of inquiry—the first condition for the recognition of unknown truth. He who would be master of his own mind, and know what is in it, and who would have no principles there but those which are pure, true, and reliable, must refuse to believe anything until he is compelled to believe it; it being no more safe to keep one's mind open to all notions, than to keep one's door open to all comers. It is clear that the use of Free Thought may be a nuisance, a terror, or an outrage, unless Courtesy takes care of it. Therefore secularism provides that advocacy shall be directed to the exposure of error and the elucidation of truth, without moral imputation upon those whose opinions are controverted; and contends that all advocacy, wanting in consideration towards others, shall be regarded as a crime against Free Thought. The quality of the thought, and not the motive of it, is the proper and sufficient subject of discussion.

Secularism further imposes upon the action of Free Thought the limit that every one shall concede to others the liberty he claims for himself, and shall permit to others, and shall recognize in each individual, 'liberty of action in all things by which others are neither injured nor damaged. Secularism, regarding the one object of all Free Thought as the attainment of truth, finds in the study of nature its immediate sphere of exercise. Free Thought is prompted by a desire to fathom the knowable; and nature and human life are the immediate sources of truth and duty, which it most concerns man to master. Therefore respect for this life, respect for pure physical conditions, respect for the moral capacity of human nature, are conditions of secular belief.

Secularism is not committed to denying that there is other good—it does not meddle with that question; it says whether there be other good or not, the good of the present life is good, and it is good to seek that good. It holds that the secular is sacred, and seeks 'to find that material condition in which it shall be impossible for man to be depraved or poor.' It does not say that all things are material, or that there are no spiritual agencies; it does not enter upon these propositions; but confines itself to showing that there are material agencies in this life, whatever else there may be, and that these, as far as they can be discovered, are the calculable forces of the world, which cannot be neglected without folly or hurt, and that it is wisdom, mercy, and duty to attend to them. Without entering upon the question of the interference of Providence, secularism contends that Science is practi-

cally the Providence of life; that conscience is higher than consequence; that deliverance from calamity is more merciful than any system of consolation which only acts when calamity has occurred; and that it is not the pursuit of happiness, but the performance of duty, which is the end of life. Secularism proceeds in the path of Positive Philosophy, not seeking for errors but for truth; not busying itself with negations, but with affirmations. In sacred writ it seeks for guiding truth and thought which commends itself to reason and experience, accepting the intrinsically true, without entering upon the vexed questions of inspiration or authenticity. Whatever principles secularism inculcates, they are affirmative in their nature, relate to the welfare of humanity, and are determined by considerations purely human.

There is unquestionably a vast outlying class in every European country, and especially in our Indian territories, who are without the pale of Christianity. They reject it, they dislike it, or they do not understand it. Secularism is intended for these, and for all who find theology indefinite, or inadequate, or deem it unreliable. The object of secularism is to afford these classes a knowledge of principles addressed to their common reason and intelligence, by an appeal to principles of a secular nature, common to humanity in every state and clime. It may be a misfortune that the principles of theism, or the acceptance of the Bible, cannot be rendered promptly acceptable to them. Since, however, this is not the case, it must be of advantage to interest them in rules calculated for the moral guidance of their conduct. Upon these Christianity may be, if shown to be tenable, subsequently superinduced. The principles of secularism are intended to constitute an education of the working-classes, which begins with their reason, grows with their intelligence, and ends only with death.

Secularism is not an argument against Christianity, it is one independent of it. It does not question the pretensions of Christianity; it advances others. Secularism does not say there is no light or guidance elsewhere, but maintains that there is light and guidance in secular truth, whose conditions and sanctions exist independently, act independently, and act for ever. Secular knowledge is manifestly that kind of knowledge which is founded in this life, which relates to the conduct of this life, conduces to the welfare of this life, and is capable of being tested by the experience of this life.

Geometry, Algebra, Botany, Chemistry, Navigation, Political Economy, Ethics, are secular subjects of instruction (distinct albeit from secularism which includes the education of the conscience). They are founded in nature, they relate to the uses of this life, promote the enjoyment of this life, and can be tested by personal experience. That which is secular can be tested in time; that which is theological is only provable after death. If a sum in arithmetic is wrong, it can be proved by a new way of working it; if a medical recipe is wrong, the effect is discoverable on the health; if a political law is wrong, it is sooner or later apparent in the disaster it brings with it; if a theorem in navigation is erroneous, delay or shipwreck warns the mariner of the mistake; if an insane moralist teaches that adherence to the truth is wrong, men can try the effects of lying, when the disgrace and distrust which ensue soon convince them of the fallacy; but if a theological belief is wrong, we must die to find it out.

The standard of secularism is utilitarian. Utility is made the test of right, not the utility which is sensual and selfish, but that which takes into account the highest attributes and noblest aspirations of humanity (see UTILITARIANISM). It is not the agent's own happiness, but the happiness of others which the utilitarian is bound to promote. The adoption of this rule makes intelligence a necessity. Secularism is not sceptical. It seeks everywhere positive truth, and regards doubt as a difficulty and a danger. It is not infidel, for that is a state of mind treacherous to the truth, and truth is the first thing to which secularism teaches allegiance. It is not atheistic, atheism being alien to secularism, which concerns itself with the affirmative. Secularism might call itself religious, if it were allowable to use the term without including some distinctive theory of theism, which is equally excluded from the subject-matter of secularism, as not coming within the region of positive knowledge. Nothing in secular morals can be insisted upon with effect, save those statements which appeal to the common experience, and with which you can dare the judgment of mankind; but if that may be called religious, which appeals to demonstrative intelligence, which addresses itself to the conscience, which inculcates love, and truth, and justice; which claims service and endurance from all men; which places happiness in duty, and makes the service of humanity the one object of life, and the source of consolation in death, then secularism may be so defined, and in this sense it has been described in the following definitions:

Secularism is the religion of the present life: it teaches men to seek morality in nature, and happiness in duty; guiding the conduct, and educating the conscience of those who do not know, or who, from conscientious conviction, stand apart from Christianity. Secularism teaches a man to acquit himself well in this world as the purest act of worship, to study the truth, to judge by reason, to regulate human interests by considerations purely human, and to act on that rule of utility which conduces to the greatest good of others; thus endeavoring to deserve another life by the unhasting, unresting pursuit of duty in this.

SECUNDERÁBA'D (more correctly Sikandarábád), a large town, and an important British military cantonment in the Nizam's Dominions, India, six miles north of Haidarábád. On the north-east are two singular granite hills, large, hemispherical in shape, completely isolated, and having on their summits the tombs of Fakirs, which are visited by a great number of pilgrims each year. The cantonment consists of a curved, irregular street, three miles in length, with the officers' houses ranged on either side. There are numerous barracks, and good hospital accommodation. There are numerous tanks in the vicinity, and the water is good. The mean annual temperature is 81° 30′, and the climate is unhealthy—though less so now than formerly—during the rainy season. Pop of S., 40,000.

SECURITY, in Law, means some deed affecting real or personal estate, the object of which is to secure the payment of a primary debt. Such are Bonds (q. v.) and Mortgages (q. v.).

SEDAN, a manufacturing town and frontier fortress of France, in the dep. of Ardennes; pop. in 1876, 15,862. In 1646, Colbert founded here the first of his famous cloth factories; and the fabrics of S. have now a European reputation, and employ many hands. There is also extensive industry in various branches of metallurgy; and there are coal and iron mines in the vicinity. The fortress of S. has played a considerable part in military history; and it has recently become noted as the place where (September 2, 1870) Napoleon III. and an army of 90,000 men surrendered to the Prussians.

SEDA'N CHAIR, a portable covered vehicle for carrying a single person, borne on two poles by two men. The name is derived from the town of Sedan, in the north of France, where this species of conveyance is said to have been invented. It is said that the Duke of Buckingham was in the practice of using one in the reign of James I., a proceeding which gave general offence, it being made matter of public remark, that this royal favorite used his fellow-countrymen to do the work of beasts. The general introduction of sedan chairs into England dates from 1634, about the same period that hackney coaches came into use. Sedan chairs were largely used during the greater part of last century, being found very well adapted for transporting persons, in full dress, to public and private entertainments. Not only were there numerous public conveyances of this kind in London and all considerable towns, but the owner of every large mansion had his private sedan handsomely fitted up. In Edinburgh, a century ago, sedan chairs were far more numerous than hackney coaches, and were almost all in the hands of Highlanders. Sedans are now seldom seen except for the transport of the sick.

SE'DATIVES are medicines which exert a direct or primary depressing action upon the vital powers, without inducing any subsequent excitement. The diseases in which sedatives are employed are chiefly those of over excitement of the nervous and circulating systems; and as some of the members of this class (hemlock, for example) act directly on the nervous system, while others (foxglove, for example) more immediately act upon the heart, it is necessary to be able to determine the kind of sedative suitable for each individual case. Inflammatory fever presents all the conditions in which sedatives are likely to be of service. 'The excited heart, elevated temperature, hard and unyielding pulse, and the disordered state of the special nerves, call for the administration of remedies fitted to appease their excited energy, and the great improvement which, in such a case, follows the use of *blood-letting*, *tartar emetic*, and *digitalis*, bears evidence to the correctness of our practice.' (Ballard and Garrod's *Elements of Materia Medica*, p. 11.) The following are the most important members of this class, aconite, carbonic acid (applied locally in cases of irritable bladder or womb, or to painful ulcers), chloroform (especially when inhaled), conium, digitalis, hydrocyanic acid, and tobacco.

SEDGE. See CAREX.

SEDGWICK, an American family, distinguished in politics, law, and literature.—THEODORE S., statesman and jurist, was born at Hartford, Connecticut, May 1746. He was descended from Robert Sedgwick, a major-general of the army of Cromwell. Educated at Yale College, he adopted the profession of law, and removed to the western part of Massachusetts, where he was a member of the Colonial Assembly. Though a loyalist in feeling at the outbreak of the American revolution, he took the part of his country, and served as an aide-de-camp to General Thomas in the unfortunate expedition to Canada. In 1785, he settled at Stockbridge, Massachusetts, where his descendants now reside, became a member of the Continental Congress, and took an active

part in suppressing Shay's rebellion. He remained in congress as representative or senator until 1799, and in 1802 was appointed judge of the Supreme Court of Massachusetts, and was a prominent member of the old Federalist party, and an early opponent of slavery. He died at Boston, January 24, 1813.—THEODORE S., American lawyer and writer, son of the preceding, was born at Sheffield, Massachusetts, December 1780. Like his father he was bred to the legal profession, and in 1801 settled at Albany, New York, where he remained in successful practice until 1821, when he retired to Stockbridge, advocating, as a popular speaker, the interests of a scientific agriculture, free trade, temperance, and anti-slavery, and wrote *Public and Private Economy, illustrated by observations made in Europe in* 1836—1837 (3 vols., 12mo, New York, 1838). He died of a stroke of paralysis, after making a public speech at Pittsfield, Massachusetts, November 7, 1839.

SUSAN RIDLEY S., wife of the preceding, descended from an old English Border family, and proud of her relationship to Bishop Ridley, was the daughter of William Livingston, governor of New Jersey. She is the author of *The Morals of Pleasure* (1829); *The Young Emigrants*, and *The Children's Week* (1830); *Allan Prescott*, a novel (1834); *Alida* (1844); and *Walter Thornby*, a novel, written in 1859, when she was more than 70 years old.—CATHERINE MARIA S., American authoress, daughter of Judge Theodore Sedgwick, and sister of the second Theodore S., was born at Stockbridge, near the close of the eighteenth century. In 1822, she published *A New England Tale*, which was followed, in 1824, by *Ridwood*, a novel, so popular that it was reprinted in England, and translated into several of the continental languages. This was followed by *Hope Leslie, or Early Times in America* (1827); *Clarence, a Tale of our Own Times* (1830); *Le Bossu* and *The Linwoods* (1835); and these by a series of popular stories illustrating morals and domestic economy, entitled *The Poor Rich Man and the Rich Poor Man, Live and Let Live, Means and Ends, Home*, &c.; and contributed a 'Life of Lucretia Maria Davidson,' to Sparks's *American Biographies*. In 1841, on her return from Europe, she published *Letters from Abroad to Kindred at Home*; in 1845, *Wilton Harvey and other Tales;* followed by *The Morals of Manners*, and *Married and Single*. She also edited, and was an active contributor to some of the leading American periodicals. Died July 31, 1867.—THEODORE S., an American lawyer, son of the second Theodore S., was born at Albany, January 27, 1811, was educated at Columbia College, and admitted to the bar in 1833; and excepting three years spent at Paris, as secretary of the American legation, continued in successful legal practice until 1850, when he again visited and made an extensive tour in Europe. He steadily declined to engage in politics, and refused all offices tendered him, until, in 1858, he accepted that of United States attorney for the southern district of New York. Among his writings are a standard *Treatise on the Measure of Damages;* a work on *The Interpretation and Application of Statutory and Constitutional Law;* the *Memoirs of William Livingston*, his grandfather; *The Life and Works of William Leggett*, and various occasional addresses. He died at Stockbridge, December 9, 1859.

SEDI'TION (Lat. *seditio*, from *se*, apart, and *ire*, to go), a general name given to such offences against the state as fall short of treason. In the law of England, it is not a strictly technical word. Writing, publishing, or uttering words tending to excite subjects to insurrection, though not urging them to rebellion or total subversion of the government, come under this denomination. There are various English statutes (as 39 Geo. III., c. 70; 57 Geo. III., c. 19; and 60 Geo. III. and 1 Geo. IV., c. 8) directed against particular acts of sedition, such as seditious libels, and seditious meetings or assemblies, which are punishable as misdemeanors. Act 36 Geo. III., directed against all seditious practices and attempts tending to high treason, is extended to Ireland by 11 Vict., and additional provisions are added to it. By this latter act, the compassing or devising, either to depose the Queen; to levy war against the Queen, for the purpose of changing her Majesty's measures, or constraining or overawing parliament; or to move any foreigner to invade the Queen's dominions, is made felony, punishable by transportation for life, or for a period not less than seven years, and that even though the facts should amount to treason.

In Scotland, sedition is distinguished from Leasing-making (q. v.), in so far as the object of the latter is to disparage the private character of the sovereign, while the former crime is directed against the order and tranquillity of the state. The punishment of sedition, formerly arbitrary, is now restricted to fine and imprisonment.

SEDU'CTION, in point of law, is the taking of an unmarried woman's chastity without marriage, and under circumstances of fraud. It is not a criminal offence unless violence is used, and resistance overcome, or the age of the female is under 21, in which cases the offence is Rape (q. v.) or Abduction (q. v.). In England, where no force has been used, no action at law can be maintained by the female seduced, however deceitful the man may have acted. But if the female is a servant, either to her father or mother or a third party, then the master or mistress can sue the seducer, provided any loss of service has been caused by the seduction, such as her absence when lying-in of a child. Though, strictly speaking, the damages recovered by the master or mistress, in such a case, should be measured solely by the pecuniary value of the services lost, yet it is an inveterate practice for juries to give damages greatly beyond that amount, especially where the father or mother sues, and the conduct of the man has been base and heartless. In Scotland, the woman can sue in her own right for damages if deceit has been used, but the difficulty of establishing that the deceit was the sole cause of the injury, prevents such actions from being common. The remedy there more frequently resolves itself into an action for breach of promise of marriage, or for declarator of marriage, or for filiation and aliment.

SE'DUM, a genus of plants of the natural order *Crassulaceæ*, having the calyx in 4—8 (usually 5) deep segments, which often resemble the leaves, the same number of spreading petals, twice as many stamens, and 4—8 (usually 5) germens, each with a nectariferous scale at the base. The species are numerous, with succulent, often roundish, leaves; and pretty, star-like flowers. Many of them grow on rocks, whence the English name STONECROP. They are natives of the temperate and cold parts of the northern hemisphere; some are British. They have no important uses; some are refrigerant, others are acrid. Among the British species is *S. Telephium*, popularly called ORPINE, sometimes used as a diuretic; and *S. acre*, the most common, whose brilliant yellow flowers adorn the tops of old walls, the débris around quarries, &c.

SEE (Lat. *sedes*, a seat), in ecclesiastical use, properly signifies the seat or chair (*cathedra*), sometimes also called 'throne,' of a bishop. Popularly, however, and indeed by universal usage, it is employed to designate the city, and thence, at least in popular language, the entire diocese, in which the seat of the bishop is placed, and over which, consequently, his episcopal jurisdiction extends. Sees have always been fixed, at least in their primitive establishments, in some city or considerable town; and it is to be observed that the name of a see is always taken not from the district governed by the bishop, but from the city or town. Sees *In Partibus Infidelium* (q. v.) still retain their ancient names, although in very many cases not merely the cities themselves, but even all traces of the Christian religion, in the sites upon which they anciently stood, have disappeared. In the Roman Church, the pope alone establishes sees, and alters their distribution and their local limits and boundaries; but these changes are not made except in extreme cases (such as that of the French Revolution) without the consent of the actual bishop. In the Anglican Church, this is done by the authority of the legislature.

SEED, in Phanerogamous Plants, that part which may in some measure be regarded as corresponding to the perfectly developed impregnated *ovum* of animals, and which is the utmost effort made by the plant for the reproduction of its species. It is the perfectly developed Ovule (q. v.). Whilst one cell of the interior of the nucleus (see OVULE) greatly enlarges, the other cells are forced back; the interior of the nucleus thus becomes a cavity (the embryo sac), and Fecundation (q. v.) now taking place by means of the pollen, the primary cell is formed, which grows to form the *embryo*. As the fertilized ovule is developed into the ripe seed, the *foramen* (see OVULE) or *micropyle* closes completely; but its place is commonly marked in ripe seeds by a little cicatrix. In the ripe seed, the integuments of the ovule, more fully developed, form the covering (*spermoderm*); whilst the *nucleus* is either entirely converted into the Embryo (q. v.), or also into an unorganic cellular mass called the Albumen (q.v.), which is, in an economical point of view, the most important part of many seeds, as of those of the cereal grasses. The embryo, which with respect to the reproduction of the plant, is the most essential part of the seed, is developed to various degree in different plants—which is also the case in different animals, and even in those of the same class, as in mammalia; but in general, the *radicle* may be distinguished in it—the beginning of the root or descending axis of the new plant, and the *plumule* or *gemmule*—the beginning of the stem or ascending axis, as well as the *cotyledon* or cotyledons, provided for the nourishment of the new plant in its youngest stage. When the embryo is accompanied with albumen, it is sometimes completely enclosed in it; sometimes it lies at the side of the albumen; and sometimes it surrounds the albumen like a ring, or even completely.

Sometimes, but rarely, the embryo is not well developed in ripe seeds, so that its parts cannot be distinguished, as in the *Orchideæ*, in which it appears as a roundish or oval, uniform, little cellular mass. In germination, the embryo breaks through the covering of the seed, and develops itself into the new plant.

Seeds are either *sessile* or *stalked*. The stalk is of various length, and is formed of the *funiculus* or *umbilical cord;* the place at the

base of the seed, by which it is affixed to the inside of the fruit, or to the end of the *funiculus*, being called the *Umbilicus* or *Hilum*. When the seed is perfectly ripe, it has no further need of connection with the parent plant, and the *funiculus* dries up, leaving the *hilum* a mere scar.

Besides being enclosed in a capsule, or in a succulent fruit, &c., the most essential parts of the seed have coverings of their own, which are reckoned as belonging to the seed itself. Its general covering is called the *spermoderm* (Gr. *sperma*, seed, *derma*, covering), which consists of an external membrane, the *testa* (Gr. shell) or *episperm* (Gr. *epi*, upon) and an internal membrane, the *endopleura* (Gr. *endon*, within, *pleura*, side). Sometimes there is within the episperm a fleshy layer, called the *sarcosperm* (Gr. *sarx*, flesh). The Aril (q. v.) is a comparatively rare additional covering.

The seeds of phanerogamous plants afford characters which distinguish two great classes as *Monocotyledonous* and *Dicotyledonous* (see COTYLEDON). Very few plants have more than two cotyledons (seed-lobes). It is the case, however, with some of the *Coniferæ*. Cryptogamous plants are also designated *Acotyledonous*, as having no seed-lobes; and the name *Spore* (q. v.) is distinctively given to their seeds.

Seeds retain their vitality very long; but the time seems to be very various with the seeds of different plants, and in different circumstances. The grains, or seeds of cereal grasses, are probably excelled in this respect by none; grains of maize found in the tombs of the Incas have been made to vegetate; and also, it is said, grains of wheat taken from Egyptian mummies, although of this there is some doubt. After the great fire of London in 1666, plants not previously common sprang up abundantly on the waste ground; certain plants previously unknown there are sure to appear after a fire in the American forests; and instances are constantly occurring of a deep trenching of land or a turning up of soil by railway or other operations, producing a crop of some kind of plant previously unknown or rare in the locality. Thus the writer of this article has seen plants of the Milk Thistle appear on rubbish thrown out from the foundation of a house in Peeblesshire, where there was no other Milk Thistle in the neighborhood. And in Paisley Moss, in Renfrewshire, willows spring up in the ditches which are cut for drainage, from the surface of the soil which underlies the moss or peat. It is difficult to conjecture how long the seeds, in such cases, may have retained their vitality.

Exposed to the air, however, seeds generally lose their vitality in a few years. Some kinds retain it much longer than others. Seeds which abound in fixed oil seem to lose it more quickly than others.

In conveying seeds from one part of the world to another, and through great diversities of climate, it is desirable to have them as closely secured from the air as possible. But it has been found that of seeds brought from the Botanic Garden at Calcutta to Scotland, round the Cape of Good Hope, with no other care than would be used in sending a parcel from a seed-shop to a neighboring garden, the greater part readily vegetated.

SEE'LAND (Dan. *Själland*), the largest and most important island of Denmark, lies between the Cattegat and the Baltic, and is separated by the Sound from Sweden, and by the Great Belt from Fünen. Length, 78 miles; extreme breath, 70 miles; area, 2672 sq. m.; pop. in 1870 (including the two small islands Möen and Samsoe), 637,711. The surface is almost flat; the coasts, which are rock-bound on the south-east, are indented by bays and fiords, the chief of which is the Roeskilde-Isefiord in the north. The rivers are small, the largest being only 50 miles long; there are several lakes, and all the waters abound in fish. The island contains several beech-forests, is exceedingly fruitful in corn, and breeds excellent horses and cattle. Agricultural and cattle-breeding are the principal employments of the inhabitants. The chief place is Copenhagen (q. v.), the capital of the country, on the east coast, and from this city, lines of railway traverse the island to Elsinore in the north, and to Korsör in the south-west, on the coast.

SEER. See PROPHECY.

SE'GGAR, a vessel used by potters to protect delicate articles from the too fierce action of the fire in the kiln. See POTTERY.

SE'GMENT (Lat. *segmentum*, a part cut off) is, in Geometry, a portion cut off from a circle by a line, or from a sphere by a plane. When the angle subtended at the center of a circle by the segment, and the radius, or when the chord of the segment and its height, are known, the length of the arc of the segment and its area can be determined with as much accuracy as the circumference and area of the whole circle. See SPHERE.

SE'GNO (Ital. sign), a word used in musical notation in connection with marks of repetition. When a part is to be repeated, not from the beginning, but from some other point, the mark :S: is placed over the point where the repetition is to commence, and the words *Dal Segno* (or *d. s.*) are written at the close of the part to be repeated.

SE'GO, an important town of Western Africa, capital of the state of Bambarra, stands on the Niger, here called the Joliba, in lat. 13° 5′ N., long. 7° W. Its streets, which are winding, have a breadth of from 24 to 26 feet, and are extremely clean. The palace of the king is large enough to accommodate 2000 men and 500 horses. The houses are built of clay and are flat-roofed, and the royal residence differs from the other dwellings only in size. The country in the vicinity is well cultivated, and the town is the seat of considerable traffic. Mungo Park, from whom we derive almost all the knowledge we possess of S., here first beheld the Joliba. Pop. estimated at 30,000.

SEGO'RBÉ, a small town of Spain, in the modern province of Castellon, on the right bank of the Palancia, in a valley renowned for the beauty of its scenery and for its amazing fertility, 20 miles north-west of Murviedro. It stands on a hill between two castles, and contains stately houses, numerous churches, and a cathedral. Brandy-distilling is carried on to a great extent, and there are flour and paper mills. Pop. 8200.

SEGO'VIA, an interesting city of Spain, capital of the modern province of the same name (see CASTILE), stands on the Eresma, by which it is nearly encircled, 47 miles north-north-west of Madrid. It occupies the top of a rocky knoll, 3300 feet above sea-level, is surrounded by picturesque walls with round towers, and consists of narrow uneven streets, with old, quaint, and stately houses, 24 parish churches, and 21 convents. The Alcazar or castle, is perched on the west extremity of the rocky height, and was originally Moorish, but repaired magnificently in 1452—1458. The cathedral of S., a noble specimen of florid Gothic, is one of the finest in Spain. The present building was begun in 1525. The square cupola-crowned tower is 330 feet high, and the prospect from this elevation is superb. The grand aquaduct of S., supposed to have been built in the time of Trajan, is believed to be the most important Roman structure in Spain. It consists of two rows of arches, the one resting upon the other, from 2500 to 3000 feet long, and 102 feet high. There is a mint here for coining copper money. Wool-scouring and the manufacture of woollen fabrics are languidly carried on. Pop. 12,100.

S. was a place of importance during the time of the Romans; was the seat of immense cloth-manufactures in the time of the Moors, and was frequently the residence of the kings of Castile and Leon. Charles I. of England lodged at the Alcazar, September 13, 1623, and supped on 'certaine trouts of extraordinary greatnesse.' The unresisting town was sacked in 1808 by the French under Frere.

The province of S, has an area of 3460 square miles, and a population (1870) of 150,812.

SEGUR, the name of a French family, distinguished both in arms and letters. It is of Limousin origin, and was known there, it is said, as far back as the 9th century. The first, however, that specially merits notice was HENRI FRANÇOIS, Comte de S. (born 1689, died 1751), an able French general in the war of the Austrian Succession. His son, PHILIPPE HENRI, Marquis de S. (born 1724, died 1801), fought in the Seven Years' War, obtained the dignity of *Maréchal de France* in 1783, and outlived in his retirement the stormy scenes of the Revolution. The eldest son of this Philippe Henri was LOUIS PHILIPPE, Comte de S. (born 1753, died 1830), a vivid dashing sort of man, for some years ambassador at the court of St. Petersburg, and a great favorite with Catharine II. Of impressionable fancy, full of enthusiasm for the 'philosophers,' the 'reign of reason,' and the 'new ideas' generally, he hailed the great Revolution with delight, but took no prominent part in it. His public career during the Empire was respectable, but not brilliant; but one notices with satisfaction that he retained in extreme old age that love of liberty that marked his early years; the last act of his life being an eulogium on the revolution of July. As a writer, S. has in wonderful perfection the national graces of style and spirit. Among his numerous writings are: *Pensées Politiques* (Par. 1795), *Histoire de Frédéric Guillaume II.* (Par. 1800, *Contes, Fables, Chansons et Vers* (Par. 1801), and *Mémoires ou Souvenirs et Anecdotes* (Par. 1824). He left two sons, OCTAVE and PAUL PHILIPPE, the latter of whom (who was born in 1780) was a general of the First Empire, took part in the fatal expedition to Russia in 1812, and wrote the story of the campaign, *Histoire de Napoléon et de la Grande Armée pendant l'anée* 1812 (Par. 2 vols., 1824). The work has had an immense success, and has been translated into almost all the languages of Europe. Other works of the Comte Paul Philippe de S., are: *Lettre sur la Campagne du Général Macdonald dans les Grisons* (Par. 1802), *Histoire de Russie et de Pierre le Grand* (Par. 1829), *Histoire de Charles VIII., Roi de France* (Par. 1834); &c.

SEGU'RA, a river in the south-east of Spain, rises in the Sierra Seca, and after an east-south-east course of about 180 miles, enters

the Mediterranean 27 miles below Orihuela. Ships unload at its mouth.

SEI'DLITZ POWDERS are composed of 120 grains of tartrate of soda and potash, and 40 grains of bicarbonate of soda reduced to powder, mixed and enclosed in a blue paper, and 35 grains of powdered tartaric acid in a white paper. The contents of the blue paper are dissolved in from half a tumbler to a tumbler of water, and those of the white paper are then stirred in. The mixture should be taken while the effervescence from the liberation of the carbonic acid is still going on. These powders act as an agreeable and mild cooling aperient. If a stronger dose is required, either an increased quantity of the powder may be used, or a little sulphate of magnesia (about a drachm) may be added.

SEI'GNIOR, GRAND, a name sometimes given to the Sultan (q. v.) of Turkey.

SEINE, the metropolitan dep. of France, completely enclosed by the dep. of Seine-et-Oise, is a portion of the former province of L'Ile-de-France, and derives its name from that of its principal river (see SEINE, river). It is at once the smallest and the most populous dep. in the empire; its area is 183 sq. m.; its pop. in 1876 was 2,410,849; and in 1881, 2,799,329. From south-east to north-west, the dep. is traversed a distance of 37 miles by the winding Seine, which receives the navigable Marne at Charenton, and the Bièvre at Paris. The surface is marked by undulations and low hills, the highest of which, Mont-Valérien, is only 446 feet above sea-level. The climate is pleasant and healthy. The scenery—of which the woods of Verrières, Meudon, and Saint-Cloud, together with those of Vincennes and Boulogne, transformed into parks, and watered by artificial rivers and lakes, are perhaps the most striking features—is remarkably pleasing.

A network of canals and railways, the latter converging in the capital, afford easy means of transit in any direction. The soil is calcareous, and in the greater part, naturally infertile, but owing to the skill of the farmers and gardeners, who obtain abundant supplies of manure from the metropolis, the country around Paris (q. v.) and its suburbs has been rendered remarkably productive. The culture of vegetables and fruits for the markets of Paris is one of the most important branches of husbandry. Enormous quantities of mushrooms are cultivated in the ancient quarries of Paris near Montrouge. Quarries abound, and are productive.

SEINE (anc. *Sequana*), one of the most important rivers of France, rises near Mont Tasselot, in the middle of the dep. of Côte-d'Or, and after leaving the northern boundary of that dep. flows west-north-west through the deps. of Aube, Seine-et-Marne, Seine, Seine-et-Oise, Eure, and Seine-Inférieure, to the English Channel, which it reaches at Havre, after a course of 470 miles. It passes the towns of Troyes Méry—where 350 miles from its mouth, it becomes navigable—Corbeil, Paris, Elbeuf, Rouen, and Havre. The source of the river is about 1420 feet above the level of the sea; but below Paris its current is slow, and its course to Rouen is marked by numerous windings. Its lower course also is banked by steep hills, which, while they are picturesque, are everywhere cultivated. The principal affluents are, from the right, the Aube, Marne, and Oise; from the left, the Yonne, Loing, Essone, and Eure.

SEINE-ET-MARNE, an inland dep. in the north of France, is bounded on the E. by the dep. of Seine-et-Oise, and forms a portion of that wide basin in the middle of which stands Paris. Area, 2214 sq. m.; pop. (1881) 348,991. The dep. owes its name to the two chief streams that water it, and of which the Seine flows through the southern, and the Marne through the northern part. There are no mountains, but ridges of low hills separate the fertile and extensive though not deep valleys. Timber is grown in every part; and among the forests is that of Fontainebleau. The soil is generally fertile. Of cereals, wheat is the principal crop. Vegetables and fruits are also largely grown, and the meadows and pastures, natural and artificial, are extensive and productive. The wines are mediocre in quality, but the grapes for the table, called the *Chasselas de Fontainebleau*, have a European reputation. The capital is Melun, and the arrondissements are Melun, Coulommiers, Fontainebleau, Meaux, and Provins.

SEINE-ET-OISE, a dep. in the north of France, encloses the metropolitan dep. of Seine (q. v.). Area, 2163 sq. m.; pop. (1881) 577,798. The great rivers are the Seine and Oise, which have numerous affluents. Extensive plains occupy the southern districts; but in the north, the country is much broken, and picturesque valleys and great forests occur. The soil is not in general very fertile; but owing to the vicinity of the capital the amount of produce is great. Among the minerals, are several fine varieties of stone and fine clays. In addition to the usual branches of manufacture, porcelain is largely made at the famous Sèvres (q. v.) factories. The dep. is divided into the arrondissements of Versailles, Corbeil, Etampes, Mantes, Pontoise, and Rambouillet, and the cap. is Versailles.

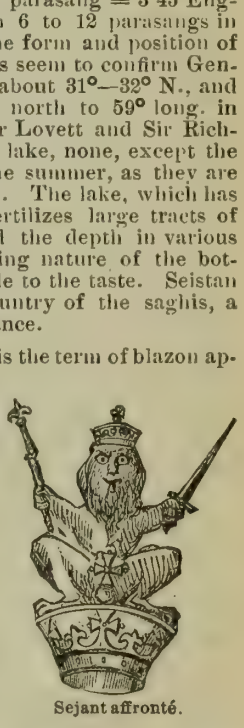
SEINE-INFÉRIEURE, a maritime dep. of France, bounded on the north-west by the English Channel, and on the south by the dep. of Eure. Area, 2328 sq. m.; pop. (1881) 814,068. The Seine flows through the southern districts; but a number of important though small streams flow north-west across the dep., and fall into the Channel. The range of the hills of Caux extends from east to west, and to the south of it are rich pasture-lands, watered by the Seine and its affluents. Husbandry flourishes chiefly in the middle and in the east districts. The coasts are formed of chalk-cliffs, varying in height from 200 to 650 feet. The arrondissements are Dieppe, la Havre, Rouen, Neufchâtel, and Yvetot. The capital is Rouen, which communicates with Dieppe by a direct line of railway.

SEIR-FISH (*Cybium guttatum*), a fish of the family *Scomberidæ* having finlets, and the sides of the tail keeled, the teeth compressed and sharp. It inhabits the seas of the East Indies, and is one of their most valuable fishes. In size and form, it is very similar to the salmon, which its flesh resembles also in firmness and flavor, although of a white color.

SEI'SIN. See SASINE.

SEISTA'N or HAMOON LAKE (anc. *Aria Palus*), a large, irregularly-shaped, shallow lake of Afghanistan, bordered with plantations of tamarisk and other trees, and enclosed by the province of Seistan. It is 25 parasangs (a parasang = 3·45 English miles) in length, and it varies from 6 to 12 parasangs in breadth. It is difficult to fix accurately the form and position of the lake, but the most recent explorations seem to confirm General Ferrier, who says that it is in lat. about 31°—32° N., and that it lies obliquely from 60° long. in the north to 59° long. in the south. It was visited in 1872 by Major Lovett and Sir Richard Pollock. Of the rivers which feed the lake, none, except the Helmund, contribute any waters during the summer, as they are then diverted for the irrigation of the land. The lake, which has no outlet, overflows its boundaries, and fertilizes large tracts of country. It is only about 4 feet deep, and the depth in various parts is constantly altering from the shifting nature of the bottom. Its waters are black and disagreeable to the taste. Seistan is a corruption of Saghistan—i. e., the country of the saghis, a kind of wood which grows here in abundance.

SE'JANT, or ASSIS (Fr.) in Heraldry, is the term of blazon applied to a beast in his usual sitting posture. A lion borne in full face, with his forepaws extended sideways, is blazoned sejant affronté, as in the crest of Scotland.



Sejant affronté.

SEJA'NUS. See TIBERIUS.

SELACHIANS, the Sharks and Rays. See CARTILAGINOUS FISHES.

SE'LBY, a market-town and river-port in the West Riding of Yorkshire, on the right bank of the Ouse, 12 miles south of York by railway. The ancient Gothic cross which adorns the market-place, and the character of the architecture of the houses, attest the age of the town. The magnificent parish church 300 feet long by 60 feet wide, is part of an abbey founded by the Conqueror in 1068. The movable bridge across the river offers a passage to shipping, and the river is navigable to S. for vessels of 200 tons. Means of communication by railway and canal are abundant. There are iron and brass foundries, and slips for building river craft; and the manufactures include sail-cloth, ropes, &c. Pop. (1871) 6193; (1881) 6033.

SELDEN, JOHN, an illustrious English scholar and lawyer, was born December 16, 1584, near Worthing, in Sussex, studied at Hart Hall, Oxford, for three years, and then removed, first to Clifford's Inn, London, and afterwards to the Inner Temple, for the pursuit of law. It was here that his great learning began to attract attention, and won for him the friendship of Camden, Usher, Sir Robert Cotton, and Sir Henry Spelman. S. wrote his first treatise, which related to the civil government of Britain previous to the Norman Conquest, and was entitled *Analecton Anglo-Britannicon*, in 1606, when only twenty-two years of age, though it was not published till nine years later.

In 1610, appeared his *Jani Anglorum Facies Altera* (English translation 1683), giving an account of the common and statute law of English Brittany to the death of Henry II.; and in 1614 was published his *Titles of Honor*, a work still regarded as of high authority on the subject of which it treats. Three years later, appeared an erudite, but, judging from what Le Clerc says, not a very critical or well-digested, work on the Syrian gods, especially in their connection with the Old Testament, entitled *De Diis Syriis. Syntagmata Duo*. Next year, however, he excited great indigna-

tion among the clergy by his *Treatise of Tythes*, in which he endeavored to prove that tithes are not due by divine right under Christianity, but solely because the law has imposed them. S. was assailed with diatribes, animadversions, additional animadversions, historical vindications of the *jus divinum* of tithes, &c.; but it does not appear that the arguments were very convincing to Selden. In 1621, he suffered a brief imprisonment for advising the parliament to repudiate King James's doctrine that their privileges were originally royal grants; in 1623, he was elected member for Lancaster, and from this period till his death, he took a considerable part in public affairs, yet not such as to materially interfere with the continuance of scholarly pursuits. S.'s political position is somewhat difficult to define. There is no doubt that he was sincerely attached to the cause of the parliament, and as sincerely opposed to the views of the court-party and the king. But he was above all things a constitutional lawyer, and derived his ideas of the rights of the subject from the history of the nation, and not from religious fanaticism or metaphysical considerations.. Still, he 'loved his ease,' according to Clarendon (who has painted S.'s portrait in his usual fine style), and so let things be done without protest, of which he did not approve. Personally, he was rather a favorite with King Charles, on account of his learning and moderation.

In 1630, he was committed to the Tower, for his activity in opposing the policy of the court, and remained a prisoner for four years, when he was released through the favor of Archbishop Laud and the Lord Treasurer; in 1640, he was chosen member for the university of Oxford; and now, when the struggle between the king and the nation began to grow dead-earnest, he was occasionally suspected of not being zealous enough by such as were themselves perhaps over-zealous. He threw the weight of his learning and argument into the scale against the bishops (towards whom, like Milton and other lay-champions of freedom, he felt a peculiarly strong antipathy), when the question came up as to their tenure of seats in parliament; he was one of those who drew up the articles of impeachment against Laud; he sat as a lay-member in the Assembly of Divines at Westminster, 1643, and perplexed his clerical colleagues sadly. In 1644, he was elected one of the twelve commissioners of the Admiralty; in 1646, the sum of £5000 was voted to him by parliament, in consideration of his services and sufferings; in 1647, he was appointed one of the university 'visitors,' and always used his influence to moderate the tyranny of his fanatical colleagues. After the execution of Charles (of which it is certain he strongly disapproved, as both unlawful and inexpedient), he took little share in public matters; and when requested by Cromwell to answer the *Eikon Basilike*, he refused. His death occurred November 30, 1654, in the house of Elizabeth, dowager-countess of Kent, with whom he had long lived in such intimacy that people said they were married.

The principal writings of S., besides those already mentioned, are: *Marmora Arundelliana* (1629); *De Successionibus in Bona Defuncti secundum Leges Hebræorum* (1634); *De Successione in Pontificatum Hebræorum, Libri Duo* (Leyd. 1638); *De Jure Naturali et Gentium, juxta Disciplinam Hebræorum* (1640), a work more learned than critical (like most of S.'s biblical productions, who thought far too much of the opinions of the Rabbins); and *Uxor Hebraica; Mare Clausum* (1635), a reply to Grotius's *Mare Liberum* (treatises which originated in a dispute between the English and Dutch concerning the herring-fishery upon the British coast, to which the Dutch laid claim); *De Anno Civili et Calendario Judaico* (1646); *De Synedriis et Præfecturis Hebræorum* (1650 *et seq.*); besides a great variety of posthumous works, of which the most famous, and also the most valuable, is his *Table-talk* (recorded and published by his amanuensis, Richard Milward, in 1689), of which Coleridge says (with considerable exaggeration, however): 'There is more weighty bullion sense in this book than I can find in the same number of pages of any uninspired writer.' S. was highly esteemed by all his great contemporaries, both royalist and parliamentarian, on account of his integrity, candor, and vast erudition; but his moral courage or enthusiasm was not remarkable (except when tilting at the bishops—*then*, like Erasmus on the monks, he was quite heroic); and, on the whole, as compared with Milton, he occupies the level which Erasmus did in relation to Luther. S.'s works were collected and published at London in three folio volumes, 1726.

SEL D'OR, a salt employed in photography, originally to aid in fixing and improving the image on a Daguerreotype-plate, and more recently for toning positive paper-proofs. It is a double hyposulphite of gold and sodium, the constitution of which is expressed by the formula $AuO.S_2O_2 + 3NaO,S_2O_2 + 4HO$. It is formed when 1 part of chloride of gold in solution is added to 3 parts of hyposulphite of soda, also in solution. The hyposulphite of soda should be always in excess during the mixture, a condition which is secured by adding the chloride of gold to the hyposulphite of soda, and not *vice versa*. The salt so formed is precipitated in fine, white, crystalline needles on the addition of alcohol to the above mixed solutions; these are collected on bibulous paper, and gently dried for use. Adulterations in the commercial article, which are unfortunately only too common, may be ascertained by precipitating, igniting, and weighing the gold contained in the sample it is desired to test. Nitric acid free from chlorine will decompose this salt, and precipitate its contained gold in the metallic form.

SELE'NE, the Greek name of the goddess of the moon; called also *Mene*, and in Latin, *Luna*. Her myth is differently told, but the most common account makes her a daughter of Hyperion and Theia, and sister of Helios (the Sun) and Eos (the Dawn); as sister of Helios, also called *Phoibos* (the Shining One), she had the name of *Phœbe*, and latterly was identified with Artemis (see DIANA), though the identification was never quite exact, as Artemis always retained her reputation for chastity, while S. had 50 daughters by her lover Endymion, and several by Zeus, one of whom was called *Erse* ('the Dew'), indicating the original physical character of the myth. In Art, the two are always distinct. S. is represented by the poets with long wings and a golden diadem, riding across the heavens in a chariot drawn by two white horses, cows, or mules.

SE'LENITE (Gr. *Selene*, the moon), a transparent and beautiful variety of Gypsum (q. v.), white, or tinged with green, gray, or yellow. It receives its name from its peculiar moon-like lustre. It is often crystallized in six-sided prisms, sometimes in lenses, and twin crystals and quadruple crystals occur. It is found in common gypsum, in rock-salt, in the Blue Clay of the south of England, &c. There is in the British Museum a splendid group of crystals of S., presented by the late Prince Albert. S. is easily cut, and is capable of being split into extremely thin plates, which are flexible, although not elastic. It was used by the ancients for some of the purposes for which we use glass. The Romans imported it from Spain, Cyprus, Cappadocia, and Africa. The hothouses of Tiberius were covered with it, and Pliny mentions that it was used in the construction of beehives by those who wished to watch the operations of the bees. It is used for making the finest kind of stucco, and the most delicate pastil colors. When burned, and perfectly dry, its powder is used for cleansing and polishing articles of gold and silver, precious stones, and pearls.

SELE'NIUM (Se; old equiv. 39·5; new, 79; sp. gr. 4·28) is an element having two forms. In the *vitreous* form, at ordinary temperatures, it is a solid of a dark-brown color, and when broken, presents a conchoidal vitreous fracture; thin splinters of it are, however, of a dark-red tint when seen by transmitted light. It is tasteless and inodorous, a non-conductor of electricity. When S. is very slowly cooled from the fused condition, its appearance is quite different; the structure being *granular* or *crystalline* (sometimes called 'metallic'). Crystalline S. is of a dull leaden color; unlike the vitreous S., is very opaque to light even in thin films; and is a conductor of electricity at ordinary temperatures. Its resistance to the passage of an electric current diminishes up to the point of fusion, but suddenly increases as the S. becomes liquid. Another property of crystalline S., which has recently given it a new interest, is that it is remarkably sensitive to light; and its electrical resistance varies very much according to its exposure to light, being much less in the light than in the dark. It was in virtue of this property that the experiments were made which led, in 1880, to the discovery of the Photophone (q. v.).

S. remains a solid up to 392°, when it fuses into a fluid, which boils at 650°, emitting an inodorous vapor of a deep yellow tint. When heated in the air, S. does not very readily take fire; but it is combustible and burns with a blue flame, while a portion of it is volatilized in red fumes. The products of combustion are oxide of S. and selenious acid.

S. is of rare occurrence in nature; it is chiefly found as a selenide in combination with lead, silver, copper, or iron; but it has also been discovered in sulphur, and in certain sulphides of iron. It forms three compounds with oxygen—oxide of S., selenious acid, and selenic acid; while with hydrogen it forms seleniuretted hydrogen, or hydroselenic acid.

S. was discovered in 1817 by Berzelius, in the refuse of a sulphuric-acid manufactory. He named it S. (from Gr. *selene*, the moon), because in many respects it resembled tellurium (named from Lat. *tellus*, the earth).

SELEU'CIA, the name of seven ancient cities of Asia, situated in Syria, Pisidia, Pamphylia, Cilicia, Caria, and Mesopotamia, and founded during the earlier existence of the dynasty of the *Seleucidæ* (q. v.). The most distinguished of these were: 1. SELEUCIA PIERIA, founded by Seleucus Nicator, on the seashore, about 4 miles north of the mouth of the Orontes, and strongly fortified. It was the seaport of Antioch, and became of great importance during the wars between the Seleucidæ and the Ptolemies for the possession of Syria. It rapidly declined under the Roman dominion. The ruins have been fully explored and

described in modern times by Pococke (*Observations on Syria*) and Chesney (*Royal Geographical Society's Journal*, vol. viii.) Its once magnificent port is in such an extremely good state of preservation as to require few repairs to render it serviceable; and the remarkable tunnel of 1088 yards in length, which was excavated out of the solid rock, and formed the only communication between the city and the sea; and the remains of its triple line of walls, of its citadel, temples, amphitheater, necropolis, &c., all attest the former importance and splendor of the city.

2. SELEUCIA ON THE TIGRIS, was also built by Seleucus Nicator, on the west bank of the Tigris, 40 miles (according to Strabo 33) north-east of Babylon, which was despoiled to supply materials for the construction of the new city. Situated in a district of great fertility, commanding the great trading routes of Assyria, Babylonia, and Western Persia, it rapidly rose to great wealth, and splendor, supplanted Babylon as the capital of the eastern portion of the Seleucide monarchy, and when in the acme of its greatness, contained a population of more than 600,000. Even in Strabo's time, it was larger than Antioch in Syria, the greatest commercial emporium of Asia; and down to the period of its final destruction, the number of its inhabitants is said to have never fallen below half a million. During the decline of the Seleucide monarchy, it became independent, and formed, from its wealth and splendor, an irresistible bait to the robber-tribes of Southern Armenia and Media, who partially plundered it on more than one occasion. But its position on the confines of Persia, which gave it its greatness, was also the cause of its destruction; for when the Seleucide monarchy was swallowed up by the Romans, and the long and desolating struggle between the latter and Persia had commenced, S., placed between two fires, was speedily brought to ruin. It was burned by Trajan (116 A.D.), and a few years afterwards, by Lucius Verus; and when visited by Septimius Severus was as desolate as the mighty city it had supplanted. The Emperor Julian, on his expedition to the East, found the whole country round it converted into a vast marsh, the haunt of innumerable beasts of chase and wild-fowl, and the city itself completely deserted.

SELEU'CIDÆ, the dynasty of kings to whom fell that portion of Alexander the Great's immense and ill-compacted monarchy which included Syria, a large portion of Asia Minor, and the whole of the eastern provinces.

SELEUCUS I., surnamed NICATOR, the first of this line, was the son of Antiochus, a distinguished officer in the service of Philip of Macedon, and was born about 358 B.C. He was one of the conspirators against Perdiccas, and in the second partition of the provinces of Alexander the Great's kingdom, obtained Babylonia, to which, with the aid of Antigonus, he subsequently added Susiana; but a misunderstanding with that powerful chief having arisen, Seleucus took refuge in Egypt (316 B.C.). The victory gained by Ptolemy over Antigonus's son, Demetrius, at Gaza having laid open the route to the East, Seleucus returned to his satrapy, amidst the joyous congratulations of his subjects (312 B.C.). From October 1 of this year (the date of Seleucus's return to Babylon), commences the era of the *Seleucidæ*. Having next recovered Susiana, he conquered Media, and extended his power to the Oxus and Indus. Of his campaign against Sandrocottus (q. v.), there are few details extant. In 306 B.C., he assumed the regal title; and four years afterwards, joined the confederacy of Ptolemy, Lysimachus, and Cassander, against the now formidable Antigonus, deciding the battle of Ipsus (301 B.C.) chiefly by his cavalry and elephants. Being now, after Antigonus's death, the most powerful of Alexander's successors, he obtained the largest share in the conquered kingdom, a great part of Asia Minor and the whole of Syria falling to him. Towards the close of his reign, war broke out with Demetrius (now his father-in-law), and afterwards with Lysimachus, king of Thrace and the other part of Asia Minor, both contests terminating in the defeat and death of his opponents, and being followed by the acquisition of the rest of Asia Minor. He was assassinated (280 B.C.) by Ptolemy Ceraunus.

Of Seleucus's personal character, little can be gathered from the fragments of his history which remain to us; according to Pausanias, he was the most upright of Alexander's successors, unstained by those crimes which have foully blotted the characters of the others; but of his consummate generalship and great political talents, we have sufficient proof. He pursued with great zeal the plan of 'Hellenizing' the East, by founding numerous Greek and Macedonian colonies in various parts of his dominions; he also built numerous cities, several of which—as Antioch in Syria, and Seleucia on the Tigris—rose to be among the most populous and wealthy in the world.—After the reigns of ANTIOCHUS I. (q. v.) and ANTIOCHUS II. (q. v.), SELEUCUS II. (246—226), surnamed CALLINICUS, obtained the throne; but having, at the instigation of his mother Laodice, murdered his stepmother Berenice, an Egyptian princess, he was driven from his kingdom by Ptolemy Euergetes (q. v.). However, he recovered his throne on Ptolemy's withdrawal; and though defeated in a great battle with the Egyptians, he succeeded in maintaining his hold of Syria and most of Asia Minor against both the Egyptians and his younger brother Antiochus, who exercised independent authority over part of Asia Minor. Antiochus was at a later period wholly defeated in Mesopotamia, and soon after murdered by robbers. Seleucus undertook a great expedition against the revolted provinces of Parthia and Bactria, but was totally routed by Arsaces I., king of Parthia; while, on the north-west, several provinces were wrested from him by Attalus, the king of Pergamus.—His sons, SELEUCUS III. (226—223), surnamed CERAUNUS, and ANTIOCHUS III. (q.v.), 'the Great,' were his successors, the latter being the first of the dynasty who came into collision with the Romans.—SELEUCUS IV. (187—175), surnamed PHILOPATOR, was eager to dispossess the king of Pergamus of the provinces which he had taken from the Syrian monarchy, but fear of the Romans prevented him from carrying out his design.—ANTIOCHUS IV. (q.v.), EPIPHANES (I.) ('the Illustrious'), conquered Cœle-Syria and Palestine from the Egyptians, to whom they had been given by his father; but retired from Egypt at the bidding of the Romans.

He practised the most atrocious cruelties on the Jews, whose religion he endeavored to root out, and introduce the Greek religion; but the heroic resistance of the Maccabees (q. v.) completely foiled his project. He died in a state of raving madness, which was attributed to his sacrilegious crimes by his subject, who, in derision, converted his surname into EPIMANES ('the Madman').—The succeeding names of the dynasty were: ANTIOCHUS V., EUPATOR (164—162); DEMETRIUS I., SOTER (162—150), who regained Babylon, lost Judea, and was defeated and slain by the impostor Alexander Balas (150—146); DEMETRIUS II., NICATOR (146—138, 128—125), who overthrew the impostor, and was himself taken prisoner by the Parthians. Syria having been already seized by DIODOTUS, surnamed TRYPHON, who set up the puppet ANTIOCHUS VI., THEOS (144—142), and afterwards ascended the throne himself (142—137); ANTIOCHUS VII., SIDETES (137—128), who restored the royal line of the Seleucidæ; ANTIOCHUS VIII., GRYPUS (125—96), who was compelled to share his dominions with his half-brother ANTIOCHUS IX., CYZICENUS (111—95); SELEUCUS V. or VI., EPIPHANES (96—94), and ANTIOCHUS X., EUSEBES (95—83), who continued the division till 94 B.C., when the latter was victorious in a pitched battle, and seized the whole kingdom; for which, however, he was forced to fight with Philip, and ANTIOCHUS XI., EPIPHANES (II.), the younger brother of Seleucus; and DEMETRIUS III., EUCÆRUS (94—88), a third brother of Seleucus, who, with Philip, next claimed the sovereignty, which was taken from them by Tigranes (83—69), king of Armenia, at the solicitation of the Syrians; ANTIOCHUS XII., DIONYSUS, a fourth brother of Seleucus, and ANTIOCHUS XIII. (69—65), ASIATICUS. The short-lived prosperity of this dynasty, for it had begun to decline during the reign of SELEUCUS II., 80 years after its foundation, is principally owing to the fatal principle on which it was founded—viz., that of establishing a Græco-Macedonian power in a foreign country, instead of conciliating the attachment of the native populations, and governing them more in accordance with the Eastern method; the consequences were the successive revolts of the natives, the foundation of the independent and hostile kingdoms of Bactria, Parthia, Armenia, Judea, and the ultimate conversion of the small remnant into a Roman province by Cneius Pompeius, 65 B.C.

SELF-DENYING ORDINANCE, a measure carried through parliament in 1645 by the influence of Cromwell and the Independents, with the view of removing Essex and the Presbyterians from the command of the army. It was moved by a fanatic of the name of Zouch Tate, who, on the ground that 'there is but one way of ending so many evils, which is, that every one of us freely renounce himself,' proposed, that 'no member of either House shall, during this war, enjoy or execute any office or command, civil or military, and that an ordinance be brought in accordingly.' The ordinance, which was clearly intended to take the executive power out of the hands of the more moderate politicians, and form an army independent of parliament, was the subject of violent and protracted debate, but eventually passed in both Houses, and became law. The consequence was that Essex, Warwick, Manchester, and others gave in their resignation, and the conduct of the war was intrusted to Fairfax; Cromwell, to whom, as a member of the Lower House, the self-denying ordinance extended, as much as to Essex and the rest, had the duration of his commission prolonged by the Commons on account of his invaluable services as a leader of cavalry, and by his brilliant achievements soon surpassed his commander in reputation.

SELIM I., Sultan of Turkey, son of Bajazet II., was born in 1467, dethroned his father by the aid of the Janizaries, 25th April 1512, and ascended the throne. To secure himself in his elevation, he caused his father, brothers, and nephews to be put to death, thus beginning a policy which he pursued inflexibly through the whole of his subsequent career, viz., to destroy without scruple every actual or possible obstacle to the accomplish-

ment of his own ends. Urged on by a devouring appetite for conquest, and by the warlike fanaticism of the Janizaries, he declared war (1514) against Shah Ismail of Persia, and marched eastwards with an army of 250,000 men, massacring on the way 40,000 Shiites. He encountered Ismail at Calderoon, and defeated him with immense loss, but a spirit of disaffection breaking out in his army, he was compelled to content himself with this success, which gave him possession of Diarbekir and Kurdistan. In the following year he overran Armenia; and leaving his lieutenants to complete this conquest, he marched against the Mameluke Sultan of Egypt, whom he had previously endeavored to detach from intimate alliance with the Persian monarch. Kansû-ghori, the Egyptian Sultan, was totally defeated (1516) at Marjabik by S., and Syria became the prize of the victor; and Kansu's successor, Touman-Bey, was still more unfortunate, his army being almost extirpated (1517) at the battles of Gaza and Rudania. The victorious Turks then entered Cairo without opposition; Touman-Bey and his chief supporters were put to death, and Egypt incorporated with the Ottoman empire.

The last lineal descendant of the Abbaside calif, who was then resident in Egypt, transmitted to S the religious prestige which had devolved upon himself by descent, and at the same time bestowed upon him the title of 'Imaum,' and the standard of the Prophet. In consequence of this gift, the Ottoman sultan became the chief of Islam, as the representative of Mohammed; and the sacred cities of Mecca and Medina, along with the chief Arabian tribes, in consequence acknowledged his supremacy. Thus, in less than four years, S. did more to extend the Ottoman empire than any of his most renowned predecessors during a whole reign. He also laid the foundation of a regular marine, constructed the arsenal of Pera, chastised the insolence of the Janizaries with savage severity, and labored to ameliorate, by improved institutions, the condition of the various peoples he had conquered. He died 22d September 1520, while planning fresh campaigns against both Persians and Christians. This prince, who in a sense merited his title of *Yavuz* (the Ferocious), was nevertheless a lover and encourager of literature, and even himself cultivated the poetic art. S. was succeeded by his son, Solyman the Magnificent (q. v.).

SELIM III., Sultan of Turkey, the only son of Mustapha III., was born 14th December 1761, and ascended the throne on the death of his uncle, Abdul-Hamid, in 1789. Seeing clearly the causes of the decadence of the empire, and the proper remedies, he inaugurated a policy of renovation and progression; but the war with Russia, in which his newly raised army of 150,000 men was totally defeated, first by the Prince of Coburg, and next by Suwarof, put a stop for a time to his schemes of reform. He was compelled, in 1791, to cede Choczim to Austria, and in the following year, all his possessions beyond the Dniester to Russia. About this time, his good harmony with Napoleon was troubled by the expedition of the French to Egypt, and subsequently by the question of the recognition of the French Empire, but on the whole, S. continued the faithful ally of France; and at every opportunity pursued with ardor his various reforms, establishing cannon-foundries, and organizing a body of troops ('the Nizam-Djedit'), armed, clothed, and disciplined in the European fashion; but this last reform stirred up against him (1805) all the fanatic bigotry of his subjects.

The priests of Islam even preached revolt in different parts of the empire, and accused their sovereign of despising the holy injunctions of the Koran, so that S. felt compelled to adopt a more cautious policy. At length, a formidable rebellion broke out, and the Nizam-Djedit, who attempted to suppress it, were overpowered, their commander put to death, and the rebels marched into Constantinople, their ranks being swelled at every step by bodies of disaffected Janizaries. All those who had favored or forwarded the sultan's schemes were seized and put to death, and S. was compelled to issue a decree suppressing the new institutions. But the malignant enmity of the mufti and his coadjutors was not thus to be satisfied, and S. saw himself forced to resign the throne (1807) to his cousin, *Mustapha IV.* (1807—1808).

On the news of this insurrection being conveyed to Mustapha-Bairaktar, the Pasha of Rustchuk, and one of the sultan's chief advisers, this energetic and able soldier marched upon Constantinople, with a view to reinstate S. on the throne, but on his arrival the unfortunate monarch was strangled, and his body cast at the feet of Bairaktar. See BAIRAKTAR. Thus perished S., and with him the first attempt at reformation in Turkey; the effects of which, however, were not wholly lost, for manufactures had begun to flourish, thousands of silk, and other looms were now in vigorous operation, a printing press had been established in Scutari, and many other improvements calculated to foster the prosperity and happiness of his subjects, had been inaugurated; though these advantages, the natural result of S.'s enlightened patriotism, were neither understood nor appreciated by the great majority of his ignorant and fanatical subjects.

SELI'MNO, a manufacturing town of European Turkey, in Eastern Roumelia, at the southern base of the Balkan Mountains, 78 miles north of Adrianople. Owing to its far inland position, there is little communication between the town and the coast, and consequently the annual fair held here is of very great importance. Arms, cloth, and attar of roses are manufactured. Pop. 15,000.

SELJUKS, or SELJUK-TURKS, were an offshoot of the Hoei-He or Hoei-Hu, a collection of tribes of Turkish race, who, being driven south-westward from the Chinese wall, had, in 744 A.D., overwhelmed that Turkish empire of Kiptchak which had given so much annoyance to the Sassanidæ (q. v.) during their reign in Persia. The Hoei-Hu rapidly extended their power from the Caspian Sea as far as the Hoang-ho, and at the time when the S. separated themselves from them, were ruled by a chief named Bigû Khan. Seljuk, from whom the S. derived their name, was the chief of a small tribe which had gained possession of Bokhara and the surrounding country. His sons, attracted by the beauty and fertility of Khorassan, began, about 1027, to migrate to that country, and after some struggles with the Ghiznevide sultans, established themselves in Northern Khorassan, with TOGRUL BEG, the eldest grandson of Seljuk, as their chief, and Nishapur as their capital. Togrul, leaving his brother in Khorassan, set out on his conquering march, subdued Balkh and Khaurezm in 1041, Irak-Ajemi in 1043, subsequently adding to these Kerman and Fars. He then advanced to Bagdad, which he took in 1055, dethroning the last vizier of the Dilemite (see SAMANI) dynasty, and being invested by the reigning calif with the vacant office, after which he completed his conquest of Persia, by the reduction of Irak-Arabi and Mosul about 1061. The S. were zealous Mohammedans, and Togrul Beg seems to have been a vigorous promoter of the faith which he professed, for he built numerous mosques, subsidized pions and learned men, and treated the calif —his spiritual chief—with profound respect.

After his death in 1063, his nephew, ALP-ARSLAN (q. v.), succeeded to supreme power, and became one of the most renowned monarchs of Asia. His son, MELEK SHAH (1073—1093), the most powerful monarch of this dynasty, added, by means of his generals, Arabia, Asia Minor, Armenia, Syria and Palestine, and Transoxiana to his empire, which now extended from the Hellespont to the borders of Chinese Tartary; and even the ruler of Cashgar acknowledged his authority. This empire, though extensive and ill-compacted, was preserved in the highest order and prosperity by his able minister, the virtuous Nizam-ul-Mulk, under whose firm, just, and wise government the rights of all classes were maintained, religion promoted, and learning encouraged, till the Persians who had dreaded the conquest of their country by the Turks as the worst of evils, were forced to confess that it had proved the greatest of blessings. In 1092, Melek Shah, lending an ear to the misrepresentations of Nizam-ul-Mulk's enemies, deprived him of his office; and the aged minister was soon afterwards assassinated by one of the followers of Hussun Subah, the chief of the Assassins (q. v.), and the mortal enemy of the good ex-vizier. Hospitals, caravansarais, bridges, roads, and canals attest the zeal with which the commercial interests of the empire were furthered; while the colleges of Bassora, Ispahan, and Herat, the law-college of Bagdad, and the observatory (the first in Asia) of the same city, indicate the care bestowed on the promotion of literature and science. Melek Shah, under whom the empire of the S. had attained the height of its power and splendor, laid a sure foundation for its rapid decline, by subdividing it into a number of separate principalities, all professedly subject to the central state of Iran or Bagdad. The chief of these principalities were: 1. The central state of *the S. of Iran*, whose ruler was the vizier of the calif, and exercised direct authority over Northern and Western Persia to the borders of the Arabian desert. The chief monarchs of this branch were Mohammed Shah, whose generals warred with the Crusaders in Palestine, and Sultan Sanjar, one of the most celebrated of the S. princes, great both in success and misfortune. This branch was annihilated in 1194 by the Shah of Khaurezm.

2. *The S. of Kerman*, who were annihilated in 1191 by the Ghuz Turkomans. 3. *The S. of Iconium*, who ruled over Asia Minor, and whose founder was Soliman, a great-grandson of Seljuk. This branch endured for 224 years—from 1075 to 1299—and during that period was engaged in numerous wars with the Byzantines and with the Crusaders, both of whom learned to dread its power. During its last years, it was tributary to the Mongols; and in 1299, the present Turkish empire rose on the ruins of its power (see OTHMAN). 4. *The S. of Aleppo*, who ruled from 1079 till their extinction in 1114. 5. *The S. of Mosul*, who was speedily supplanted by *attabegs*, or independent governors, of whom Zenghi, and his renowned son Noureddin (q. v.), were the most celebrated. 6. *The S. of Damascus*, an offshoot (1096) from the Aleppo principality, which lasted till 1155, when it was put an end to by Noureddin. 7. *The S. of Mardein*, who only appear in

common history as the allies of the S. of Iconium, Mosul, Aleppo, and Damascus, against the mighty crusading armies of Western Europe. And 8. *The S. of Khaurezm* (*Khiva*), who founded a great empire, including the whole of the country within the Jaxartes, the Bolar Mountains, the Indus, the Sea of Oman, and the Persian Gulf; but the last monarch, Allah-ed-din Mohammed Shah, having wantonly put to death some Mongol merchants who were pursuing their avocations within his dominions, was doomed to destruction by the terrible Genghis Khan (q. v.), who crossed the Sir-Daria, conquered Transoxiana, defeated Mohammed's armies, and drove the Shah himself to take refuge in an island of the Caspian, where he died. The advance of the Mongols was gallantly opposed by Mohammed's celebrated son, Jelal-ed-din, who twice defeated them; but being totally routed (1221), on the west bank of the Indus, by Genghis himself, he plunged his horse into the Indus, and safely reached the opposite bank, none of his enemies daring to follow him. The whole of this extensive empire now fell under Mongol domination.

SELKIRK, ALEXANDER. See JUAN FERNANDEZ.

SE'LKIRK, a Scottish royal burgh, capital of the county of the same name, on an eminence overlooking Ettrick Water and the famous field of Philiphaugh, where General David Leslie defeated Montrose and crushed the cause of King Charles in Scotland, 40 miles by the North British Railway south-south-east of Edinburgh. The county buildings (opened 1870), the old town-hall, with a spire 110 feet high, and the monuments to Sir Walter Scott and to Mungo Park, are the principal architectural features. S. has large woollen mills. Tweeds, hosiery, and blankets are the chief articles of manufacture. Pop. (1881) 6090. S. joins with Hawick and Galashiels in sending one member to parliament. S. commands a splendid view across the valley or haugh in which the Ettrick and Yarrow meet. It is within a few miles of many of the most famous localities in Scotland, and is a favorite starting-point for tourists desirous of exploring the 'Scott' country, the 'Forest,' the Yarrow, and St. Mary's Loch. Upwards of a hundred fighting men went from S. to join King James in his fatal march to Flodden; of these, only four returned, but they proudly bore a standard taken from the enemy on that occasion. The manufacture of 'single-soled shoon' long flourished here, and the 'Souters of Selkirk' are commemorated in song and story.

SELKIRKSHIRE, in ancient times called Ettrick Forest, is bounded by the counties of Midlothian, Roxburg, Dumfries, and Peebles, on the N., E., S., and W. respectively. It extends in length from north to south about 28 miles, and from east to west 16 to 18 miles, and consists mainly of the two parallel valleys through which flow the rivers Ettrick and Yarrow. Its area is 260 sq. m., or 166,524 acres. S. contains three entire parishes, and parts of other seven. It is in a great measure a pastoral county, and some of the hills are of considerable altitude, being upwards of 2000 feet in height. The hills are rounded at the top instead of peaked, and are covered generally with grass affording excellent pasturage, but in some places with heather. The arable land, situated from nearly 300 to 800 feet above sea-level, and bearing the proportion of about one-eighth of the area, is, in general, of a light soil, and produces the ordinary crops in abundance. Besides the Ettrick and Yarrow, the Tweed, Gala, and Caddon flow through parts of the county. The banks of several of these are beautifully wooded; but the extensive woods from which the county originally took its name of the Forest have disappeared. According to the agricultural returns for 1880, the acreage under permanent pasturage (exclusive of heath and mountain land) was 6630; that of corn crops was 5250, including 16 acres of wheat, 771 acres of barley, and 4442 acres of oats; that of green crops was 3230, embracing 2812 acres of turnips, 224 acres of potatoes, and 156 acres of cabbage, kohlrabi, and rape. The acreage under hay and grass, not included under permanent pasturage, was 7837.

The average of produce is above that of most of the other counties. Of horses, there were 556; of cattle, 2629; of sheep, 167,239; of swine, 335—total stock, 170,759. The old valued rent was £6692. The new valuation, including the burgh, is about £110,000. This county contains some historical scenes, among which is the field of Philiphaugh, where the Marquis of Montrose was defeated by the Covenanters under General Leslie. Oakwood Castle, in ruins, was the residence of the famous wizard, Michael Scott; and Newark, also in ruins, was the residence of Anne, Duchess of Buccleuch, where the *Lay of the Last Minstrel* is represented by Scott as having been sung. S. is pretty well appointed for roads. The Hawick line of the North British Railway runs for a short distance along its border, from which, at Galashiels, there is a branch to Selkirk; and the North British line from Edinburgh to Peebles passes through its northern end from Innerleithen to Galashiels, a distance of about 12 miles. There are several places of worship, belonging to the Establishment, the Free Church, and various other dissenting bodies. There is no coal, or lime, or sandstone. The Douglas family, four centuries ago, were the principal proprietors. The Duke of Buccleuch now holds about two-thirds of it. The population in 1871 was 18,572, and in 1881 it was 25,564. S. and Peeblesshire conjoined return one member to parliament.

SE'LTERS WATER (commonly but incorrectly written *Seltzer Water*), takes its name from the village of Lower Selters near Limburg, in the duchy of Nassau, where several springs united, in one basin, yield 5000 cubic feet an hour of this sparkling and effervescing mineral water. Its chief ingredients are carbonic acid, carbonate of soda, and common salt. It acts as a mild stimulant of the mucous membranes and as a diuretic; and is applied in chronic disorders of the digestive, respiratory, and urinary organs. It is much recommended as a beverage, either alone or with sugar, to those suffering from liver complaint, and in hot climates and seasons. More than 1½ millions of jars or bottles of this famous water are exported yearly to all quarters of the world, affording to the state a revenue of above £6000. The spring was discovered early in the 16th c., but was at first so little prized, that in the middle of the 18th c. it was rented for 4*s*. The water is little drunk at the springs. Artificial Selters Water is extensively manufactured both on a large scale and for domestic use. See AERATED WATERS.

SE'MAPHORE (from *sema*, a sign, and *phero*, I bear) was the name applied to the system of telegraphy in use before the application of the electric current. Semaphores were first established by the French in 1794, as a plan for conveying intelligence from the capital to the armies on the frontier. In the following year, Lord George Murray introduced them in England; and by their means the Board of Admiralty were placed within a few minutes of Deal, Portsmouth, or Plymouth. These semaphores consisted of towers built at intervals of from 5 to 10 miles, on commanding sites. On the top of each tower was the telegraph apparatus,

Semaphore.

which at first comprised 6 shutters arranged in 2 frames, by the opening and shutting of which, in various combinations, 63 distinct signals could be formed. In 1816, Sir Home Popham substituted a mast with 2 arms, similar to many of the present railway signals. The arms were worked from within the tower by winches in the look-out room, where a powerful telescope in either direction constantly commanded the mast of the next station. If a fog set in at any point on the route, the message was delayed; otherwise, when a sharp look-out was kept, the transmission was very rapid. For instance, the hour of one by Greenwich time was always communicated to Portsmouth when the ball fell at Greenwich; the semaphores were ready for the message, and it commonly passed from London to Portsmouth and the acknowledgment back to London within three-quarters of a minute. Each station was in the charge of a naval officer—usually a lieutenant—with one or two men under him. To save the cost of this establishment, the Deal and Plymouth lines fell into disuse soon after the peace of 1815; and the superior advantages of the electric telegraph being incontestable, the Portsmouth line sent its last message on the 31st December 1847, and, on land at least, the semaphore closed its career of usefulness for ever. In calm weather, when flags will not extend, semaphores are employed on board ship as a means of signalling from vessel to vessel, or to the shore; in such a case, the post containing the arms is movable, and can be readily shipped or unshipped near the stern. See also SIGNALS.

SE'MÉ, in Heraldry. When a charge is repeated an indefinite number of times so as to produce the appearance of a pattern, the term *semé* (sometimes *aspersed* or *powdered*) is applied to it. When a field is semé, it is treated as if it were cut out of a larger extent of surface, some of the charges being divided by the outline of the shield. The term *crusilly* denotes semé of cross crosslets, and *billetty* semé of billets.

Semé.

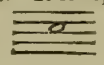
SEMECA'RPUS, a genus of trees of the natural order *Anacardiaceæ*. The MARKING NUT of India is *S. anacardium*, a tree 50 feet high, growing on mountains. The swollen receptacle of the flower becomes a succulent fruit, eatable when roasted, but

astringent and acrid when raw. On the receptacle is seated the nut, which is heart-shaped and black, consisting of a kernel—not unwholesome, although rarely eaten—surrounded by two skins, between which is a black acrid juice. This juice is used in medicine as an external application to heal rheumatism, &c. It is also in general use in India for marking cotton cloth; and the color is improved, and running prevented, by the addition of a little quicklime and water. The wood of the tree contains so much acrid juice that it is dangerous to work upon.

SE'MELE. See BACCHUS.

SE'MENCINE, SEMEN CINÆ, AND SEMEN CONTRA. See ARTEMISIA.

SEME'NDRIA, a frontier fortress of the principality of Servia (q. v.), stands amid romantic scenery on the right bank of the Danube, 28 miles south-east of Belgrade. The inhabitants, about 12,000 in number, are employed principally in the wine-culture, in breeding hogs, and in general trade. It was at one time the seat of the Servian kings; and it has been frequently stormed by the nations who have contended for the Danube from the middle ages to the present century.

SE'MIBREVE, in Music, a note of half the duration of the breve of old ecclesiastical music, but the longest note in use in modern music. It is represented by a character circular or elliptical in form  and is adopted as the integer or measure-note, the other notes—minim, crotchet, quaver, &c.—being proportional parts of it.

SEMI-DEMI-SEMIQUAVER, a musical note, of which 8 are equivalent to a quaver, 32 to a minim, and 64 to a semibreve. It is represented thus, or in groups thus,

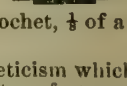
SE'MINOLES, a tribe of American Indians, originally a vagrant branch of the Creeks, whose name, Seminole, signifies wild or reckless. In 1705, they aided in driving the Appalaches from Florida; and in 1817, they joined with the Creeks and some negroes who had taken refuge with them, ravaged the white settlements in Georgia, plundering plantations, and carrying off slaves, whom they refused to surrender. General Jackson, sent to punish them, took at the same time several Spanish forts, and hastened the negotiations which ended in the cession of Florida to the United States. At this cession in 1823, the S. engaged to retire into the interior, and not molest the settlers; but as the negroes continued to take refuge with them, a treaty was made with some of the chiefs, in 1832, for the removal of the whole tribe west of the Mississippi. This treaty was repudiated by the tribe, at the instigation of Osceola (q. v.), one of their chiefs; and a war commenced against a handful of savages, which lasted eight years, and cost thousands of lives, and ten millions of dollars. In the end, the remains of the tribe were removed to the Indian Territory on the borders of Arkansas.

SEMIPALATI'NSK, an extensive Russian territory in Central Asia, is bounded on the E. and S. by Tomsk, the Chinese empire, and Turkestan. Area, 170,000 sq. m.; pop, (1880) 526,000. It is separated from Turkestan on the south by the Alexandrian Mountains in lat. 42° 30′ N., and it is traversed by several other mountain chains. The chief rivers are the Irtish, Ili, and Chui; and among the lakes are those of Issik-Kul, Ala-Kul, and Balkash. The country abounds in pasturage, and cattle form almost the sole wealth of the inhabitants, although the precious metals, together with lead and copper, are found. Steamers ply on the great rivers and lakes.—Semipalatinsk, the capital, stands on the left bank of the Irtish, in lat. about 50° 15′ N. It is the seat of an important transit-trade, and contains (1880) 14,200 inhabitants.

SEMI-PELA'GIANISM, a modification, as the name implies, of the doctrine of the Pelagians as to the powers of the human will, and as to the effects to be attributed to the action of the supernatural grace of God, and of the divine decree for the predestination of the elect. The Pelagians (q. v.), discarding altogether the doctrine of the fall of Adam, and the idea that the powers of the human will had been weakened through original sin, taught that man, without any supernatural gift from God, is able, by his own natural powers, to fulfil the entire law, and to do every act which is necessary for the attainment of eternal life. The condemnation of this doctrine by the several councils held in the early part of the 5th c. is capable of various constructions, and has been urged by some to the extreme of denying altogether the liberty of man, and converting the human will into a merely passive instrument, whether of divine grace upon the one hand, or of sinful concupiscence upon the other. The writings of St Augustine on this controversy have been differently construed by the different Christian Communions (see PELAGIANS); and the same diversity of opinion existed in his own day.

Among those who, dissenting from the extreme view of Pelagius, at the same time did not go to the full length of the Augustinian writings in opposition to Pelagius, were some monks of the southern provinces of Gaul, and especially of Marseille whence their school was called Massilian, from the Latin name (*Massilia*) of that city. Of these leaders, the chief was a priest named Cassian, who had been a deacon at Constantinople. Of the system which he propounded, without going into the details, although many of them are exceedingly curious and interesting, it will be enough to say that it upheld the sufficiency of man's natural powers only so far as regards the first act of conversion to God and the initial act of man's repentance for sin. Every man naturally possesses the capability of beginning the work of self-conversion; but for all ulterior acts, as well as for the completion of justification, the assistance of God's grace is indispensable. The Semi-Pelagian doctrine is often confounded with that of the Molinistic (see MOLINA) school of Roman Catholic theology; but there is one essential difference, viz., that the latter persistently maintain the necessity of grace for all supernatural acts, even for the beginning of conversion, although they are generally represented as agreeing with the Semi-Pelagians as to the mode of explaining the freedom of the human will acting under the influence of divine grace. The chief writers in the controversy were Prosper, Hilary, and Fulgentius; and the question was referred to Celestine, Bishop of Rome in 431. It continued, however, to be agitated in the West for a considerable time. Faustus, Bishop of Riez, towards the end of the 5th c., revived the error, and it was condemned in a council held at Arles in 475, and still later in a synod (the second) held at Orange (Arausio) in 525, and again in the third council of Valence in 530.

SEMIPLE'NA PROBA'TIO, in Scotch Law, is that kind of half-proof, half-suspicion which was usually given in cases of affiliating a bastard, as well as in a few other cases. It was a species of *primâ facie* evidence; and when considered by the court sufficient, it was eked out by the oath of the party, called an Oath in Supplement. The practical effect of the admission of parties as witnesses, under 16 Vict. c. 20, has been to do away with Oaths in Supplement, the parties being usually the principal witnesses, and the court deciding from a consideration of the balance of credibility between them.

SE'MIQUAVER, a musical note, represented thus, or in groups thus,  equivalent in value to $\frac{1}{2}$ of a quaver, $\frac{1}{4}$ of a crochet, $\frac{1}{8}$ of a minim, or $\frac{1}{16}$ of a semibreve.

SEMI-QUI'ETISM, a form of mystical asceticism which, while it adopts the theoretical principle, that the most perfect state of the soul is that of passive contemplation, and denies, in certain conditions of the soul, the necessity of prayer or other active manifestations of virtue, yet maintains the incompatibility of this passive contemplation with any external sinful or sensual action. The Semi-Quietists thus differed from the grosser sectaries referred to under QUIETISM.

SEMI'RAMIS. See ASSYRIA.

SEMITIC. See SHEMITIC.

SE'MITONE, in Music. The name given to the smaller intervals in the diatonic scale, as E F or B C, in which the ratio is as 15 to 16.—In the pianoforte, the interval between any two notes between which no other note is interposed, as C to C♯ or B♭ to B, is a semitone.

SEMLER, JOHANN SALOMO, one of the most influential German theologians of the 18th c., was born, 18th December 1725, at Saalfeld, where his father was archdeacon, educated at Halle, and in 1749 went to Coburg as professor at the gymnasium. In 1751, he was appointed a Professor of Theology at Halle, where he taught with great success; and six years later, became director of the theological seminary there. He died 14th March 1791. S. was, in the early part of his student-career, somewhat of a Pietist, but the prelections of Sigm. Jak. Baumgarten may be said to have revolutionized his religious convictions, and swung him round to rationalism, of which he was the first systematic exponent. S.'s rationalism, however, was always moderate in *degree*, though definite enough in *kind*. As a thinker, he was deficient in philosophical consistency and breadth of view; and as a writer, he possessed no literary skill or grace; but his works are valuable for the spirit of historical criticism by which they are pervaded. The principal are: *Apparatus ad liberalem Veteris Testamenti Interpretationem* (Halle, 1773), *Abhandlung von der Untersuchung des Kanons* (4 vols., Halle, 1771—1775), *De Dæmoniacis* (Helle, 1760), *Umständliche Untersuchung der Daemonischen Laute* (Halle, 1762), *Versuch einer Biblischen Daemonologie* (Halle, 1776),

Selecta Capita Historiæ Ecclesiasticæ (3 vols., Halle, 1767—1769), *Commentationes Historicæ de Antiquo Christianorum Statu* (2 vols., Halle, 1771—1772), *Versuch Christlicher Jahrbücher oder ausführliche Tabellen über die Kirchengeschichte bis aufs Jahr.* 1500 (2 vols., Halle, 1783—1786), *Observationes novæ, quibus Historia Christianorum usque ad Constantinum Magnum illustratur* (Halle, 1784).—See his *Lebensbeschreibung von ihm selbst verfasst* (Halle, 1781—1782), Schmid, *Theologie Semler's* (1858), and Tholuck in his *Vermischte Schriften.*

SEMLIN, a frontier town of Austria, in the Croatian-Slavonian Frontier (till of late the Military Frontier), stands on a tongue of land at the junction of the Save and Danube, on the right bank of the latter, opposite Belgrade. Within recent years, the town has been much improved, though even yet a suburb consisting of mud huts thatched with reeds stretches along the Danube. The only noteworthy edifices are the churches, the German theater, and the Lazaretto (*Contumaz*), the chief quarantine station in the whole of the Military Frontier. At this institution, travelers crossing from Turkey are compelled to remain a greater or less time—sometimes 40 days—in proportion to the violence and proximity of the plague. The reason why the principal Lazaretto is here is, that S. is the great seat of the Turco-Austrian transit-trade, and the principal ferry for passengers from Christendom to the land of the Moslem. Pop. (1880) 9500.—For a graphic notice of S., see Kinglake's *Eothen.*

SEMMERING, a mountain on the borders of Styria and Austria, and 44 English miles south-west-by-west from Vienna, is 4416 feet above the level of the sea. The Vienna, Grätz, and Trieste Railway has been carried across this mountain by a series of ingenious engineering contrivances. See GLOGGONITZ.

SEMMES, RAPHAEL, American naval officer was born in Maryland about 1810, in 1828 entered as midshipman in the sloop-of-war *Lexington*, and was employed in the service as passed midshipman and lieutenant until 1855, when he attained the rank of commander. In 1858, he was appointed Secretary to the Light-house Board; but resigned March 26, 1861, joined the naval service of the Confederate States, and was appointed to the command of the war-steamer *Sumter.* The career of Captain S. until the sinking of his famous ship, the *Alabama*, by the American war-steamer *Kearsage*, is described at length in the article ALABAMA. Captain S., with 13 officers and most of his men, was rescued from drowning by the yacht *Deerhound*, and brought to England, where he expected to take command of one of two rams built at Liverpool for the Confederates, but which were seized by the British government. He returned to America, was included in the surrender, and was elected Judge of Probate at Mobile, Alabama; but, being prohibited by the Federal authorities, he was, in 1866, appointed Professor of Moral Philosophy in the southern university. He published the *Cruise of the Alabama and the Sumter*, in 1864; and *My Adventures Afloat* in 1869.

SEMNOPITHE'CUS, a genus of monkeys, natives of the East, having a very long, slender, powerfully muscular, although not prehensile, tail. The canine teeth are long, but the molar teeth are more tuberculous than in Gibbons (q. v.) and other allied monkeys, indicating a greater aptitude for vegetable food. With this the structure of the stomach corresponds, which is very remarkable, and different from that of all other animals; consisting of a cardiac pouch, slightly bifid at the extremity; a very wide middle portion, formed of numerous pouches or sacs; and a very long canal, furnished with sacs at its commencement, but simple towards its termination. Professor Owen has been careful, however, to point out that these three portions do not correspond to any of the parts of the stomach of a ruminant animal, not exhibiting any such diversities in their internal surface. The species are numerous. The Entellus (q. v.) Monkey is one of them. Another is the Negro Monkey (*S. Maurus*) of Java, remarkable for its jet-black color and long silky hair.

SEMOLI'NA (Semola or Semoule), an article of food much used in France and Italy, and to a small extent in Britain, and other countries. It consists of particles of wheat varying in size from grains of sand to small millet. Only the hard-grained wheats of Spain, Odessa, and Southern Italy are adapted for making it; these hard wheats are not easily reduced to flour, and small particles escape being crushed by the mill-stones, and will not pass through the sieves—these constitute semolina. In France, more attention is paid to this article than in any other country; and as it fetches a higher price than flour, the skilful miller so adjusts his mill-stones as to produce a considerable quantity. The granules of Semolina are of various sizes, and they are carefully separated by sieves, the openings of which are from fine to coarse. A favorite kind of bread made of the coarser kinds of semolina—the semoule of the French—is sold in Paris under the name of *gruau.* In Italy, it is used in making polenta, in common with maize, meal, and millet; and in Britain it is used for puddings.

SE'MPACH, a small town of Switzerland, in the canton of Lucerne, and 9 miles by railway north-west of the town of that name, stands on the east shore of the lake of Sempach. It is surrounded with walls, now in a ruinous condition, has a population of a little over 1000, and was one of the outposts of the confederate cantons against their Swabian and Austrian assailants in the 14th century. Under the walls of S. took place the second great conflict of the confederated Swiss cantons with Austria. Leopold's army of 4000 horse and 1400 foot arrived before S. on the 9th July 1386, and found itself unexpectedly opposed by the confederated Swiss to the number of 1300. The nature of the ground being unfitted for the action of cavalry, the knights dismounted, and formed themselves, into a solid and compact body, which was at once charged by the Lucerners; but the wall of steel was impenetrable, and not a man of the Austrians was even wounded, while 60 of the bravest of Lucerne with their landamman fell. The mountaineers were beginning to despair of making an impression on their apparently invulnerable opponents, when Arnold von Winkelried, a knight of Unterwalden, seized with a noble inspiration, rushed forward, grasped with outstretched arms as many pikes as he could reach, buried them in his bosom and bore them by his weight to the earth. His companions rushed over his body into the breach thus made, slaughtered the armor-encumbered knights like sheep, and threw the remainder into the utmost confusion and dismay. The conflict continued in an irregular manner for some time longer, but the result was a decisive victory for the Swiss, who had lost only 200 men; while the loss of the Austrians was ten times as great, including 600 counts, barons, and knights. The body of Duke Leopold, who had throughout displayed the most obstinate valor, was found next day buried among a heap of slain. The anniversary of this great victory is still celebrated by prayer and thanksgiving on the field of battle.

SEMPERVI'VUM. See HOUSE-LEEK,

SENATE. See ROME.

SENA'TUS ACADE'MICUS, one of the governing bodies in the Scottish universities, consisting of the Principal and Professors. It is charged with the superintendence and regulation of discipline, and the administration of the university property and revenues, which last function, since the Universities Scotland Act of 1858, the Senatus exercises subject to the control and review of the University Court. Degrees are conferred by the Senatus through the Chancellor or Vice-chancellor. The Principal is president, and besides his deliberative vote, has a casting-vote. In his absence, the senior professor present acts as chairman, who has also a double vote. One-third of the Senatus is required to form a quorum.

SENDOMIR or SANDOMIR MOUNTAINS. See RADOM.

SE'NECA, M. ANNÆUS, the rhetorician, was born at Corduba (Cordova) in Spain. The time of his birth is doubtful, probably about 61 B.C. He seems to have been in Rome during the early period of the power of Augustus. He was rich, belonged to the equestrian order, and enjoyed the friendship of many distinguished Romans. From Rome he returned to Spain, where he married Helvia, and had by her three sons. The time of his death is uncertain; but he probably lived till the close of the reign of Tiberius, and died in Rome or Italy. His extant works are *Controversiarum Libri X.*, and *Suasoriarum Liber*, neither of which is complete. They are elaborately rhetorical in style, but do little to support the fame of their author, who is more remembered for his prodigious memory than for anything else,

SENECA, L. ANNÆUS, son of the preceding, and a celebrated philosopher, was also born at Corduba, a few years B.C. When a child, he was brought by his father to Rome, where he was initiated in the study of eloquence. He cared more, however, for philosophy, in which his first teacher was the Pythagorean Sotion, whom he afterwards left to follow Attalus the Stoic. He traveled in Greece and Egypt; and, in obedience to his father's wishes, he pleaded in courts of law; but notwithstanding his forensic triumphs, he left the bar from fear of Caligula's jealousy. On entering into public life, he filled the office of quæstor, and had already risen high in the favor of the Emperor Claudius, when he was accused of an adulterous connection with Julia, the daughter of Germanicus, and wife of Vinicius. He was exiled to Corsica, where he remained for eight years, deriving from philosophy what consolation he could, while incessantly complaining with a by no means philosophic querulousness, and appealing to the emperor for pardon. When Claudius married his second wife, Agrippina, S. was recalled by her influence, raised to the prætorship, and appointed instructor of her son Nero. On the death of his governor and military tutor, Burrus, Nero gave way to his depraved passions with a force which S. could not control. All his influence over his pupil was lost, but he profited by his extravagant bounty to such a degree that his accumulated wealth amounted to 300,000 sestertia, or to £2,421,870 of our money. Nero soon began to

look with envious eyes on this fortune; and S., to avert dangerous consequences, offered with much tact, to refund to the emperor his gifts, and begged leave to retire on a small allowance. This Nero declined; and S., under pretence of illness, shut himself up, and refused to appear in public. Nero then attempted to have him poisoned, but failed.

A short time afterwards, Antonius Natalis, when on his trial for participating in the conspiracy of Piso, implicated S. as one of the conspirators. This was quite enough to fix S.'s guilt. He was sentenced to put himself to death. His wife, Paullina, declared her resolution to die with him, and, in spite of his remonstrances, accompanied him into the bath in which, according to his own choice, he was to be bled to death. The emperor, however, would not allow Paullina to die, but removed her from her husband, who gradually expired, 65 A.D. S.'s extant writings are mainly on moral subjects, and consist of Epistles, and of treatises on Anger, Consolation, Providence, Tranquillity of Mind, Philosophical Constancy, Clemency, The Shortness of Life, A Happy Life, Philosophical Retirement, and Benefits. He also speculated on physical phenomena, and wrote seven books entitled *Quæstiones Naturales*, in which he is thought to have anticipated some notions regarded as principles in modern physics. Ten tragedies, ascribed to him by Quintilian, and generally included in editions of his works, have also come down to us; but whether he is really their author remains still a dubious and debated point. Some allege that they were the work of his father, Seneca the rhetorician; some that they must be attributed to another Seneca. They were not intended, and are certainly not adapted for the stage. They are overcharged with declamation; and, if rich in moral sentiments, are wanting in dramatic life. Of his genuine prose writings, modern opinion takes a divided view; some critics praising his practical sagacity, others finding him wanting in speculative reach. It is perhaps a significant fact, that he is admired by French scholars, and disparaged by German. One of the best editions of the prose works is the Bipontine, 1809; of the tragedies, that of Bothe, 1819.

SENECA LAKE, one of a range of narrow lakes in the western part of the state of New York, U. S. It is 37 miles from north to south, and from 2 to 4 miles in width, 441 feet above the Atlantic, 630 feet deep, and was never known to be frozen over until March 1856. It is navigated by steamboats from its head to the pretty village of Geneva at its mouth, and empties itself by the Seneca and Oswego rivers into Lake Ontario. It takes its name from the Seneca Indians, one of the Six Nations.

SENE'CIO, a genus of plants of the natural order *Compositæ*, suborder *Corymbiferæ*, having a hairy pappus, a naked receptacle, and a cylindrical involucre of linear equal scales, with a few smaller scales at their base. The species are very numerous; annual, perennial, and half-shrubby plants, natives chiefly of the temperate and cold parts of the world, the half-shrubby species being from the warmer latitudes. Eleven species are reckoned as British, and commonly known as Groundsel (q. v.) and Ragwort (q. v.). *S. Saracenicus*, probably not a true native of Britain, but introduced in the middle ages, has undivided lanceolate leaves, and was once in repute as a vulnerary. The FIREWEED of North America is *S. hieracifolius*. It receives its popular name from its appearing abundantly wherever a part of the forest has been consumed by fire. Many species of S. have a strong disagreeable smell. A few are rather ornamental as flowers.

SENE'FFE, or SENEF, a town in the province of Hainault, Belgium, about 11 miles north-west of Charleroi, has a pop. of between 3000 and 4000, and is the center of a district in which manufactures of pottery and glass are extensively carried on. S., however, is chiefly notable for its proximity to the battlefield on which William of Orange (III. of England), at the head of the forces of the coalition against France, was defeated, after a bloody contest, by the Great Condé, 11th August 1674. In William's army there were four lieutenants—Montecuculi (q. v.), Duke Charles of Lorraine, the Prince of Waldeck, and the Prince of Vaudemont, the first three of whom subsequently attained prominence as military commanders. Of the allied forces of 60,000 men, the Dutch lost from 5000 to 6000 men, the Spaniards 3000, and the Imperialists 600; while the French army, which entered into the conflict 30,000 strong, could scarcely muster 20,000 after their victory.—Under the walls of S., Moreau, in 1794, defeated the Austrians.

SE'NEGA or SNAKE ROOT is the dried root of *Polygala Senega*. The following are its characters: 'A knobby root-stock, with a branched tap-root of about the thickness of a quill, twisted and keeled; bark, yellowish-brown, sweetish, afterwards pungent, causing salivation; interior, woody, tasteless, inert.' Senega is a powerful and trustworthy stimulating expectorant, and may be advantageously prescribed in the advanced stages of chronic bronchitis and pneumonia, especially when occurring in aged or very debilitated patients. It is also a valuable remedy in prolonged hooping-cough, and in the latter stages of croup and of bronchitis in young children. The preparations are the Infusion and the Tincture; the average dose of the former being an ounce and a half, of the latter a drachm. For children, the powdered root in doses of ten grains is the best form. See POLYGALA.

SENEGA'L (called by the natives *Senaga*), a large river in Western Africa, rises in Mount Cooro, in lat. 10° 30′ N., long. 10° 40′ W., flows first north-west and then west, and falls into the Atlantic after a course of 1000 miles, for the last 740 of which it is navigable for flat-bottomed boats. Here and there, throughout the whole course, the navigation is interrupted by cataracts, shoals, and rocks. In the lower course, the river forms numerous, large, cultivated, and very fertile islands, and its banks are green and productive, and in part clothed with wood. The entrance is difficult on account of breakers and a bar which, in the dry season, is covered by only 8 to 9 feet of water. It is navigable for some months by fair-sized steamers to Mediné (the furthest inland French station), 650 miles from the mouth. Thence the French were in 1883 making a railway to Bamakon on the Niger.

SENEGAMBIA, a large tract of country in Western Africa, lying between the Senegal and Sierra Leone. It is bounded by the Atlantic on the west, but has very indefinite limits towards the east. The country takes its name from its two principal rivers, the Senegal and the Gambia. Between these two rivers, which are 250 miles apart, there are no watercourses of any importance, and from the Gambia south to the frontier of Sierra Leone, the only considerable stream is the Rio Grande. The coast is deeply indented by arms of the sea, which resemble the estuaries of rivers. The country forms the western and northern declivity of the plateau of Kong, and part of is still unexplored. The soil is of two kinds, that of the coasts, and that of the interior: the former consisting in part of low flat alluvial plains, and partly of an undulating country, which broadens toward the north, until, on the northern frontier, it merges into the Sahara; while the plateau of the interior rises from the coast plains in mountainous terraces, until it loses itself in the Kong Mountains. Its loftiest elevations are only about 3280 feet high. S. is divided into three districts—High, Middle, and Low Senegambia. The first comprises the country to the north of the Senegal, and is inhabited by Moors, who, of course, profess Islamism. Middle S. comprises the countries bordering the Senegal, having an area of 1350 sq. m., and is inhabited by Negroes, who divide themselves into numerous tribes. Of this tract, the climate is extremely hot, and is unhealthy in the marshy districts. The soil is generally fertile, and yields the crops usually produced in the hot regions of Africa. Low S. comprises the countries bordering the Gambia, and extends south to Nunez. France possesses on the left bank of the Senegal (inland to Mediné), and along the coast to the Gambia, about 96,000 sq. m. of territory; the Portuguese, a small tract (30 sq. m.) on and around the estuary of the Rio Grande; and the English some little territory at the mouth of the Gambia (28 sq. m.).

SE'NESCHAL (Teuton. *sene-scalc*, senior servant?), in the origin of the office, probably an attendant of the servile class who had the superintendence of the household of the Frankish kings. In the course of time, however, the seneschalship rose to be a position of dignity, held no longer by persons of servile race, but by military commanders, who were also invested with judicial authority. The lieutenants of the great feudatories often took the title of seneschal. A similar office in England and Scotland was designed steward, but is rendered into Latin as *senescallus*.

SENIOR, NASSAU WILLIAM, political economist, born 1790, eldest son of Rev. J. R. Senior, vicar of Durnford, Wilts, was educated at Eton, and Magdalen College, Oxford, where he graduated in 1811, taking a distinguished first-class in classics. In 1819, he was called to the bar at Lincoln's Inn. In 1825, he was elected to the professorship of Political Economy at Oxford, founded by the late Henry Drummond, M.P. He held it for the statutory term of five years, and was succeeded by Mr. Whately, afterwards Archbishop of Dublin. In 1832, the enormous evils of the poor-law administration in England led to the appointment of a Commission of Inquiry. S. was one of the commissioners; and the portion of the Report in which the abuses of the existing system were detailed, was drawn up by him. This Report encouraged the Whig government to bring in the Poor-law Amendment Act of 1834. See POOR AND POOR LAWS. In 1836, he received the appointment of Master in Chancery; and in 1847, was re-elected to his former professorship for another term of five years.

More recently, he was nominated one of the commissioners of National Education, under the presidency of the late Duke of Newcastle. His publications, which are numerous, comprise various excellent treatises on political economy, some of which were delivered in the form of lectures at Oxford, and several pamphlets on social and political questions. He also contributed numerous articles to the *Edinburgh Review*, and other leading periodicals. He has left some interesting journals of his visits to

Turkey and Greece, and observations on the political and social condition of these countries. His *Essays on Fiction*, contributed to the chief reviews between the years 1821 and 1857, and republished in 1864, relate principally to the novels of Scott, Bulwer Lytton, and Thackeray. He analyzes the plots, and classifies the characters of the Waverley novels with curious felicity, and devotes a masterly essay to Thackeray, whom he regards as the greatest novelist of his day. The intellect of S. was clear and penetrating, and the perspicuity of his style made him an able expositor of the truths of political and social science. The *Treatise on Political Economy* was reprinted for the *Encyclopædia Metropolitana*. His *Conversations with distinguished Persons during the Second Empire*, a most interesting and valuable work, appeared in 1878. He died June 4, 1864.

SENLIS, a very ancient town of France, dep. of Oise, 33 miles north-north-east of Paris. Its older portion is surrounded by walls, flanked with 16 towers, which are all that remain out of the 28 towers of early times. The cathedral, a small edifice, is a beautiful example of early Gothic. Manufactures of cloth, lace, and thread are actively carried on. Pop. (1876) 6537.

SENNA is one of the most important purgatives contained in our Materia Medica. Two sorts of senna are recognized in the Pharmacopœia—viz., Alexandrian senna and Tinnevelly senna. The Alexandrian senna leaves are chiefly obtained from *Cassia lanceolata*, while the Tinnevelly senna leaves are yielded by *Cassia elongata*. *Alexandrian senna* is chiefly grown in Nubia and Upper Egypt, and is imported in large bales from Alexandria. It is apt to be adulterated largely with the flowers, pods, and leaves of *Cynanchum arghel* and *Tephrosia apollinea*. *Tinnevelly* or *East Indian senna* in odor and taste entirely resembles Alexandrian senna. The leaflets are, however, about two inches long, lanceolate, acute, unequally oblique at the base, flexible, entire, green, without any admixture.

Senna is, as Dr. Christison observes in his *Dispensatory*, 'so certain, so manageable, and so convenient a purgative, that few remedies of its class are held in equal estimation. In point of energy, it holds a middle place between the mild laxatives and drastic cathartics. It acts chiefly on the small intestines, increasing their mucous secretion, as well as their peristaltic motion, and producing loose brown evacuations.' The drawbacks to its more universal administration are its disagreeable taste, and its tendency to produce nausea, griping, and flatulence; the means of correcting which are subsequently noticed. The only circumstance positively contra-indicating its employment is an inflammatory state of the intestinal mucous membrane Although senna has been frequently submitted to chemical analysis, its active principle is not known; but whatever the cathartic principle may be, it is obviously absorbed into the circulation before it begins to operate, since this drug imparts a purgative property to the milk of nurses.

The following are the most important preparations of this medicine:

1. *Infusion of Senna*, which is obtained by infusing for one hour, and then straining, half an ounce of senna and half a drachm of sliced ginger in half a pint of boiling water. The taste of this infusion is much concealed by the addition of some black tea, or what Neligan finds 'still better, coffee, and it may be sweetened with sugar, and milk added; it is in this way readily taken by children.' The addition of neutral laxative salts checks the griping, which is often caused by senna alone, and at the same time increases its activity. The ordinary *Black Draught* is commonly prepared by adding one ounce of sulphate of magnesia to four ounces of infusion of senna. Two or three ounces of this mixture, to which a drachm each of the tinctures of senna and of cardamoms may be added, usually act as a very useful aperient.

2. *Tincture of Senna*, composed of senna, raisins, caraway seeds, and coriander seeds macerated in proof-spirit, and formerly known as *Elixir Salutis*, or *The Elixir of Health*, is seldom given alone. Christison recommends a mixture of an ounce of the tincture of senna with an ounce and a half of sulphate of magnesia, dissolved in four ounces of water, and as much infusion of roses. 'A wine-glassful of this given every hour seldom fails to act with energy, and without sickness or tormina, and is an excellent combination for most febrile disorders.' The tincture is, however, most commonly prescribed in doses of one or two drachms, as an adjunct to other cathartic mixtures, to correct their griping properties.

3. *Confection of Senna*, commonly known as *Lenitive Electuary*, is a pulpy mixture of powdered senna with powdered coriander seeds, figs, tamarinds, cassia pulp, prunes, extract of liquorice and sugar; all of which substances are, under certain specified conditions, combined by the action of boiling water. When properly prepared, which is often not the case, it forms a mild aperient, well suited for persons suffering from piles.

In the above preparations, it is immaterial whether Alexandrian or East Indian senna is employed.

The senna leaves of commerce and of medicine are the produce of several species of *Cassia* (q. v.), natives of India, Arabia, Syria, and the north of Africa. *Cassia obovata* is a perennial herbaceous plant 1—2 feet high, having smooth leaves, six or seven pair of obovate obtuse leaflets, racemes of yellow flowers, and curved, compressed pods, with an interrupted ridge along the middle of each valve. It is found in Egypt and Nubia, and is now also cultivated in Italy, Spain, the West Indies, &c.—*C. acutifolia* is a half shrubby plant, about two feet high, with racemes of yellow flowers, lanceolate acute leaves, and flat elliptical pods, somewhat swollen by the seeds. It grows in the deserts near Assouan, and the leaves are collected by the Arabs, and carried by merchants to Cairo for sale.—*C. elongata* is an annual with erect, smooth stem; narrow leaves, with 4—8 pair of lanceolate leaflets, which are rather downy beneath; racemes of yellow flowers; and oblong pods, quite straight, rounded at the apex, and tapering to the base. It grows in India.—*C. Æthiopica* is about 18 inches high, with 3—5 pair of oval-lanceolate, downy leaflets; the pods flat and smooth. It grows in the North of Africa.—*C. lanceolata* is an Arabian species, differing from the others in its erect pods.—All these seem to furnish the officinal senna.

Linnæus, not aware of the diversity of species, assigned it to one which he named *C. Senna*, but it would be hard to say which has a preferable claim to this name. All the species have the leaflets unequal-sided, by which they are readily distinguished from other leaflets often used for the adulteration of senna, as those of *Argel* (q. v.) and *Bladder Senna*. The commercial names of the different kinds of senna do not seem in general to correspond with differences of species, but rather to refer to the countries or ports from which they are brought.

BLADDER SENNA (*Colutea*) is a genus of shrubs of the natural order *Leguminosæ*, suborder *Papilionaceæ*, having pinnated leaves, red or yellow flowers, and remarkably inflated pods, whence the English name. One species (*C. arborescens*) is common in shrubberies in Britain. It is a native of the south of Europe, and is found on the ascent of the crater of Mount Vesuvius—almost the only plant that exists there.

SENNAA'R, lately a negro state, is now an Egyptian pashalik in the south of Nubia. The town from which it is named, *Sennaar*, near the Bahr-el-Azrek, and 160 miles S.S.E. of Khartoum, was once a most important city, but is still a trading center of some consequence. Pop. about 10,000.

SENNA'CHERIB, an Assyrian king, son of Sargon, reigned 702—680 B.C. The interest attaching to his name is principally due to the extraordinary and incomprehensible disaster that befell his army, either at Libnah or at Pelusium, when no fewer than 185,000 Assyrians are said to have been slain by the 'angel of the Lord' (see HEZEKIAH). The Egyptian account of this mysterious affair (reported by Herodotus, book ii. 141), and that of Berosus the Chaldæan, quoted by Josephus (*Antiq. of Jews*, book x. chap. 1), as well as the scriptural narrative (2 Kings, chap. 18) justify us in believing that S. at least sustained, a sudden, unexpected, and terrible overthrow, which forced him to retreat in hurried confusion to his own country. All that we know of his subsequent history is, that he was assassinated by his sons while worshiping his favorite god. The discrepancies, both as regards dates and names in the life of S., between the writer of Kings and profane historians, are felt even by strenuous apologists, like the Rev. George Rawlinson, to be almost, if not altogether irreconcilable. S. belongs to that showy class of eastern monarchs whose rule is commonly described as 'magnificent'—i. e., he built great palaces, and erected monuments in the different parts of his empire, and everywhere left an impression of his grandeur. In Scripture, in Herodotus, in Josephus, S. is the 'Great King.' His most imperial work was the palace at Koyunjik, which covered a space of more than eight acres, and was richly adorned with sculpture.

SENS, an old town of France, in the dep. of Yonne, 70 miles south-east of Paris, stands amid pleasing scenery on the right bank of the Yonne. The town proper is surrounded by walls, chiefly of Roman construction, and in the vicinity, the remains of ancient roads and of Roman camps abound. The spacious and handsome Gothic cathedral is the principal edifice. An active trade in wines, grain, hemp, wool, and timber is carried on. Pop. (1876) 12,251.

SENSA'TION (in Physiology) may be defined to be 'the perception by the mind of a change wrought in the body.' According to this definition, which is borrowed from Dr. Todd, sensation involves—first, a bodily change from some cause, whether inherent or external; and secondly, a mental change, whereby the perception of the bodily change is accomplished. The true organ of sensation is the brain, and especially that portion of it which (to use the words of the above-named eminent physiologist) constitutes the center of sensation, and extends into the spinal cord, forming the posterior horns of its gray matter. See SPINAL MARROW. Physiologists distinguish between *common* and *special*

sensation. Common sensation exists in the skin, and in all parts of the body to which ordinary sensory nerves are distributed, and is excited by ordinary mechanical or chemical stimuli; while special sensation is exemplified in the special senses of vision, hearing, &c. For the due action of the latter, there are organs of special sensation, which, by the peculiar character of the nerves with which they are supplied, become the recipients of impressions of a particular kind; thus, the eye is sensible to light, the ear to sound, &c.; and if the special nerves going to these organs be irritated, instead of pain being excited, as in the case of an ordinary sensory nerve, there is a feeling closely allied to that which would be excited by the application of the normal stimulus, as light, sound, &c. Any *ordinary* sensibility those organs (the eye, ear, &c.) possess is dependent on ordinary sensory nerves, and is quite independent of the nerves of special sense.

In works on the physiology of the nervous system, we often meet with the phrases *objective sensation*, *subjective sensation*, and *reflex sensation*. We shall conclude this article by a brief description of the meaning of these terms. 'In the ordinary mode of exciting sensations,' says Dr. Todd, 'the presence of an object is necessary. This object creates an impression on the peripheral parts of the sensitive nerves; and the change caused by this impression being duly propagated to the center of sensation, is perceived by the mind.' This, which is the ordinary form of sensation, is termed an *objective* sensation, in opposition to a so-called *subjective* sensation in which a mental act can develop a sensation independently of any present object. These subjective sensations are sometimes excited by the mind recalling, more or less exactly, the presence of an object; but in many cases they are caused by physical changes in the nerves themselves, owing to an excess or deficiency of blood, or some other pathological causes. Thus disordered conditions of the retina or optic nerve may give rise to motes or flashes of light; disturbance of the auditory nerve occasions singing in the ears, the sound of distant bells, &c.

To understand the mode in which *reflex* sensations are brought about, an acquaintance with *reflex action*, described in the article NERVES AND NERVOUS SYSTEM, is requisite. As examples of this form of sensation may be mentioned the facts, that the irritation of a calculus in the bladder will give rise to pain in the thighs; that diseased liver often excites pain in the shoulder-joint; and that ice or iced drinks suddenly introduced into the stomach, occasion intense pain in the forehead. For further information on the subject the reader is referred to Dr. Todd's article 'Sensation,' in the 4th vol. of his *Cyclopædia of Anatomy and Physiology*.

SENSATION, a name of great import in the Philosophy of Mind, as well as familiar in ordinary speech. In the mental process so named, there is a concurrence of many contrasting phenomena, rendering the word ambiguous, and occasioning verbal disputes.

1. In Sensation, there is a combination or concurrence of physical facts with a mental fact, and the name is apt to be employed in expressing either side. Thus, in sight, the physical processes are known to be—the action of light upon the globe and retina of the eye, a series of nerve-currents in the brain, and a certain outgoing influence to muscles and viscera; these are accompanied by the totally different phenomenon termed the feeling, or the mental consciousness of light. It is to the last fact, the mental fact, that the name Sensation is most correctly applied; but there is a natural liability to make it include those physical adjuncts which are inseparable from the mental manifestation.

2. In the still more comprehensive contrast of Mind and the External or Extended World, both members may be designated under Sensation. One and the same situation on our part may contain a strictly mental or *subjective* experience—pleasure or pain, for example—and an *objective* experience, or a recognition of the extended world, as distinct from mind. In looking at a fine prospect, both facts concur in fluctuating proportions; we have a feeling of pleasure (mind or subject) and a knowledge of the outspread or extended world (object), which is what affects us in the same way at all times, and affects all minds alike. As before, sensation is most properly used to express the strictly mental or subjective experience, the pleasure or the pain, while the 'Perception' should be applied to express the objective experience. See PERCEPTION.

3. In Sensation, a past experience recovered by memory is inextricably woven with the present impression, a circumstance which confuses the boundary-line between Sense and Intellect. The sensation that the full moon gives rise to is not solely owing to the present effect of the moon's rays on the organs of vision; the present effect revives or restores the total ingrained impression of the moon consequent on all the occasions when we have observed it. Again, it is impossible for us to have a sensation without a more or less complex feeling of difference or discrimination, which property is a fundamental fact of intellect. Our sensation of the moon supposes a contrast of the white light with the adjoining blue, of the round form with other forms, of the broad disc with a starry point, and so on. Thus, in Sensation we have a concurrence of all three processes of the intellect—Retentiveness, Agreement, and Difference. Sensation without Intellect is a mere abstraction; it is never realized in fact.

This last remark has important bearings upon the question as to the origin of our knowledge. It has been disputed whether or not our ideas are wholly derived from Sense. Now, seeing that there is no such thing as Sense to the exclusion of Intellect, the question ought to be enlarged and put in this form: Are our ideas wholly derived through Sense in conjunction with the intellectual processes, or are there any ideas that are not or cannot be so derived? When it is alleged, by Cudworth, Price, and others, by way of maintaining the doctrine of Innate Ideas, that Likeness, Unlikeness, Equality, Proportion, &c., are not obtained from sense, the answer is, that their origin may in all probability be accounted for by Sense co-operating with the well-known powers of the Intellect, and that, until the conjunction of the two is proved insufficient, the theory of an Intuitive origin is not called for.

SENSES. Referring for an account of the several senses to their respective designations, we will here endeavor to state what faculties or sensibilities of the mind are properly included under the name.

The common reckoning includes the Five Senses—Taste, Smell, Touch, Hearing, Sight—but this is not now considered exhaustive or complete.

For example, the feelings of Hunger, Thirst, Suffocation, Internal Warmth, and Chillness, &c., have all the characters implied in an ordinary sensation: they are the result of some External Agent acting on a distinct bodily organ, and giving rise to Feeling, sometimes pleasurable and sometimes painful. In order that these states, related to the sensibility of the different viscera, may find a place among the Senses, they have been grouped under one general head, and designated 'Sensations of Organic Life.' They are of great importance as regards our enjoyments and our sufferings, although not contributing much to our knowledge or intelligence. They approach nearest to Taste and Smell, the more emotional senses, and are at the furthest remove from the intellectual senses—Touch, Hearing, and Sight.

Again, the feelings connected with our Activity, or with the exercise of the muscular organs—as the pleasures of exercise and rest, the pains of fatigue, the sensibility to weight, resistance, &c.—were, until lately, overlooked in the philosophy of the mind. When they began to be recognized, it was common to treat them as a sixth sense, called the Muscular Sense. But this does not represent their true position. They do not arise from external agents operating on a sensitive part, but from internal impulses proceeding outwards to stimulate the muscular energies, and to bring about movements; they are thus the contrast of the senses generally. Sense is associated with the *ingoing* nerve-currents, Movement with the *outgoing*. The contrast is vital and fundamental; and accordingly, the Feelings of Movement and Muscular Strain should be considered as a genus distinct from the genus Sense, and not as a species of that genus.

The classification of the fundamental sensibilities of the mind would then stand thus: I. Feelings of Muscular Energy. II. Sensations of the Senses. 1. Organic Life; 2. Taste; 3. Smell—Emotional: 4. Touch; 5. Hearing; 6. Sight—Intellectual.

SENSIBI'LITY is a term somewhat vaguely used by physiologists. Until a comparatively recent period, it was often confounded with Irritability, although Haller more than a century ago, very clearly laid down the distinction between these two properties of tissues. We not unfrequently find it applied to nerves, to signify their power of evolving nervous force, but Excitability (as Dr. Todd observes) more exactly implies what is meant in this case. The term should be limited to signify the power which any part of the body possesses of causing changes, inherent or excited in it, to be perceived by the mind; and the greater this power is, the greater is the sensibility of the part. The degree of sensibility of different parts of the outer surface of body is very various. The relative sensibility has been ascertained by Weber by touching the surface with the points of a pair of compasses tipped with cork, and then (the subject's eyes being closed) by approximating the points until they were brought within the smallest distance at which they could be felt to be separate. The following are a few of his results: point of tongue, $\frac{1}{4}$ a line; tips of fingers, 1 line; red surface of lips, 2 lines; palmar surface of 2d phalanx, 2 lines; palmar surface of metacarpus, three lines; tip of the nose, 3 lines; palm of the hand, 5 lines; dorsum of the hand, 8 lines; vertex, 15 lines; skin over the spine and the middle of the thigh, each 30 lines; so that the sensibility of the skin is at least sixty times greater in some parts than in others.

SE'NSITIVE PLANT, a name commonly given to certain species of *Mimosa* (see MIMOSEÆ), on account of the peculiar

phenomena of Irritability (q. v.) which their leaves exhibit in their collapse when touched or shaken. Numerous species of *Mimosa* possess this property, and, indeed, most of the species in a greater or less degree; but those in which it is most conspicuous are humble herbaceous or half-shrubby plants. They have leaves beautifully divided, again and again pinnate, with a great number of small leaflets, of which the pairs close upwards when touched. On repeated or rougher touching, the leaflets of the neighboring *pinnæ* also close together, and all the pinnæ sink down, and at last the leaf-stalk itself sinks down, and the whole leaf hangs as if withered. If the stem is shaken, all the leaves exhibit the same phenomena. After a short time, the leaf-stalk rises, and the leaflets expand again. On account of this curious and interesting property, some of the sensitive plants are frequently cultivated in our hot-houses. They are generally treated as annuals, although capable of longer life. *M. sensitiva*, one of the best known species, is a native of Brazil, with prickly stems and leaf-stalks, and small heads of rose-colored flowers. *M. pudica* has a herbaceous stem, bristly, but not prickly. *M. casta*, *M. pudibunda*, *M. palpitans*, and *M. viva*, are also among the most sensitive species.

SENSO'RIUM. This term is applied by physiologists to a series of ganglionic centers, each of which has the power of communicating to the mind the impressions derived from the organ with which it is connected, and of exciting automatic or involuntary muscular movements in respondence to these sensations. (See Carpenter *On the Functions of the Nervous System in Human Physiology*, 6th ed. p. 545.) These ganglionic centers, which lie at the base of the brain in man, are in direct connection with the nerves of sensation, and appear to differ entirely in their functions from the other parts of the encephalon. Anterior, there are the *olfactive* ganglia, or what are termed the bulbs of the olfactive nerves. The ganglionic nature of these structures is more evident in many of the lower mammals, in whom the organ of smell is highly developed, than it is in man, although even in the human subject these masses contain gray or vesicular nervous matter, indicating their true ganglionic nature. Behind these, we have the *optic* ganglia, commonly known as the corpora quadrigemina, small in man, but comparatively large in many of the lower mammals. The *auditory* ganglia do not form distinct projecting masses, but are represented by small masses of vesicular matter, into which the auditory nerves may be traced, and which are imbedded in the medulla oblongata. In fishes, there is a well-developed and distinct auditory ganglion. The *gustatory* ganglion is the least distinct of any, but it is supposed to be represented by a mass of vesicular matter embedded, like the preceding ganglion, in the medulla oblongata, and into which the nerves of taste may be traced. On examining a progressive series of brains from man to the lowest mammals, we find a continuous diminution of the hemispheres, and a corresponding development of these ganglia, or, at all events, of the olfactory and optic ganglia; while, if we continue the investigation to the brains of birds, reptiles, and fishes, we find the same law in force, till finally, in reptiles and fishes, those ganglia form the greatest part of the brain.

It was long attempted to determine some one point in the brain where the soul is more especially located or centralized; and to this ideal point the name of Sensorium was applied in the older psychological speculations. The fancy of Descartes made it a small body near the base of the brain, called the 'pineal gland.' The recent views of the nervous system repudiate the idea of a central point of this nature; in consciousness, the brain generally is active, although, under different impressions and ideas, the currents may be presumed to follow different nerve-tracks. Consequently, no meaning is now attached to a sensorium in psychology, as distinct from the cerebrum at large.

SENTENCE. A sentence is the form of words in which a thought or a Proposition (q. v.) is expressed. A mere phrase or group of words, such as, 'A very high mountain,' which only conveys meaning or calls up an idea, but does not make an affirmation, is not a sentence. Since speech is the expression of thought, the sentence is the proper unit or integer of speech, and thus forms the starting-point in the study of language.

Every single sentence is made up of two parts—the one naming the subject, or the something that is spoken about; the other the predicate, or the something that is said of it—as, 'The sun—shines;' 'Those who have the greatest gifts, and are of the greatest usefulness—are the most humble.' Every sentence must contain a finite verb, as it is the function of the Verb (q. v.) to make affirmations. 'The sun shines,' is an example of a sentence in its barest form, containing merely the subject 'sun,' and the predicate 'shines,' which are called the *principal* elements. The enlargement or development of the sentence takes place by means of adjuncts, or *secondary* elements, tacked on to the principal elements—as, '*Young* birds build *nests without experience*.' Sentences may be divided into simple, compound, and complex.

1. A simple sentence has only one subject and one finite verb. Reduced to its essentials, it is of the form, 'The sun shines;' 'The day is cold.' 2. A compound sentence consists of two or more simple sentences combined—as, 'The sun gives light by day, and the moon by night;' which contains two affirmations or sentences, 'The sun gives light by day,' and 'The moon gives light by night.' 3. A complex sentence consists of one principal sentence together with one or more dependent sentences. In the compound sentence given above, there are two distinct statements, and as both are put on the same footing, they are said to be *co-ordinate* sentences. But when we say, 'The moon rose as the sun went down,' the going down of the sun is not mentioned on its own account; the only thing directly affirmed is that the moon rose at a certain time, and the going down of the sun is only introduced as marking that time. Such clauses are called *subordinate* sentences (see CONJUNCTIONS). The subordinate clauses of complex sentences may be considered as transformations of the elements of the simple sentence; and according to the nature of the element which has been transformed, they might be called noun-sentences, adjective-sentences, or adverbial sentences—e. g., '*The existence of God* is denied by none' = '*That God exists*, is denied by none.' '*Benevolent* men are happy' = 'Men *who seek the good of others* are happy.' 'The moon rose *at sunset*' = 'The moon rose *as the sun went down*.' Further, the nouns, adjectives, and adverbs that enter into a subordinate sentence, may, one and all of them, be transformed in their turn into sentences, which will thus be subordinate in a still higher degree—e. g., 'Europe rejoiced *that Greece was delivered from that oppressive power*' = 'Europe rejoiced *that Greece was delivered from the power that had oppressed her*.' Here the adjective *oppressive* in the first sentence has in the second been converted into a sentence which is directly dependent, not on the principal sentence (Europe rejoiced), but on the subordinate, and is therefore subordinate in the second degree. Subordination is seldom carried beyond the second or third degree, as it becomes perplexing, and weakens the force of the principal assertion. The same sentence is often compound, as containing two or more co-ordinate sentences, and at the same time complex, as containing one or more subordinate sentences in addition; and to discriminate all these and point out their relations, is to give the syntactical analysis of the sentence.

SE'NTINEL, SENTRY (from the Lat. *sentire*, to feel or perceive, through the Ital. *sentinella*), a private soldier, marine, or sailor, posted at a point of trust, with the duty of watching the approach of an enemy, or any person suspected of hostile intentions. Sentries mount guard over dépôts of arms, the tents of commanding officers, &c. During the night, each sentry is intrusted with the 'word,' or countersign; and no person, however exalted in position, may attempt to approach or pass him without giving that as a signal. In such case, the sentry is bound to arrest the intruder, and, if necessary, to shoot him. It has happened before now that the commander-in-chief of an army has been prisoner in the hands of one of his own sentries. When an army is in the field, the sentries, are its eyes, for they guard the approaches in every direction some distance in front of the main body of troops. In the event of attack, they give the alarm, and retire slowly on their supports. There is usually an agreement, tacit or expressed, between commanders that their outlying sentries shall not fire upon one another, which would only be productive of useless bloodshed. Under martial law, death is the penalty to a sentry for sleeping on guard.

SE'NZA SORDI'NO (Ital. without the mute, or without the damper), a musical term, which, when applied to the violin or violoncello, denotes, that the Mute (q. v.) is to be removed. In pianoforte music, it means that the performer must press down the pedal which takes off the dampers.

SEPAL. See CALYX.

SEPARATE ESTATE is the legal term denoting the property of a married women, which she holds independently of her husband's interference and control. Where a marriage is about to be entered into, and the lady has property, it is usual, before the marriage, for her to assign and convey to trustees all or part of her property, so that it may continue to be vested in them for her exclusive benefit, and so that she may be able to deal with it in much the same manner as if she were not married. The deed in that case entirely regulates the extent of her rights. Where the deed has been properly executed, she can draw the interest, and do what she pleases with it. A third party who bequeaths property to a married woman, may also so give it as to make it separate estate. If there is no clause in the deed or will prohibiting alienation or anticipation, she will be able to dispose of her life-interest. She can, in general, alienate her separate estate without the husband's consent; and she is not bound out of it to maintain the husband, even though he may be destitute; nor is she bound to maintain her children, unless the latter would otherwise be chargeable to the parish. When a wife incurs debts and liabilities, her separate estate will become chargeable with these, unless she was at the time acting only as the agent of the husband.

such as ordering necessaries for the house. In Scotland, a wife is bound out of her separate estate to maintain a destitute husband, and the husband's consent is necessary to her alienation of the separate estate.

SEPARATION of married persons is either judicial or voluntary. If the parties enter into a deed, or other arrangement, to live separate, this is called a voluntary separation, and, in general, the legal rights of the parties are not altered, except that if the wife is provided with maintenance, she has no longer an implied authority to bind the husband. And though voluntary separation is not encouraged by courts of law, yet effect will be given frequently to deliberate contracts of this kind entered into between the parties. See JUDICIAL SEPARATION.

SE'PARATISTS. See QUAKERS, OATH.

SE'PIA AND SEPI'ADÆ. See CUTTLE-FISH.

SEPIA, a pigment used as a water-color. It is prepared from the secretion of a peculiar organ, called the ink-bag, found in the Dibranchiate *Cephalopoda*, or Cuttle-fishes. This secretion is black at first, and insoluble in water, but extremely diffusible through it; it is therefore agitated in water to wash it, and then allowed slowly to subside, after which the water is poured off, and the sediment, when dry enough, is formed into cakes or sticks. In this state it is called 'India Ink.' If, however, it is dissolved in a solution of caustic potash, it becomes brown, and is then boiled and filtered, after which the alkali is neutralized with an acid, and the brown pigment is precipitated and dried: this constitutes the proper sepia. It is usually prepared in Italy, great numbers of the species which yields it most abundantly, *Sepia officinalis*, being found in the Mediterranean. The black kind, called India Ink, is prepared in China, Japan, and India, and forms the common writing-ink of those countries.

SE'POY, corrupted from the Indian word *sipahi*, a soldier. This word sipahi, in its most familiar form of *spahis*, is known in most eastern armies; and is itself derived from *sip*, a bow and arrow, the ordinary armament of an Indian soldier in ancient times. The word sepoy now denotes a native Hindu soldier in the British army in India. See EAST INDIA ARMY. The present sepoy force numbers about 140,000.

SEPS. See SCINK.

SEPTA'RIA are ovate flattened nodules of argillaceous limestone, internally divided into numerous angular fragments by reticulating fissures radiating from the center to the circumference, which are filled with some mineral substance, as carbonate of lime or sulphate of barytes, that has been infiltrated subsequent to their formation. The fissures have been produced by the cracking of the nodule when drying. They are largest and most numerous in the center, and gradually decrease outwards, showing that the external crust had first become indurated, and so, preventing any alteration in the size of the whole mass, produced wider rents as the interior contracted. The radiating figure, and the striking contrast between the dark body of argillaceous limestone and the more or less transparent sparry veins, when the nodule is cut and polished, has caused them to be manufactured into small tables and similar objects. They are, however, most extensively employed in the manufacture of cement. As they are composed of clay, lime, and iron, they form a cement which hardens under water, and which is known commercially as Roman cement, because of its properties being the same as a famous hydraulic cement made of ferruginous volcanic ash brought from Rome. Septaria occur in layers in clay deposits, and are quarried for economical purposes in the clays of the London basin. Large numbers are also dredged up off Harwich, which have been washed out of the shore-cliffs by the waves. The nodules generally contain a scale, shell, plant, fruit, coprolite, or some other organic substance, forming the nucleus that has apparently excited the metamorphic action which withdrew from the surrounding clay the calcareous and ferruginous materials scattered through it, and aggregated them around itself.

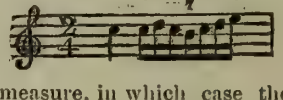
SEPTE'MBER (Lat. *septem*, seven) was the 7th month of the Roman calendar, but is the 9th according to our reckoning, though we preserve the original name. Various Roman emperors, following the example of Augustus, who changed 'Sextilis,' the sixth month of the Roman calendar, into 'Augustus' (August), attempted to substitute other names for this month, but the ancient appellation continued to hold its ground. The Saxons called it *gerst-monath*, or barley-month, because barley, their chief cereal crop, was generally harvested during this month. It has always contained 30 days.

SEPTE'MBRISTS, SEPTEMBRI'SERS (Fr. *Septembriseurs*) the name given to the frantic executioners in what are known as the 'September massacres' in Paris. The particular causes of this ferocious outburst were twofold—mad fear of domestic traitors and of foreign despots. The news came pouring into Paris, ever more and more maddening, of Prussian and Austrian hordes marching victorious over the frontiers; insolent royalists obtruding themselves in the van of the invading armies, and breathing threatenings and slaughter; while numerous *aristocrates* (i. e., favorers of the king and court) were believed to be making preparations to receive them in Paris. At the very same moment broke out the royalist insurrection in *La Vendée*, rendering France still further delirious, whereupon Danton, 'minister of justice,' got a decree passed, August 28. 1792, ordering domiciliary visits for the arrest of all suspected persons, and for the seizure of arms of which patriotic France stood much in need. Upwards of 2000 stand of arms were got in this way, and 400 head of new prisoners.

On the morning of September 2, the news of the capture of Verdun by the Prussians arrived. The mingled rage and panic of the people cannot be described. All the bells in Paris were set a-clanging; men and women hurried in myriads to the *Champ de Mars* to get themselves enrolled as volunteers. Danton entered the legislature—'the black brows clouded, the colossus-figure tramping heavy, grim energy looking from all features of the rugged man'—and made that famous speech, ending: 'Pour les vaincre, pour les atterrer, que faut-il? De l'audace, encore de l'audace, et toujours de l'audace.' The effect was electrical. He obtained from the Assembly a decree condemning to death all 'who refused to march to the frontiers or to take up arms.' But patriotism against foreigners was not enough. Were not the traitors at home deserving of death? Marat thought so: multitudes of ardent frantic men and women shared his conviction; but it is not proved that either Marat or Danton formally ordered the massacres, or, indeed, that anybody ordered them. They were rather the spontaneous outburst of patriotic insanity, beholding aristocratic treachery and plots everywhere. Priests, Swiss soldiers, aged and infirm paupers, women both reputable and disreputable, and criminals, were mercilessly cut down or shot. From Sunday afternoon till Thursday evening the wild butchery went on at the Bicêtre, the Abbaye, the Convent of the Carmelites, the Conciergerie du Palais, the Grand Châtelet, St. Firmin, La Force, and the Salpétrière. One gathers a glimpse of the savage sincerity of the Septembriseurs when one reads that the gold rings, watches, money, &c., found on the persons of the massacred were all religiously brought to the town-hall; not a single thing was stolen or furtively appropriated until after the essential work was done. Then the roughs or blackguards ('sons of darkness,' as Carlyle calls them) sallied out into the streets like Mohawks or Alsatians, and commenced to plunder, but were speedily suppressed and forced back into their dens.

Great misapprehension prevails as to the numbers who perished in these fearful scenes. Royalist pamphleteers and others, trusting mainly to fantasy (according to Carlyle, *Fr. Rev.* vol. ii. p. 158), reckon the victims at 3000, 6000, and even 12,000; but the accurate advocate Maton (who was in the thick of the horrors, and narrowly escaped the guillotine) reduces the number by 'arithmetical ciphers and lists,' to 1089, which, be it observed, included numbers of forgers of assignats, and other criminals. It was a sad and horrible affair, as all massacres are; but it is above all things desirable to know exactly the *dimensions* of, and the motives that stirred the actors in, so execrable a tragedy.

SEPTIMOLE, in Music. When a note is divided into seven instead of four parts—for example, a minim into seven quavers, or a crotchet into seven semiquavers—the group is called a septimole, and the figure 7 is generally placed over it.



A septimole may also occur in a $\frac{6}{8}$ measure, in which case the seven notes are collectively of the value, not of four, but of six.

SEPTUAGE'SIMA SUNDAY (Lat. *Septuagesima*, 'the seventieth'), the third Sunday before *Lent* (q. v.), so called, like 'Sexagesima' and 'Quinquagesima,' from its distance (reckoned in round numbers) before Easter.

SE'PTUAGINT (Gr. *Hoi ton O*, or *hoi O*; Lat. *Septuaginta*; Seventy, LXX., Alexandrine version, &c.), the most ancient Greek translation of the Old Testament that has come down to us, and the one commonly in use among the Jews at the time of Christ. Its origin is shrouded in deep obscurity. The principal myth about it—repeated by Philo, Josephus, the Talmud, and the Church Fathers (Justin, Clement of Alexandria, Epiphanius, and the rest), with individual variations—is contained in a letter purporting to be written by a Greek, Aristeas, to his brother, Philokrates, during the reign of Ptolemy Philadelphus (284—247 B.C.). This king, it is stated, anxious to embody in a collection of laws of all nations on which he was engaged, also those of the Jews, invited, by the advice of his librarian, Demetrius Phalereus, 72 men of learning and eminence from Palestine, who performed the task of translation (on the isle of Pharos) in 72 days. The facts upon which this legend—utterly rejected now as a piece of his-

tory—rests, cannot well be ascertained now. So much, however, seems clear from another anterior testimony (Aristobulos), that Ptolemy, aided by Demetrius, did cause a Greek version of the Pentateuch to be executed, probably during the time of his being co-regent of Ptolemy Lagi. That the translator or translators, however, were not Palestinian but Egyptian Jews, appears equally clear both from the state of the text from which the translation must have been made, and from the intimate acquaintance with Egyptian manners and customs which it evinces. This text differs, especially in the Pentateuch, considerably from our received text, but agrees in many instances with the Samaritan (q. v.). The question of the number of translators has been much and warmly discussed, but with little positive result. So much only seems certain, that different hands were employed in the rendering of the different parts of the Pentateuch, upon which infinite care was bestowed, as well as of the other books of the Old Testament, which, indeed, do not seem to have been done at the same time.

In some instances, it would appear as if the translation had been made before the non-pentateuchial books were united with the others into one canon. This seems particularly evident in the case of the book of Jeremiah, which in the translation, appears in a more primitive form than in the state in which we possess it now. In a less degree does this discrepancy appear in Job, the Proverbs, Daniel, and Esther; of these, however, our canon probably contains the original form, while the LXX. shows later variants. It is, however, in neither of these books to be decided now whether the discrepancies observable are due to an already altered text upon which the translators worked, or whether they were their own emendations; or even whether many of them are not due to a much later period. The translation of the book of Daniel is the most flagrant instance of subsequently introduced 'corrections' and additions. Apart from the apocryphal pieces attached to it, its obscure passages were 'emendated' to such an extent by both Jews and Christians, that it was by the authority of the early Church utterly rejected, and replaced by the version of Theodotion. The translator of Job, though less arbitrary, has yet altered, added to, and abbreviated considerably, hie text. Esther has many apocryphal additions, which owe their origin probably to the Alexandrine period, and never existed in Hebrew. Of exaggerated literalness is the version of Ecclesiastes and the Psalms. Among the most successful books are to be mentioned the Psalms and Ezekiel. But, on the whole, there is to be noticed throughout, a lack of an exact knowledge of the original, a striving after minute fidelity in one part, and an unbridled arbitrariness in another; further, a desire to tone down or to utterly eliminate anthropomorphisms or anything that appeared objectionable to the refined taste of the time.

The Septuagint was held in the very highest repute among the Alexandrine Jews, while the Palestinians looked upon it as a dangerous innovation, and even instituted the day of its completion as a day of mourning. Gradually, however, it also found its way into Palestine, and at the time of the composition of the New Testament, it seems almost to have superseded the original, considering that its quotations from the Old Testament are almost invariably given from the LXX. It was read and interpreted in the synagogues for some centuries after Christ, until the increasing knowledge of the original, fostered by the many academies and schools, and the frequent disputations with the early Christians, brought other and more faithful and literal translations, such as that of Aquila, Theodotion, &c., into use, and gradually the LXX. was altogether discarded in the synagogue. The Church, however, for a long time, and the Greek Church up to this day, considered it as of equal authority and inspiration with the Hebrew text itself; and many translations were made from it into the vernaculars of different Christian communities (the Itala, the Syriac, the Ethiopian, Egyptian, Armenian, Georgian, Slavonian, &c.). The large diffusion of the LXX. among the Hellenists and the churches, and the want of anything like a critically fixed text, together with the pious desire bodily to insert the peculiar explanation given to obscure passages by single authorities, the ignorance of the copyists, and a number of other causes, contributed not a little to render the MSS. corrupt, in some instances past mending. Nor were the endeavors of Origen (q. v.) in his *Hexapla*, or of Lucianus and Hesychius for a restoration of the proper text, of any avail.

The principal MSS. that have, as far as we know, survived are the Codex Alexandrinus in the British Museum, the Codex Vaticanus in Rome, and the Sinaitic Codex (imperfect) in St. Petersburg; all of which belong to the time between the 4th and 6th centuries A.D. The principal editions are the Complutensian (1514—1517), reprinted in the Antwerp and Paris Polyglot; the Aldine of Venice (1518); the Sixtine of Rome (1587), partly reprinted in Walton's Polyglot (1657) by Lamb Bos. (Franeker, 1709); Reineccius (Leip. 1730); Parsons and Holmes (Oxford, 1798—1827); Tischendorf (1850, &c.). Following more closely the Codex Alexandrinus is the edition of Grabe (Oxford, 1707—1720. completed by F. Lee), reprinted by Breitinger (Zürich, 1730—1732) and others. The Alexandrine Codex has been reproduced in facsimile by H. H. Baber; the Sinaitic in the same manner by Tischendorf. Some other MS. recensions are mentioned by the early Fathers, such as the 'Hebrew,' the 'Syrian,' the 'Samaritan,' the 'Hellenian,' &c. The literature of the LXX. is very large, and special grammars and dictionaries have been compiled for its peculiarly corrupt idiom.

SEPU'LCHRAL MOUND. The practice of rearing mounds of earth and stone over the resting-place of the dead may be traced to remote antiquity. It had doubtless its origin in the heap of earth displaced by interment, which, in the case of the illustrious warrior or chief, it became the practice to raise into the size and form of the barrow or tumulus which is found all over Northern Europe, from Great Britain and Ireland to Upsala in Sweden, and the Steppes of Ukraine. Sepulchral mounds of some sort seem, indeed, to have been erected among all the nations of Asia as well as of Europe, and they are found in numbers in Central America. Some of the larger tumuli or moathills are but partially artificial; natural mounds having been added to or shaped into the form which it was wished that they should take.

There is considerable diversity in the form of the tumuli, the different forms corresponding to different periods, considerably remote from each other. The oldest are long-shaped, and in the form of gigantic graves, often depressed in the center, and elevated towards one end. Inside the tumulus, the body was laid at full length, often along with spear and arrow heads of flint and bone. The bell and bowl-shaped tumuli seem to have succeeded this early form. Within them is often found a short cist and primitive cinerary urn, showing that the body had been burned; but there appears also to be evidence that the processes of inhumation and cremation had been in use contemporaneously, or sometimes the body was placed within the cist in a sitting posture. Skeletons of dogs and horses are occasionally found beside the ashes of the deceased. The sepulchral mounds which seem to be of latest date are broad and low, surrounded sometimes by an earthen vallum, and sometimes, particularly in Scotland and Scandinavia, by a circle of standing stones. In both the enclosed and encircled tumuli, weapons have been found belonging to the period when the metallurgic arts were practiced, and in some instances Roman as well as native relics. A remarkable form of tumulus frequent in Sweden, and occasionally seen in Scotland, consists of an oblong mound larger than the primitive barrow, and terminated at both ends in a point, whence it has been called the *skibs ælunger*, or ship-barrow. Scandinavian antiquaries have come to the conclusion that the bodies of the warriors of the deep were sometimes burned in their ships, whose form was repeated in the earthwork reared above their ashes.

The most numerous class of sepulchral mounds in Scotland are the *cairns* (q. v.) or tumuli of stone, which abound in every district of the country, and were often of much larger dimensions than the earthen tumuli. Another species of monument is the *cromlech* (q. v.).

SEPULVEDA, JUAN GINES DE, a Spanish historian, surnamed the Livy of Spain, was born at Pozo-blanco, in the neighborhood of Cordova, about 1490, studied first at Cordova and Alcala, and went to Bologna in 1515, where he obtained the acquaintance and esteem of the most celebrated savans of Italy and Spain. There he wrote the life of Cardinal Albornoz, which was published in 1521. He assisted Cardinal Cajetan at Naples in revising the Greek text of the New Testament, and in 1536 returned to Spain as chaplain and historiographer to Charles V., and preceptor to his son, afterwards Philip II. Died in 1573 or 1574. Erasmus speaks of S. in the *Ciceronianus* in terms of high encomium, and there is indeed little doubt that he was one of the most learned men and best writers of his time. His works comprise Latin translations of part of Aristotle (1531), and of the commentary of Alexander Aphrodisiensis (1527); miscelaneous dissertations, among which were treatises on Fate and Free-will, in opposition to Luther (1526), in favor of a war with the Turks (1529), in defence of Alberto Pio Cardinal Carpi (1531), on Marriage (1531), and in support of the congruency of the military profession with Christianity (1541), on Monarchy and the Duty of Kings (1571). His histories of the Reign of Charles V., of that of Philip II., and of the Conquests of the Spaniards in Mexico, all of them written in Latin, are still inedited. His other works were collected and published by the Royal Academy of History at Madrid in 1780 (4 vols. fol.), accompanied with a portrait of S., and an account of his life and writings.

SEQUESTRA'TION, the Scotch legal term for Bankruptcy (q. v.).—In English law, sequestration is the appropriate term denoting the process by which the creditor of a clergyman of the Church of England in possession of a living, sues out execution on his judgment, and obtains payment of the debt. In ordinary cases of lay debtors, the sheriff takes possession of the real estate of

judgment debtors; but when the debtor is a clergyman, the bishop puts in force the law, and appoints sequestrators to take possession of the benefice, and draw the emoluments, and pay them over to the creditor, first making due provision for the proper celebration of divine worship.

SE'QUIN (Ital. *zecchino*, from *zecca*, the name of the Venetian mint), a gold coin first struck at Venice about the end of the 13th c., was about the size of a Ducat (q. v.), and was equivalent to about 9*s*. 4*d*. sterling. Coins of the same name, but varying in value, were issued by other states.

SERA'GLIO (properly, SERAI) is the palace of the sultan at Constantinople. It stands in a beautiful situation on a head of land projecting into the sea, known as the Golden Horn, and is enclosed by walls 7½ miles in circuit. Within the walls are a variety of mosques, gardens, and large edifices, capable of containing 20,000 persons, though the whole number of the inhabitants scarcely ever reaches the half of this. The principal entrance (*Babi Humayun*, or Sublime Gate) is a kind of pavilion, which is constantly guarded by *capidjis*, or officers of the seraglio; and the chief of the large edifices within is the *harem* (Arab. sacred spot), which is distinctly separated from the rest of the seraglio, and consists of a group of houses and gardens, one of each being possessed by each of the sultan's wives, and of the habitations of the concubines and slaves.

The harem is ruled by the *kiaja-khatun*, or inspector of the women, who is under the sultan's authority alone, and is supplied with what they require by the *kislar-aga*, or chief of the black eunuchs who form the principal or inner guard of the harem. The second and outer guard is given to the white eunuchs, under their chief the *kapu-agassy*, or *kapu-oghlan*. Other classes of household officers are the *mutes* (Turkish, *bisebân* or *dilssis*), who, till recently, were the executors of the sultan's orders, especially those in which the utmost secrecy was required; the *bostanjis*, or gardeners; the *baltajis*, or cleavers of wood; and the *itsh-oghlans*, or attendants of the sultan. The sultan's mother always resides within the seraglio, but his sisters do not. Access may easily be had to the seraglio, with the exception of the harem, which is scrupulously guarded from even the eyes of strangers. The English have improperly confounded the two terms 'seraglio' and 'harem.'

SERAI'NG, a town of Belgium, in the province of Liege, and between three and four miles south-west from Liege, on the right bank of the Meuse. It is a station on the railway between Namur and Liege, and is connected by a handsome suspension bridge with the village of Jemeppe, on the left bank of the Meuse. S. is a place of great activity, and contains a manufactory of steam-machinery, locomotives, &c., which is probably the largest in the world. This manufactory was established by an Englishman, John Cockerill, in 1816; the king of Holland, to whose dominions Belgium then belonged, joining him in the enterprise. After the revolution of 1830, Cockerill bought up the shares belonging to the king of Holland, and the works became entirely his own. On his death in 1840, a company was formed, called *La John Cockerill Société*, to which they now belong. They occupy the former palace of the Prince-bishops of Liege, which still forms their front, the extensive gardens behind it having been covered with buildings, where all the processes of machine-making are carried on. Forty or fifty tall chimneys are clustered on this spot. The town depends on these works for its prosperity. Pop. (1870) 22.000; (1876) 24,315.

SERA'JO. See BOSNA-SERAI.

SERAMPO'RE, a neat town of British India, built in the European style, and extending a mile along the right bank of the Hooghly, 14 miles north of Calcutta. Paper is here manufactured in large quantity. S. was at one time a Danish settlement, but was transferred by purchase to the British in 1845. Pop. (1871) 24,440.

SERANG. See CERAM.

SERA'PEUM (Gr. *Serapeion* or *Sarapeion*), a temple so named in honor of Serapis (q. v.), several of which are known to have existed in the ancient world. The most remarkable of these temples was that of Alexandria, which was situated south of the canal, and outside the walls of the city, and superseded an older temple at Rhacotis. Hither was transported the statue of Dis or Pluto from Sinope by Ptolemy I., and attached to it was the celebrated Alexandrian Library (q. v.). The S. at Memphis attained scarcely less reputation, and consisted of a group of temples dedicated to Astarte, Anubis, Imouthos or Æsculapius, and Serapis. It was approached from the city of Memphis by an avenue of sphinxes, which had already become partially buried in the sands in the days of Strabo, and were discovered by M. Mariette in 1850, who after a series of excavations, uncovered the ruins, and discovered the cemeteries of the mummied Apis or Bulls sacred to Ptah and Osiris at Memphis. Close to the S. was the Apeum, or temple of the living Apis, in which the bull lived, as well as the cow which had produced him. The S., or, as it was called in Egyptian, the abode of *Osor-hapi*, or the Osiris-Apis, was, in fact, the sepulchre of the bull.

The most remarkable part of the work, which was of great extent, was the subterranean tombs of the mummies of the Apis, consisting of galleries with numerous chambers, in which the remains of these bulls had been deposited from the reign of Amenophis III. of the 18th dynasty, about 1400 B.C., till the time of the Romans. Two principal galleries contained the tombs. The second gallery, commenced in the 53d year of Psammetichus I., was on a grander scale than the first, with larger sepulchral chambers, and magnificent sarcophagi of granite, measuring sometimes 12 feet high, 15 feet long, and weighing many tons. During the reign of the Persians, and subsequently, the chambers decreased in size, and the monuments exhibit the general decadence of the arts. The Apis, considered as the incarnation of the god Ptah during life, received royal and divine honors after death; his body, or the principal portion, being embalmed, and a sepulchral tablet or tombstone placed on his sepulchre, along with other tablets of different worshipers, who adored his divinity, and dedicated them to the deceased bull. As the principal tombstone of the bull contained the dates of the king's reign in which he was born or discovered, enthroned in the Apeum, and died or was buried in the S., these tablets have become an important element for the chronolgy of the 19th and subsequent dynasties, and have aided to fix some of the hitherto doubtful points of the chronology of the period. They terminate with Ptolemy Euergetes II., 177 B.C. The tablets, votive and sepulchral, amounted to about 1200, and the most remarkable are at present in the Museum of the Louvre at Paris.

Numerous bronze figures and other antiquities were found during the excavations, comprising costly objects of jewelry, many of which are also in the Louvre. Besides these, several Greek papyri which appear to have formerly belonged to the library or archives of the S. were previously known, and many have been published. These throw great light upon the constitution of the hierarchy of the S. amongst which was a kind of order of monks, who lived within the precincts of the building, beyond which they did not go, and subsisted upon alms or the contributions of their family.—Mariette, *Serapeum de Memphis* (4to, Paris, 1856); *La Mère d'Apis* (4to, Paris, 1856); *Athen. Fran.* (4to, Paris 1855—1856); Lepsius, *Ueber den Apis-kreis, Zeitsch. d. Morg. Gesell.* (8vo, Leip. 1853).

SE'RAPHIM (plural of *Seraph*), celestial beings in attendance upon Jehovah, mentioned by Isaiah. They are similar to the Cherubim (q. v.), have the human form—face, voice, two hands, and two feet—but six wings, with four of which they cover their face and feet—as a sign of reverence—while with two they fly. Nothing is more uncertain than the origin of this conception, or of the word which expresses it. Their office of singing the praises of Jehovah's greatness, and of being the swift messengers between heaven and earth, does not go far to explain it. Deserving of consideration, however, considering the close contact between Judæa and Assyria and Babylon, both before and after the Captivity, is a comparison between the S. and the winged men and beasts that have been brought to light in these last-named countries.

SE'RAPHINE, a keyed musical instrument in which the sounds were produced by the action of wind on free vibratory reeds. It was the precursor of the harmonium (q. v.).

SERA'PIS, or SARAPIS, the Greek name of an Egyptian deity, introduced into Egypt in the time of Ptolemy I., or Soter. This monarch is said to have seen the image of a god in a dream commanding him to remove it from the place where it was; and Sosibius, a traveler, having recognized it as existing at Sinope, Soteles and Dionysius were sent from Egypt, and brought it from Sinope to Alexandria. On its arrival, it was examined by Timotheus the interpreter and the celebrated Manetho, who called it Serapis, and appear to have identified it with Osorhapis, or Osiris united with Apis, i. e., Osiris, in his character of the Egyptian Pluto, as a deity of similar character. The figure, in fact, appears to have been one of Hades or Pluto, having at its side Cerberus, and a dragon or snake. According to some authorities, the statue of S. was sent to Ptolemy II., or Philadelphus, because that monarch had relieved the city of Sinope from famine by supplying it with corn, and the statue was placed in the Serapeum, at the promontory of Rhacotis. The S. of the Ptolemaic period, however, was not an Egyptian, but a Greek deity, whose temple was not admitted into the precincts of Egyptian cities, and only found favor in the Greek cities founded in Egypt. It is said that 42 temples were erected under the Ptolemies and Romans to this god in Egypt. His resemblance to Osiris consisted in his chthonic or infernal character, as judge of the dead and ruler of Hades. About his nature and attributes the Greeks themselves entertained very different ideas, some considering him allied to the Sun, others to Æscula-

Serapis.
From a Seal in the British Museum.

pius or Hades. The god had a magnificent temple at Alexandria, to which was attached the celebrated Library; another at Memphis, in the vicinity of the cemetery of the mummies of the Apis, which has been recently excavated by M. Mariette; and another temple at Canopus.

From recent discoveries, it appears that he represented or was identified with the Hesiri Api, or Osorapis, the 'Osirified' or 'dead Apis,' who was also invested with many of the attributes of Osiris, and considered, while living, to be the incarnation of the god Ptah-Socharis-Osiris, the tutelary divinity of Memphis. The worship of S., introduced into Egypt by the Ptolemies, subsequently became greatly extended in Asia Minor; and his image, in alliance with that of Isis and other deities, appears on many of the coins of the imperial days of Rome. In 146 A.D, the worship of the god was introduced into the city of Rome by Antoninus Pius, and the mysteries celebrated on the 6th May; but they were not long after abolished by the senate, on account of their licentious character. A celebrated temple of S. also existed at Puteoli (Pozzuoli), near Naples, and the remains of it are still seen, and present curious geological phenomena. In Egypt itself, the worship of the deity subsisted till the fall of paganism, the image at Alexandria continuing to be worshiped till destroyed, 398 A.D., by Theophilus, archbishop of that town. Busts of S. are found in most museums, and his head or figure engraved on certain stones was supposed to possess particular mystic virtues. His temples were oracular, the votaries consulting him by sleeping and dreaming in them; and at Alexandria the priests connected his worship with the healing art.—Plutarch, *De Isid*, s. 28; Clemens, *Orat. Adhort.* p. 21; Tacit. *Hist.* iv. c. 83, 84; Strabo, Lib. xvii. p. 552; Macrobius, *Saturn*, i. 7, 25; Nixon, *Dell' Edifizio di Pozzuoli detto il Tempio di Serapide* (Nap. 1773); Wilkinson, *Mann. and Cust.* iv. p. 360; Gibbon, *Decline and Fall*, c. 28.

SERA'SKIER, or SERI-ASKER (Pers. head of the army), the name given by the Turks to every general having the command of a separate army, and, in particular, to the commander-in-chief or minister of war. The seraskier, in the latter sense, possesses most extensive authority, being subordinate only to the sultan and grand vizier; he is selected by the monarch from among the pashas of two or three tails.

SERENA'DE (Ital. *serenata*), originally music performed in a calm night; hence an entertainment of music given by a lover to his mistress under her window. Serenading has been chiefly practised in Spain and Italy. It is common among the students of the German universities to assemble at night under the window of a favorite professor, and give him a musical tribute.—A piece of music characterized by the soft repose which is supposed to be in harmony with the stillness of night, is called a serenade, or sometimes a *Nottorno*.

SERE'TH, an important affluent of the Danube, rises in the Austrian crownland of Galicia, runs southward through almost the whole length of Moldavia, and joins the Danube 5 miles above Galatz, after a course of 300 miles.

SERF (Lat. *servus*, a slave). A numerous class of the population of Europe known as serfs or villeins, were in a state of slavery during the early middle ages. In some cases, this serf population consisted of an earlier race, who had been subjugated by the conquerors; but there were also instances of persons from famine or other pressing cause selling themselves into slavery, or even surrendering themselves to churches and monasteries for the sake of the benefits to be derived from the prayers of their masters. Different as was the condition of the serf in different countries and at different periods, his position was on the whole much more favorable than that of the slave under the Roman law. He had certainly acknowledged rights—and this was more particularly the case with the classes of serfs who were attached to the soil. In England, prior to the Norman Conquest, a large proportion of the population were in a servile position, either as domestic slaves or as cultivators of the land. The name of *nativus*, generally applied to the serfs, seems to indicate that they belonged to the native race, the earliest possessors of the soil. The powers of the master over his serf were very extensive, their principal limitations being that a master who killed his serf was bound to pay a fine to the king, and that a serf deprived of his eye or tooth by his master was entitled to his liberty. The Norman Conquest made little change in the position of the serf. The lowest class of serfs were the *villeins in gross*, who were employed in menial household services, and were the personal property of their lords, who might sell them or export them to foreign countries; while the most numerous class, who were employed in agriculture, and attached to the soil, were called *villeins regardant*. These latter, though in some respects in a better position than the villeins in gross, might be severed from the land, and conveyed apart from it by their lord. They were incapable of enjoying anything like a complete right to property, inasmuch as it was held, in accordance with the principles of the Roman law, that whatever the slave acquired was his *peculium*, which belonged to his lord, who might seize it at his pleasure.

By a peculiarity in the usages of Britain, the condition of a child as regards freedom or servitude followed the father, and not the mother, and therefore the bastards of female villeins might be free. In France and Germany, besides the classes of serf alluded to, there were others whose servitude was of a milder description, and who were only bound to fixed duties and payments in respect of their lands.

The abolition of serfdom in Western Europe was a very gradual process, various causes having combined to bring it about. The church both inveighed against the practice of keeping Christians in bondage, and practised manumission to a large extent. In the course of time, usage greatly modified the rights and liabilities of the serf, whose position must have been considerably altered when we find him making stipulations regarding the amount of his services, and purchasing his own redemption. The towns afforded in more than one way a means of emancipation. A serf residing a year in a borough without challenge on the part of his lord, became *ipso facto* a free man; and the result of experience showed that the industry of the free laborer was quite as productive as that of the serf. At all events, serfdom died out in England without any special enactment; yet it was not wholly extinct in the latter half of the 16th c., for we find a commission issued in 1574 by Queen Elizabeth, to inquire into the lands and goods of all her bondsmen and bondswomen in the counties of Cornwall, Devon, Somerset, and Gloucester, in order to compound with them for their manumission, that they might enjoy all their lands and goods as freedmen. In a few rare instances, liability to servile duties and payments in respect of lands seem to have continued down to the reign of Charles I. In Scotland, as in England, serfdom disappeared by insensible degrees; but a remarkable form of it continued to survive down to the closing years of last century. Colliers and salters were bound by the law, independent of paction, on entering to a coal-work or salt-mine, to perpetual service there; and in case of sale or alienation of the ground on which the works were situated, the right to their services passed without any express grant to the purchaser.

The sons of the collier and salter could follow no occupation but that of their father, and were not at liberty to seek for employment anywhere else than in the mines to which they had been attached by birth. Statutes 15 Geo. III. c. 28 and 39 Geo. III. c. 56, restored these classes of workmen to the rights of freemen and citizens, and abolished the last remnant of slavery in the British Islands.

In France, though a general edict of Louis X., in 1315, purported to enfranchise the serfs on the royal domain on payment of a composition, this measure seems never to have been carried into effect, and a limited sort of villeinage continued to exist in some places down to the Revolution. In some estates in Champagne and Nivernais, the villeins, known as *gens de main morte*, were not allowed to leave their habitations, and might have been followed by their lords into any part of France for the *taille* or villein-tax. In Italy, one great cause of the decline of villeinage was the necessity under which the cities and petty states found themselves to employ the peasant population for their defence, whom it became expedient to reward with enfranchisement. In the 11th and 12th centuries, the number of serfs began to decrease and villeinage seems no longer to have had an existence in Italy in the 15th century. Over a large portion of Germany, the mass of the peasants had acquired their freedom before the end of the 13th c., but in some parts of the Prussian dominions a modified villeinage continued to exist until swept away by the reforms of Von Stein in the present century.

In Russia, where the feudal system never prevailed, the early condition of the peasant was not a servile one. Down to the 11th c., he could occupy any portion of the soil that he had the means of cultivating, the land being the property of all, and farmed on the purest communistic principles. The reduction of the peasantry to a state of serfdom, and their attachment to the soil, was gradually effected, and not completed till the close of the 16th century. The Russian peasant of the 19th c. was in some respects in as servile a condition as the feudal villein of the 12th c. in the west of Europe; but there was this peculiarity attaching to his position, that while he himself was the property of his lord, the land which he cultivated belonged to himself—a consideration which greatly complicated the question of his emancipation. The Emperor Alexander I. introduced various improvements in the condition of the peasantry, particularly those belonging to the crown, and in his reign serfdom was abolished in Courland and Livonia. The entire abolition of villeinage has been effected by the present emperor, Alexander II., by a very sweeping measure. From March 1863, the peasants, both husbandmen and domestics, have been made entirely free as regards their persons, while they have also obtained the perpetual usufruct of their cottages and gardens, and certain portions of land.—See, on the subject of

serfdom generally, Hallam's *State of Europe during the Middle Ages*, chap. 2.

SERGE, a kind of twilled worsted cloth of inferior quality. There is also a coarse kind of twilled silk used for lining gentlemen's coats called silk serge.

SE'RGEANTS (Fr. from Lat. *serviens*, serving) are non-commissioned officers of the army and marines in the grade next above corporal. They are selected from the steadiest among the corporals, and their duties are to overlook the soldiers in barracks, and to assist the officers in all ways in the field. They also command small bodies of men as guards, escorts, &c. Every company has four sergeants, of whom the senior is the color-sergeant. A superior class are the staff-sergeants, as the quarter-master-sergeant, armorer-sergeant, hospital-sergeant; and above them all is the sergeant-major. The daily pay of a sergeant varies from 1*s.* 11*d.* in the infantry to 2*s.* 11*d.* in the horse-artillery. For his privileges, see NON-COMMISSIONED OFFICERS. In ancient times, the rank of sergeant was considerably more exalted. In the 12th c., the sergeants were gentlemen of less than knightly rank, serving on horseback. Later, the sergeants-at-arms were the royal bodyguard of gentlemen armed *cap-à-pie*.

SE'RGEANTY, GRAND (Fr. *Sergenterie*, from Lat. *serviens*), a tenure by which lands were held in feudal times in England. After the Conquest, the forfeited lands were parcelled out by William to his adherents on condition of the performance of services of a military character. The military tenants of the crown were, however, of two descriptions: some held merely *per servicium militaire*, by knight-service; others held *per sergentiam*, by grand sergeanty, a higher tenure, which involved attendance on the king not merely in war, but in his court at the three festivals of the year, and at other times when summoned. Although the word baron, in its more extended sense, was applied to both classes of crown tenants, yet it was only those holding by grand sergeanty whose tenure was said to be *per baroniam*. In its earliest stage, the distinction between the greater nobility and lesser nobility or gentry in England was, that the former held by grand sergeanty, and the latter by knight-service only. In theory, lands held by sergeanty could not be alienated or divided; but practically this came to be often done, and by this means tenures by sergeanty became gradually extinct before the abolition of military holdings. Considerable misapprehension on the part of Dugdale and later writers has arisen from a double use of the word *serviens*, or sergeant, which is sometimes applied to a tenant either by grand sergeanty or knight-service who had not taken on himself the obligations attendant on knighthood.

The term petty sergeanty was applied to a species of socage tenure in which the services stipulated forebore some relation to war, but were not required to be executed personally by the tenant, or to be performed to the person of the king, as the payment of rent in spurs or arrows.

SERGI'PÉ, a maritime province of Brazil, bounded on the N. by the Sao Francisco, which separates it from Alagoas; on the W. and S. by Bahia; and on the E. by the Atlantic. According to the most recent statements, this province is the smallest in the empire. Area, 15,000 sq. m.; pop. 177,000. The shores are low and sandy, the interior mountainous. The east part is fertile, well-wooded, and produces sugar and tobacco; the western districts are devoted principally to the rearing of cattle. The chief town is Sergipe d'el Rey, at the mouth of the chief river—the Vasa Barris—and with a pop. stated at 9000.

SERINAGUR, SIRINUGGUR, or CASHMERE, the capital of the valley of Cashmere, stands on both sides of the Jhelum, which is here 100 yards wide, 170 miles north-north-east of Lahore. It is quaint and picturesque-looking almost beyond conception. The streets, or rather narrow lanes, lead to the river, and the houses, five and six stories high, are built of wood. Not a single straight line is to be seen. The houses overhang the river, and lean towards each other above the lanes in various stages of dilapidation. Communication between the two quarters is kept up by means of a number of rustic wooden bridges, built on enormous piles of timber. Shawls are an important article of manufacture (see CASHMERE). The manufacture of articles of papier-mâché, the designs of which are far in advance of the workmanship, and engraving on stone and metal, are also important branches of industry. The vicinity of the city, with its border of towering mountains, is exceedingly beautiful. The numerous lakes, connected with the town and river by canals, recall Venice to the traveler. The most notable public structures are the Jumna Musjid or 'Great Mosque,' capable, according to native estimate, of containing 60,000 persons, the mosque of Shah Hamedan, a royal tomb, and the governor's residence. Near the east end of the city lies the dal or Lake of Serinagur, about 5 miles long, and 2½ broad. It is a lovely and tranquil sheet of water, was formerly a choice retreat of the Mogul emperors, the remains of whose pleasure-grounds and palaces are still visible on its margin, the most celebrated being the Shalimar, of polished black marble. Pop. in 1871, 132.681; in the early part of the present century it is stated to have been from 150,000 to 200,000—*Captain Knight's Diary of a Pedestrian in Cashmere and Tibet* (1863).

SERINGAPATA'M (properly, *Shri Ranga Patanam*, City of Vishnu), a decayed city of Southern India, built on an island in the channel of the Kaveri, nine miles north-north-east of Maisur. The island, three miles long, and one mile broad, has a wretched appearance, and the town itself is ill-built, ill-ventilated, and ugly. The fort, about three-quarters of a mile broad, is surrounded by strong walls of stone, and contains the palace of Tipu Sahib (q. v.). In the days of its highest prosperity, S. is said to have contained 300,000 inhabitants; in 1800, it contained 31,895, and in 1871 it contained 10.594. Hyder Ali (q. v.) made it the seat of his government in 1765. It was besieged by Lord Cornwallis in 1791, and again in 1792. On the last occasion, the terms dictated by the commander of the British to Tipu, the son and successor of Hyder Ali, were very severe. A British army appeared before the walls again in 1799, and on the 3d May of that year, the fort was stormed, and Tipu slain in the vicinity of his own palace.

SERJEANT-AT-ARMS, in the English Court of Chancery, is the officer who attends upon the Lord Chancellor with the mace, and who executes by himself or deputies various writs of process directed to him in the course of a Chancery suit, such as apprehending parties who are pronounced to be in contempt of the court. A similar officer attends on each House of Parliament, and arrests any person ordered by the House to be arrested.

SERJEANT-AT-LAW used to be the highest degree of barrister in the common law of England, and was called serjeant-counter, or of the coif. The degree is of great antiquity, and formerly a barrister could only be appointed after being of sixteen years' standing. Formerly, also, they had exclusive audience in the Court of Common Pleas. No appointments have been made of late, and the order was nearly extinct in 1883. The proper forensic dress of serjeants was a violet-colored robe with a scarlet hood. A serjeant was appointed by a writ or patent of the crown. The Chief Justice of the Common Pleas recommended the barrister to the Lord Chancellor, who advised the crown. The degree of Serjeant was entirely honorary, and merely gave precedence over barristers; and when he was appointed, he was rung out of the Inn of Court to which he belonged, and thereafter joined the brotherhood of Serjeants, who formed a separate community. By ancient custom, the common law judges were always admitted to the order of serjeants before sitting as judges, but this practice was abolished in 1874. A Queen's Counsel (q. v.) takes precedence of all serjeants, unless these have patents of precedence, which prevent them being displaced by the Queen's Counsel who come after them. Sometimes one or more of the serjeants are appointed Queen's Serjeants.

SE'ROUS FLUIDS. This term is applied by chemists and physicians to various fluids occurring in the animal body. They are arranged by Gorup-Besanez, one of the highest authorities on Physiological Chemistry, under three heads: 1. Those which are contained in the serous sacs of the body, as the cerebro spinal fluid, the pericardial fluid, the peritoneal fluid, the pleural fluid, the fluid of the tunica vaginalis testis, and the synovial fluid. 2. The tears and the fluids existing in the eyeball, the amniotic fluid, and transudations into the tissue of organs. 3. Morbid or excessive transudations, such as dropsical fluids, the fluids occurring in hydatids, and in blebs and vesicles on the skin, and transudations from the blood in the intestinal capillaries, as in cases of intestinal catarrh, cholera, or dysentery.

All these fluids bear a close resemblance to one another, both in their physical and chemical characters. In so far as relates to their physical characters, they are usually clear and transparent, colorless or slightly yellow, of a slight saline, mawkish taste, and exhibiting an alkaline reaction with test-paper. They possess no special formal or histological elements, but on a microscopic examination, blood-corpuscles, cells of various kinds, molecular granules, and epithelium may occasionally be observed in them. The ordinary chemical constituents of these fluids are water, fibrin (occasionally), albumen, the fats, animal soaps, cholesterin, extractive matters, urea (occasionally), the same inorganic salts which are found in the serum of the blood, and the same gases as occur in the blood. As rare constituents, and only occurring in disease, may be mentioned sugar, the biliary acids, salts of lactic and succinic acids, creatinine, mucin, &c. The following

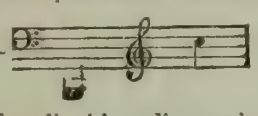
analyses of four of these fluids will serve to give a good idea of their composition:

	Plasma of the Blood.	Peritoneal Dropsy.	Hydro-thorax.	Dysenteric Transudation.
Water	901·51	946·0	936·0	958·6
Solid Constituents	98·49	54·0	64·0	41·4
Fibrin	8·06		0·6	
Albumen }	81·92	33·0	52·8	15·0
Extractive Matters }		13·0	3·0	14·6
Inorganic Salts	8·51	8·0	7·4	11·8

SEROUS MEMBRANES. There are seven of these membranes in the human body, three being median and single, while two are double and lateral. They are the arachnoid, the pericardium, and the peritoneum, with the two pleuræ and tunicæ vaginales testis. Thus they are connected, with the obvious view of facilitating motion and affording general protection, with all the most important organs in the body. They are all closed sacs, with one exception, and a reference to the articles PERICARDIUM, PERITONEUM, and PLEURÆ, will at once show the reader that each sac or continuous membrane consists of two portions—a parietal one, which lines the walls of the cavity, and a visceral, or reflected one, which forms an almost complete coating or investment for the viscera contained in the cavity. The interior of the sac is filled during life with a halitus or vapor, which after death condenses into a serous fluid. With regard to their structure, it is sufficient to state that they consist essentially of (1) Epithelium; (2) Basement Membrane; (3) A stratum of areolar or cellular tissue, which constitutes the chief thickness of the membrane, and is the constituent on which its physical properties are mainly dependent. This layer is more liable to variation than the others, and one of the most common alterations is an augmentation of the yellow fibrous element, by which an increased elasticity is given to the membrane, which is thus better adapted for distention, and for a subsequent return to its original bulk. The situations in which this augmentation is found are, as Dr. Brinton (*Cyclopædia of Anatomy and Physiology*, vol. iv. p. 524) has pointed out, in exact conformity with this view: in the peritoneum, which lines the anterior abdominal wall, and covers the bladder, it attains its maximum; in the detached folds of the mesentery, in the costal pleuræ, and in the suspensory ligament of the liver, it is still very prominent; while on the posterior wall of the belly, and in serous membranes covering the heart, liver, &c., it is almost absent.

The following are the most important of the morbid changes to which these membranes are liable. One of the most frequent of the morbid appearances seen in these structures is the presence of an excess of serous fluid in their cavity. This condition occurs in deaths from various diseases, and in general the serous membrane only shares in a dropsy which is common to other structures, and especially affects the areolar or cellular tissue. When general anasarca, or dropsy of the cellular tissue, has existed for a long time, more or less dropsical effusion is usually found in the pleuræ and peritoneum. The inflammation of these structures is sufficiently described in the articles PERICARDITIS, PERITONITIS, and PLEURISY. Tubercle is seldom primarily deposited in these membranes, although it is not uncommon after other organs have been implicated. Cancer and ossification of the serous membranes are rare affections, but cysts of various kinds, some of which are of parasitic origin, are often found.

Synovial membranes present many points of similarity to serous membranes; as, however, they also present several points of difference, they will be briefly noticed in a special article.

SERPENT, a powerful bass musical wind instrument, consisting of a tube of wood covered with leather, furnished with a mouthpiece like a trombone, ventages, and keys, and twisted into a serpentine form, whence its name. Its compass is said to be from B♭ below the bass staff to C in the third space of the treble clef, including every tone and semitone—  , but the highest octave does not sound well with ordinary players. When unskillfully played, it exhibits the most startling inequalities of tone, in consequence of there being three notes much more powerful than the rest. The serpent is in B♭, and therefore music for it must be written a whole tone above the real sounds. The serpent was invented by a French priest at Auxerre in 1590, and while its principal use has been in military music, it has also been employed in the orchestra to reinforce the basses. As an orchestral, and even as a military instrument, the serpent is far less manageable than the Ophicleide (q. v.), which has nearly superseded it. It is still much used in the music of the Roman Catholic Church.

SERPENTA'RIA. See ARISTOLOCHIA.

SERPENT-CHARMING, an art which has been practised in Egypt and throughout the East from remote antiquity, and which forms the profession of persons who employ it for their own gain, and for the amusement of others. In India, and partly if not entirely in other countries, this profession is hereditary.

There are several allusions to serpent-charming in the Old Testament: see Psalm lviii. 4, 5; Eccles. x. 11; Jer. viii. 17. It is mentioned also by some of the ancient classics, as Pliny and Lucan.

Serpent-charmers usually ascribe their power over serpents to some consitutional peculiarity, and represent themselves as perfectly safe from injury even if bitten by them. To confirm this, they are accustomed, in their exhibitions, to exasperate the serpents, and allow themselves to be bitten, so that blood flows freely. But it has been fully ascertained that the serpents which they carry with them, and produce on these occasions, although of the most venomous kinds, have been at least deprived of their poison-fangs, and to prevent new ones from growing, a portion of the maxillary bone is often if not always taken out; in some cases, it appears that the poison-glands themselves are removed by excision and cautery.

So much, however, being set aside as of the nature of a mere juggler's trick, much still remains which is interesting, and in which there is unquestionable reality. The serpent-charmers of the East have a power beyond other men of knowing when a serpent is concealed anywhere, long practice having probably enabled them to distinguish the musky smell which serpents very generally emit, even when it is too faint to attract the attention of others. They are therefore sometimes employed to remove serpents from gardens and the vicinity of houses. In this, as in their exhibitions, they pretend to use spells. What power the tones of their voice may exert, is of course uncertain; but they accompany their words with whistling, and make use also of various musical instruments, the sound of which certainly has great power over serpents. When they issue from their holes, the serpent-charmer fearlessly catches them, by pinning them to the ground by means of a forked stick. But one of the first things he does afterwards is to knock out or extract the poison-fangs.

In the exhibitions of serpent-charmers, the creatures are often made to twine round the bodies of the performers. They also erect themselves partially from the ground, and in this posture they perform strange movements to the sound of a pipe, on which the serpent-charmer plays. It appears also that he exerts a very remarkable influence over them by his eye, for even before any musical sound has been employed, he governs and commands them by merely fixing his gaze upon them.

In 1850, a party of Arab serpent-charmers visited London, where exhibitions took place similar to those which are common in the East.

SE'RPENTINE, a mineral, composed of silica and magnesia in almost equal proportions, with about 13—15 per cent. of water, and a little protoxide of iron. S. is generally massive; very rarely crystallized in rectangular prisms. COMMON S. sometimes occurs as a rock. It is unctuous to the touch, and soft enough to be scratched by calcareous spar. It is not easily broken, but can be cut without much difficulty. It is generally green, black, or red; the color sometimes uniform, sometimes spotted, clouded, or veined. It receives its name from the serpent-like form which the veins often assume. It is cut and turned into ornaments of various kinds. PRECIOUS S. or NOBLE S., is of a rich dark-green color, hard enough to receive a good polish, translucent; and sometimes contains embedded garnets, which form red spots, and much add to its beauty. It is a rare mineral. It occurs at Baireuth in Germany, in Corsica, at Portsoy in Banffshire, in the Shetland Islands, &c. It is generally found along with foliated limestone, in beds under gneiss, mica-slate, &c., or in Common Serpentine. The ancient Romans used it for pillars and for many ornamental purposes; and vases, boxes, &c. are still made of it, and much prized. The ancients ascribed to it imaginary medicinal virtues.

S. beiongs to the metamorphic rocks. It occurs as an irregularly overlaying mass in the Lizard district of Cornwall, as a dyke at Portsoy, and as nodular aggregations in the granite of Aberdeenshire. It is generally associated with the granitoid, igneous, or metamorphic rocks, though it is occasionally found as a member of the trappean series. Trap dykes, in passing through or coming into contact with limestone, not unfrequently convert it into serpentine, or fill it with lines or masses of serpentine.

SERPENTS (*Ophidia*) an order of Reptiles, which is in general simply characterized as having a very elongated body and no external limbs. The links, however, which unite saurians with serpents are very numerous; the limbs of many saurians being partially wanting, and little more than rudimentary; whilst rudimentary limbs are found by anatomical examination in many serpents, and the rudimentary hinder limbs of some, as boas, appear externally in the form of hooks or claws. See BOA.

The body and tail are covered with scales, the head often with plates. The vertebræ and ribs are extremely numerous, a pair of ribs being attached to each vertebra throughout the whole length of the body. Some serpents have more than 300 pair of ribs. The ribs not only serve to give form to the body, and aid in respiration, but are also organs of locomotion. There is no breast-bone (*sternum*) for the small end of the ribs to be attached to, as in other vertebrate animals, but each rib is joined by a slender cartilage and a set of short muscles to one of the scales of the

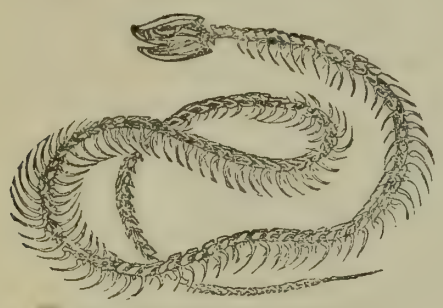


Fig. 1.—Skeleton of the Rattlesnake.

abdomen. A serpent moves by means of the ribs and of these scales, which take hold on the surface over which it passes, and in this way it can glide—often very rapidly—along the ground, or on the branches of trees; and many species climb trees with great facility, gliding up them as if on level ground. Most—if not all—of the species are also capable of elevating a great portion of the body from the ground; and many of those which live among the branches of trees hold their place firmly by means even of a few scales near the tail, and freely extend the greater portion of the body in the air. On a perfectly smooth surface, as that of glass, a serpent is quite helpless and has no power of locomotion.

The vertebræ of serpents are so formed as to admit of great pliancy of the body, which is capable of being coiled up, with the head in the center of the coil, and some serpents have the power of throwing themselves to some distance from this coiled position. The vertebræ are articulated by perfect ball-and-socket joints, the anterior extremity of each being rounded into a smooth and polished ball, which fits exactly into a hemispherical cup in the next; but there are processes in each vertebra which prevent any motion except from side to side, so that serpents are quite incapable of the vertical undulations so often represented in prints. The ribs are also attached to the vertebræ by ball-and-socket joints.

Cuvier divided serpents into three sections, the first—of which the common Blindworm (q. v.) or Slow-worm of Britain is an example—consisting of those which have the skull, teeth, and tongue similar to those of saurians, and in which the eye has three lids, and there are vestiges of bones of anterior limbs; the second, which Cuvier calls True Serpents, having no vestiges of such bones, the eye destitute of lids, and the bones of the head so formed that the mouth and throat are capable of very great dilation; the third, which he calls Naked Serpents, containing only the genus *Cæcilia* (q. v.), now known, notwithstanding its form, to belong really to the Batrachians or Amphibia.

The serpents of Cuvier's first section have been conjoined with some of the nearly allied saurians, more or less furnished with external limbs, under the name *Saurophidia*, by Mr. Gray. They are connected with the True Serpents by the families *Amphisbænidæ* and *Typhlopsidæ*, which nearly agree with them in the structure of the head and mouth, but want the third eyelid—some of the *Typhlopsidæ*, indeed, having the eye itself merely rudimentary—and, like the True Serpents, have no vestige of breast-bone or shoulder. These, with all the creatures included in this section, are, in so far as is known, perfectly harmless. They live chiefly on insects and other very small animals.

The True Serpents live on larger prey, which they swallow entire, some of them—as the boas—crushing it by constriction in the coil of their muscular body. The prey of a serpent is often thicker than the serpent itself, and to admit of its being swallowed, the throat and body are very dilatable. The bones of the head are adapted to the necessity of a great expansion of the mouth and dilation of the throat, as will be seen by the annexed figure of the distended jaws of the rattlesnake. The bones composing the upper jaw are loosely joined together by ligaments; and even the arches of the palate are movable. The two halves of the lower jaw are connected by a ligament, so loose and elastic that they are capable of separation to a great extent; and the mastoid and tympanic bones, which connect the lower jaw and the skull, are lengthened out into pedicles, allowing an extraordinary power of dilation. Serpents, however, sometimes seize prey too big for them to swallow, and die in the attempt, their teeth being so formed as to render it difficult to reject by the mouth what has once got into the throat.

Fig. 2.

The teeth of the True Serpents are simple, and directed backwards. In the non-venomous kinds, there are four rows on the upper part of the mouth, two rows on the jaws, and two on the palate; each division of the lower jaw is also armed with a single row. In vipers, rattlesnakes, and other venomous serpents, there are no teeth on the upper jaw, except the poison-fangs; the palatal teeth, however, forming two rows as in the non-venomous kinds, the arrangement of teeth in the lower jaw being also the same. Venomous serpents do not, in fact, need the same array of teeth as the non-venomous; depending rather on the power of their venom for their prey, which they suddenly wound, and then wait till it is dead. The poison-fangs are long in comparison with the other teeth; they are two in number, firmly fixed into a movable bone; when not in use, they are laid flat on the roof of the mouth, covered by a kind of sheath formed by the mucous membrane of the palate; when the animal is irritated, and about to assail its enemy or its prey, they stand out like two lancets from the upper jaw. They move with the bone into which they are fixed; and the bone and muscles are so arranged that the opening of the mouth brings them into the position for use. There is above them, and towards the back of the head, a large gland for the elaboration of the poison, which is forced through them by the action of the muscles, each fang being tubular. The tube of the fang is formed, not as by a hollowing of it, but as by a bending of it upon itself, and is situated in front. The opening near the fang's point is a narrow longitudinal fissure. The poison-fangs are very liable to be destroyed, and the germs of new ones are generally found behind them, ready to grow and supply their place.

It is sometimes stated as a distinction between venomous and non-venomous serpents, that the former have only two rows of teeth on the upper part of the mouth, whilst the latter have four. This rule must not, however, be accepted without qualification. In the marine serpents (*Hydridæ*), there are rows of maxillary teeth behind the poison-fangs; and some of the venomous land-serpents, as the Bongars or Rock Snakes of the East Indies, which, however, are not amongst the most venomous, have some smaller teeth in the jaw-bones behind the poison-fangs.

The venom of serpents differs very much in its deadly power in different species. The bite of some causes the death of a human being in a few minutes, so that no creatures are more formidable; that of others proves fatal after the lapse of hours; whilst the bite of others, such as the common viper, is seldom fatal, although causing great pain and many unpleasant consequences. 'I have carefully examined all the evidence on record,' says Mr. Buckland, 'as regards the most efficacious internal remedy that can be given in such cases, and have come to the conclusion that nothing is so good as ammonia' (*Curiosities of Natural History*). The same writer also recommends brandy or other stimulating drinks to be taken in large quantities. But it is of the utmost importance to suck the wound as soon as possible after it has been inflicted, and no danger is to be apprehended in doing so, if there be no scratch or sore about the mouth, for the poison, so deadly when it mixes with the blood, is quite innocuous when taken into the stomach.

Many antidotes to the poison of serpents are in vogue in different countries, most of them, if not all, utterly unworthy of regard. Dr. Fayrer believes that the bite of the cobra, elaps, and Russell's viper is almost certain death. *Tight* ligatures above the bitten part, to stop the circulation of the poisoned blood; excision; cauterizing with live coal, red-hot iron, or gunpowder; application of ammonia, and repeated doses of alcohol, are the chief remedies to be tried; but they must be resorted to *immediately* after the patient has been bitten.

The peculiarities of the lungs of serpents are noticed in the article REPTILES. The heart is placed very far back in the body. The intestines have a great absorbent power, and the fæces consist only of the most indigestible portions of the prey in an extremely dessicated state; the members of the animal which has been swal-

lowed being still often distinguishable, and hair, scales, and the like remaining unchanged.

The tongue of serpents is forked, and is often thrust out of the mouth. It is vulgarly regarded as the *sting*, but serpents have no sting, their only weapons being the fangs already noticed. The only sound which serpents emit is that of hissing.

Serpents are either strictly oviparous or they are ovoviviparous. The non-venomous serpents are generally oviparous; the venomous, ovoviviparous. The eggs of those which lay eggs are generally deposited in a long string, connected by a kind of viscous substance, in some heap of decaying vegetable matter, the mother paying no further heed to them. But some serpents coil themselves around their eggs and hatch them; and it would even seem that the habits of the same species differ as to this, in different climates. The eggs of serpents are not quite devoid of calcareous covering, but have so little that their integument is soft and pliable.

It has been often alleged that vipers and other serpents, when alarmed, swallow their young, and eject them again after reaching a place of safety. There still remains some doubt on this curious question, which has been much discussed; and it is not improbable that the alleged proofs of it from living young ones issuing out of the body of the parent when crushed, are to be accounted for by the ovoviviparous mode of generation.

It seems probable that serpents do not possess the senses of taste or smell in great perfection. The ear has no external opening, and no tympanum, nor is it certain that their hearing is acute, but they are remarkably sensible of the power of music, of which serpent-charmers avail themselves, both to bring them from their holes and to control them. See SERPENT-CHARMING. A European gentleman, residing in one of the mountainous parts of India, found that his flute attracted them in such numbers to his house that he was under the necessity of ceasing to play it. Their eyes are small, and are protected from the dangers to which they might otherwise be exposed by a transparent integument connected with the skin, and which comes away with the skin when the old skin is cast off, as is the case at least once a year.

The colors of serpents are very various, and often very beautiful. As a general rule, but not without exceptions, the venomous species are of darker and more uniform color than the non-venomous. The aversion and horror with which serpents are so generally regarded, are of course due to the dangerous character of so many of them, and the difficulty of observing and avoiding them.

Serpents are used as food by some savage tribes. They are capable of being tamed, and some of the non-venomous species have frequently been so, and have been found useful in killing mice, rats, and other such vermin.

Serpents abound chiefly in tropical climates, although some are found in northern countries, as in Scandinavia. The British species were long supposed to be only two in number, the Common Snake (*Tropidonotus natrix*), and the Viper or Adder (*Pelias berus*),

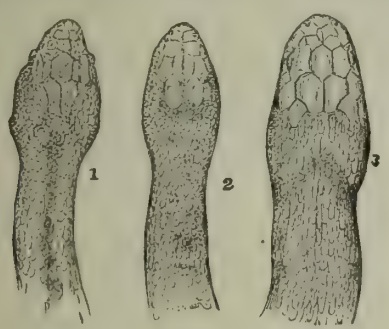
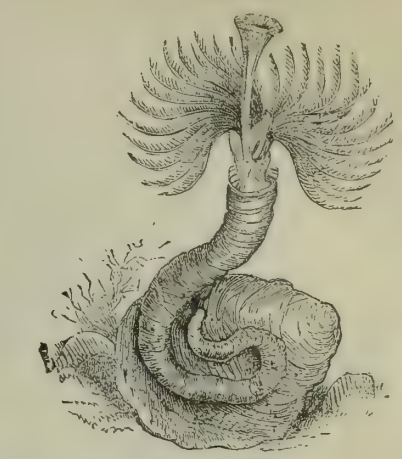


Fig. 3
1. Viper; 2. Coronella lævis; 3. Common Snake.

the latter alone being poisonous; but the harmless Coronella (q. v.) (*Coronella lævis*), which is widely distributed over the continent of Europe, has also occurred in Britain. These three forms may be readily distinguished one from another (see fig. 3), and from the Blindworm (*Anguis fragilis*), which, as already stated, is a limbless lizard. See Huxley's *Comparative Anatomy of Vertebrated Animals;* Cassell's *Natural History;* Fayrer's *Thanatophidia of India;* and British Museum *Catalogue of Snakes.*

SERPUKO'V, a very ancient Russian town, 56 miles south of Moscow, close to the left bank of the Oka. It contains a cathedral, and is defended by a Kreml, or citadel. There are upwards of 50 factories, of which those engaged in the manufacture of cotton prints, sailcloth, woollen goods, and leather are of importance. Pop. (1880) 16,720.

SE'RPULA, a genus of Annelida, of the order *Tubicolæ*, forming and inhabiting a calcareous tube, like that of molluscs, and therefore described in old works on conchology. Indeed, the shell of a S. is not always easily distinguished from that of molluscs of the genus *Vermetus*, although the inhabitants are extremely different; but the shell of *Vermetus* has a regular spire at the apex, which is not found in that of any serpula. The serpulæ attach their shells to rocks, shells, &c., in the sea. The shell is



Serpula contortuplicata, on the back of an Oyster-shell.

variously contorted, and some of the species live in groups, with the shells intertwined. The wider end of the shell is open, and from it the animal protrudes its head and gills, which expand as beautiful fan-like tufts. They are in general exquisitely colored, and serpulæ are among the most interesting and beautiful creatures that can be placed in an aquarium. On the slightest alarm, they disappear completely into the tube, which then is closed by an operculum curiously framed as an appendage to the gills. Several species of S. are common on the British coasts, but the largest are found in tropical seas, and are among the many lovely objects to be seen in looking down through clear still water on coral reefs.

SERRAVA'LLÉ, a city of Northern Italy, in Venetia, on the river Aleschio, 35 miles north of Venice. It is situated in a valley, and was formerly fortified. The cathedral S. Andrea is very ancient. Pop. 5400.

SERTO'RIUS, Q., one of the ablest Roman commanders in the later ages of the Republic, was a native of Nursia, in the country of the Sabines, and began his military career in Gaul. He fought, 105 B.C., in the disastrous battle on the Rhone in which the Roman proconsul, Q. Servilius Cæpio, was defeated by the Cimbri and Teutones, and took part in the splendid victory at Aquæ Sextiæ (mod. Aix.), 102 B.C., where Marius annihilated the same barbarians. On the breaking out of the sanguinary struggle between the party of the nobles under Sulla (q. v.) and the popular party headed by Marius (q. v.) (88 B.C.), he espoused the cause of the latter. Morally, he was much superior to the military adventurers of his time; and the impression we have of him from Plutarch's picturesque biography is that of a valiant, resolute, honest, and stubborn Roman, such as was commoner in the 3d than in the 5th c. of the Republic. None of the Marian generals held out so long or so successfully as he against the victorious oligarchy. He fought in conjunction with Cinna the battle of the Colline Gate, which placed Rome at the mercy of the Marians, but he had no hand in the bloody massacres that followed. What we do hear of him is to his credit. He got his own troops together, and slew 4000 of the ruffianly slaves whom Marius was permitting to plunder and ravish at will through the city. On the return of Sulla from the East (83 B.C.), S. withdrew into Etruria, but finding it impossible to act in concert with the other military leaders of his party, he went to Spain, where he continued the struggle in an independent fashion. At first he was not very successful, and found it advisable to embark for Mauritania. After several adventures, in the course of which he once passed through the Strait of Gibraltar, and fell in with some sailors who had visited the Atlantic islands, and whose descriptions so wrought upon his imagination, that he 'was seized with a strong desire to dwell in the islands, and to live in quiet, free from tyranny and never-ending wars'—(Plutarch)—he returned to the Peninsula, at the invitation of the Lusitanians, got together an army composed of natives, Libyans and Romans, and after a time became the virtual monarch of the whole country. During 80—76 B.C., he was victorious over all his opponents, nor was it until the arrival (76 B.C.), of young Pompey ('Pompey the Great'), that he found an opponent worthy to cope with him; and even Pompey was scarcely yet his equal in military skill.

S. drove Pompey over the Iberus (Ebro) with heavy loss; nor was the campaign of the following year (75 B.C.), more favorable.

for though S.'s subordinates were twice beaten, Pompey himself had no success, and was forced to write urgent letters to the senate for reinforcements. The campaigns of the next two years were unimportant, except in so far as they show us the gradual operation of that miserable jealousy and envy of S. that brought about his ruin. Perperna, and other Roman officers of the Marian party, who had fled to him in 77 B.C., when Sulla became triumphant at home, and who seem to have been a set of base adventurers, secretly stirred up the Spaniards against him, and when that artifice did not prove so successful as was hoped, they conspired against his life, and assassinated him in his own tent, 72 B.C., under circumstances of shameful perfidy. With S. the Marian or popular cause sunk, until it was revived and attained final success in the person of Julius Cæsar (q. v.). Plutarch has written S.'s life, and Corneille has made it the subject of a tragedy.

Sertularia Ingra, with a portion magnified.

SERTULA'RIA, a genus of Campanularian Hydroids, in which the branched horny investment of the plant-like colony forms a cup around each polyp. The polyps are arranged in double row, and the colony is attached to stones, shells, seaweeds, &c. Numerous species of S. occur round the British coasts. See HYDRA, MEDUSA; and Hincks, *British Hydroid Zoophytes*.

SE'RUM. See BLOOD.

SE'RVAL (*Felis Serval* or *Leopardus Serval*), one of the smaller *Felidæ*, a native of South Africa, the *Boschkatte*, or Bush-cat, of the Cape Colony. It is about two feet in length, exclusive of the

Serval (*Felis Serval*).

tail. The S. is a beautiful animal, yellowish with black spots, the lower parts white with black spots. The fur of the S. is in great request, and is know to furriers as that of the *Tiger Cat*. The S. is one of the mildest and most docile of the *Felidæ*.

SERVANT. See MASTER AND SERVANT.

SERVETUS, MICHAEL, or in his native Spanish, MIGUEL SERVEDE, a notable and unfortunate speculator in theology, was born at Villanueva, in Aragon, in 1509. At the age of nineteen, he quitted Spain, and commenced the study of law at Toulouse, which he soon abandoned to devote himself with ardor to the knotty points of the Reformation doctrines. In 1530, he went to Basel to hear Œcolampadius, and thence to Strasburg, where Bucer and Capito taught. His daring denial of the doctrine of the Trinity frightened or angered these divines to such a degree that they denounced him as 'a wicked and cursed Spaniard.' S. appealed from their judgment to that of the public in his *De Trinitatis Erroribus Lib. VII.* (Haguenau, 1531; modern edition, Nürnberg, 1791), and his *Dialogues* (Haguenau, 1532); but the public thought as little of his teaching as the theologians; and to avoid the odium which it had occasioned, he changed his name to Michael de Villanueva, and fled to Paris, where he studied medicine under Sylvius and Fernel, and took his degree as a physician with honors.

S. seems to have possessed a kind of penetrating, if also rash and reckless intellect, which enabled him to *hit* truth occasionally in his flighty researches, or, at least, to make happy guesses in the right direction. Thus, for example, he had an idea (see M. Flourens in the *Journal des Savants*, April 1854) of the doctrine of the circulation of the blood. He attacked Galen and the Faculty with his customary violence in a treatise on Syrups (*Syruporum Universa Ratio*, Paris, 1537; Lyon, 1546). About this time, he made the acquaintance of Calvin, with whom he had several conferences or private disputations, the result of which was a public challenge; but S., after assenting to the arrangements, decamped, afraid probably, and not without reason, that his precipitate imperious way of thinking did not fit him for discussing with so cool, wary, and merciless a logician as the Genevese reformer; afraid, too, perhaps, of being unceremoniously handed over to the authorities for heresy! After living successively for some time at Lyon, Charlieu, and Avignon, and supporting himself by writing for the booksellers, he found an asylum in the palace of Pierre Paulmier, Archbishop of Vienne, in 1541, where he remained for some years, and wrote his famous *Christianismi Restitutio*, first published in 1553. The work has been twice reprinted, first by Dr. Meade of London (incomplete), and again by Murr, at Nürnberg, in 1790. Its celebrity is due more to the fact, that it sealed the fate of its author, than to its intrinsic merits, the ideas being obscure, and the style incorrect. After its publication, S. wished to go to Italy, by way of Switzerland, but in passing through Geneva, was arrested and imprisoned at the instigation of Calvin (q. v.). After a long and complicated judicial procedure, S. was condemned to be burned, and the sentence was carried into execution, 27th October 1553. The fate of S., after all palliations are weighed, remains a dark stain on the memory of Calvin. See Willis's *S. and Calvin* (1877).

SERVIA (*Srbija*), proclaimed a kingdom in 1882, but a principality tributary to Turkey till 1878, when the Berlin Conference recognized its independence. Its frontiers touch those of Austria, Roumania, Bulgaria, and Turkey. Area, 18,720 square miles; pop. (1880) 1,700,211 (of the present area, 4000 sq. miles were added in 1878, and of the pop., over 300,000). The country is mountainous and densely wooded. From the interior, numerous chains proceed northward, forming massive barriers both on the eastern and western frontiers, and sloping pretty steeply towards the swampy plains along the Save and the Danube. In the extreme north-east, near Orsova, they reach the very edge of the Danube, and along with the Eastern Carpathians on the opposite shore, imprison the great river within a wall of rock, known as the *Iron Gate* of the Danube. The highest of these chains is the Rudnik Mountains (gathered into a knotty group about the center of the state), which in the Great Schturaz attains an elevation of 3400 feet. The *Schumadia*, or Forest, extends sonthwards from Belgrade for 60 miles. Beautiful landscapes are everywhere to be seen. The principal rivers (Serb. *Rjeka*) flowing through the country are the Morava and Timok, affluents of the Danube; and the Kolubara, an affluent of the Save, which itself falls into the Danube at Belgrade. The climate is temperate and salubrious, but somewhat cold in the higher regions. The soil in the valleys and level districts is fertile, and equally fitted for the rearing of cattle, the favorite occupation of the people, and the production of corn and wine; but not more than ⅛th of the land is under tillage; the remainder is forest or wilderness. Oak is the most common wood, but chestnuts and fruit-trees of all sorts abound, especially pears, of which there are whole forests in some places. The mountains are believed to be rich in copper and silver, but mining is almost unknown, and manufacturing industry is in the most backward condition.

Constitution, &c.—In 1881, S. paved the way for its recognition as a kingdom. Its constitution dates from 1869. The legislative power resides partly in the prince, partly in the *Skupschtina* or National Assembly. There are six ministers. The Council of State or Senate is a deliberative, not legislative, body, and has the duty of drafting the laws to be submitted to the Skupschtina. This Council comprises one member for each of the twenty-two districts into which S. has been divided since its enlargement in 1878. The Skupschtina now consists of 160 members, of whom 40 are nominated by the government and 120 elected by the people, at the rate of one deputy for every elector. The electors must be 21 years old and pay all the direct taxes.—The army has since 1878 been remodelled and extended. The actual army is about 8000 strong. The number of men available for the permanent army is about 50,000. The first *van* of the national army (or landwehr) comprises 125,000 men; the second, 90,000; so that the total military force of S. in time of war is 265,000 men.

Religion, Education, and Finance.—The inhabitants nearly all belong to the Greek Church, but are independent of the Patriarch of Constantinople. Ecclesiastical affairs are managed by a Metropolitan, whose seat is at Belgrade, and by the three bishops of Uzitza, Shabatz, and Timok. For the few who acknowledge the authority of the pope and the Latin Church, there is a bishop *in part. infid.*, but who resides at Diacobar in Austrian Slavonia. S., according to recent estimates, had 298 churches, 651 parishes, and 652 priests, besides 38 cloisters. It also possessed upwards of 300 educational institutions, including several gymnasia, a Lyceum for philosophical and juristic studies, a theological college, an artillery school, a school of agriculture, and 300 elementary schools for boys, and 13 for girls! These schools are not under the control of the clergy, and education is consequently making rapid progress. In 1878–79, the revenue of S. was £760,000, the expenditure being £745,000; the national debt is about £1,500,000.

Character.—The Servians are distinguished for the vigor of their

frame, their personal valor, love of freedom, and glowing poetical spirit. Their manners and mode of life are exceedingly picturesque, and strongly prepossess a stranger in their favor. They rank among the most gifted and promising members of the Slavic family.

History.—In the earliest times of which we have record, S. was inhabited by Thracian or Illyrian races—the Bessi, Scordisci, Dardanii, and Triballi. Shortly before Christ, it was subjugated by the Romans, and under the name of *Mœsia Superior*, formed part of the province of Illyricum, whose fortunes it shared during the vicissitudes of the empire. Overrun successively by the Huns, Ostrogoths, Longobards, &c., it reverted to the Byzantine rulers about the middle of the 6th c., but was wrested from them by the Avars in the 7th c., to oppose whom the Emperor Heraclius, about 636, invoked the aid of the Serbs from Eastern Galicia. The Serbs obeyed the call, and in less than two years drove the Avars from the land, over which they themselves spread in great numbers, their settlements extending from the Morava as far west as the Dalmatian Alps and the Adriatic, and from the Save as far south as the Balkan and Lake Scutari. About the middle of the 9th c., they were converted to Christianity by missionaries sent by the Emperor Basilius, but this did not in the least abate their natural ardor for battle, and for nearly 200 years they were almost constantly at war with the neighboring Bulgarians—the inveterate enemies of their Byzantine liege lord. In 1043, however, Stephen Bogislav expelled the imperial governors; and during 1050—1080, his son, Michael, made himself wholly independent, took the title of king of S., and procured the recognition of his royal dignity from Pope Gregory VII. For the next hundred years, the Serbs had to fight hard to maintain their independence, but the struggle terminated in their favor; and in 1165, Stephen Nemanja founded a dynasty which lasted for two centuries, during which period the kingdom of S. attained the acme of its power and prosperity.

Under Stephen Dushan (1336—1356), the greatest monarch of the Nemanja dynasty, it embraced the whole of Macedonia, Albania, Thessaly, Northern Greece, and Bulgaria. The progress of the Turkish arms, however, was fatal to its welfare, and in 1389 King Lazar fell in the disastrous battle at Kossovopolje. Sultan Bajazet divided the country between Lazar's son, Stephen, and Lazar's son-in-law, Vuk Brankovitch, but compelled both to pay tribute, and to follow him in war. Gradually the Serbs sunk more and more under the Turkish yoke, until, in 1459, S. was thoroughly subjugated by the Sultan Mahmud. It was uniformly the theater of the bloody wars between Hungary and Turkey, and frequently suffered the uttermost horrors of devastation. Prince Eugene's brilliant successes for a moment flashed a ray of hope into the miserable hearts of the long-suffering Serbs, and by the treaty of Passarowitz (1718), a considerable portion of the country was made over to Austria; but in 1739 it reverted to Turkey, and for the next 60 years the cruelty and oppressions of the Pashas and their Janizaries surpasses all belief. At length the unhappy people could endure the tyranny of their foreign masters no longer, and in 1801 an insurrection broke out, headed by George Czerny (q. v.), which by the help of Russia, ended in the triumph of the patriots, and in the election of Czerny by the people as Prince of Servia. The invasion of Russia by France, however, left the Serbs at the mercy of their late rulers, and the war again broke out. Czerny was forced to flee, and the tyranny of the Turks became more ferocious than ever. Again the people flew to arms under the leadership of Milosch Obrenovitch, and were a second time successful in winning back their liberties. Milosch was chosen Prince of Servia in 1815. Compelled to abdictate in 1839, he was, in 1858, restored to his former dignity, which was made hereditary in his family. In July 1876, S., excited by the rebellion in Herzegovina, declared war against Turkey, and was joined by Montenegro. The Servians, generally unsuccessful, in spite of the help of numerous Russian volunteers, were totally defeated at Alexinatz in September; in November an armistice was concluded; and in March 1877 the conditions of peace were signed.

Next month war was declared by Russia against Turkey. The sympathies of the Principality were undoubted; but Servia did did not venture again to take the field against Turkey till the fate of the war had been practically decided by the fall of the Turkish stronghold of Plevna in December 1877. The recognition of Servia's independence and an important increase of its territory to the southward, demanded by Russia at the close of the war, were agreed to by the Berlin Congress in 1878.

Language and Literature.—The Servian language, called also the Illyrian, belongs to one of the four great divisions of the Slavic family, and is more nearly allied to Russian than to Polish or Bohemian. It is distinguished from the other members of its division by the predominance of vowels, and consequently by its soft, melodious resonance. This character it owes in part to the influence of the Italian and Greek languages—the former influence being the result of commercial intercourse; the latter, of community of religious belief. The long domination of the Turks has also left unmistakable traces on the Servian tongue; nevertheless, it has on the whole preserved a genuine Slavic character, possessing along with the other members of that family a complete system of declension and conjugation, along with a free syntax. The old classical metres are imitated with facility in it. It is spoken (in the three dialects—Herzegovic, Razavic, and Syrmic) by more than 7,000,000 people, of whom 4,500,000 are under Austrian, 2,500,000 under Turkish, and a few under Russian authority.

After their conversion to Christianity, the Serbs, like the Russians, employed the old Slavic church-language in writing, but in two different styles, one called the church style, and the other the chancery or legal style. The most important monument of the latter is the 'Law-book,' published by King Stephen Dushan, though the oldest extant specimens go back as far as the 11th century. The literary remains of the former are more numerous, and embrace ecclesiastical, devotional and historical works, for the most part composed by the clergy and the monks.

With George Brankovitch (born 1645, died 1711), who wrote a *History of Servia* from the origin of the nation to his own time, this first or medieval period in Servian literature closes. The second or modern period is characterized in its commencement by an effort to raise the spoken language of the Serbs to the dignity of a written language. The consequence was, for a considerable time, the literary language of S. was a chaos of confusion, writers not appearing able to make up their minds which dialect to use, and spoiling their productions by a barbarous mixture of both; and it was not till Vuk Stephanovitch published his *Grammar of the Servian Language* (1814), and his *Songs of the Servian People*, that the victory of the reformers was complete. Since then, the spoken language of S. has also become the language of literature. These Servian popular songs or ballads constitute by far the finest part of Servian literature. The picturesque scenery of the land, and the free solitary life led in the mountain ranges, kindled the imagination of the people, and awoke the voice of song at an early period. Some of the ballads—now so widely known throughout Christendom by means of translation—go back to a period anterior to the appearance of the Turks in Europe. In a wonderful manner, they combine the rude strength, spirit, and naïveté characteristics of the ballad everywhere, with oriental fire and Greek plasticity. They are invariably unrhimed, but preserve at the same time a rhythmic measure. See Kapper's *Volkslieder der Serbein* (2 vols. Leip. 1852); and Bowring's *Servian Popular Poetry* (Lond. 1827), and Owen Meredith's *Serbske Pesme* (Lond. 1861); the last, however, a book of doubtful honesty. Among the poets who acquired distinction in the first part of the century, and have employed the vernacular, the most important is Lucyan Muschiki (died 1837), Archbishop of Carlovitz, whose *Poems* appeared at Pesth in 1838. Of recent or living Servian poets, the most gifted are Branko Raditshevitz and Jovan Ilitz. As yet, science has made little progress. In another branch of the Servian people—the so-called Illyrians, especially the Dalmatians, who profess the Roman Catholic faith—literature received an earlier and more artistic development than among the Serbs of the Greek Church.

In the 12th c., a priest of Ducla (Dioclea) wrote a Chronicle, first in Slavic, and afterwards in Latin, fragments of which are still extant. During the 13th and 14th centuries, devotional works in the vernacular were numerous, and towards the end of the 15th c. the republic of Ragusa (Slav. Dubrovnik) obtained the name of the 'Illyrian Athens' on account of the brilliant success with which it cultivated literature, art, and science. Epic, lyric, and dramatic poetry, history and jurisprudence, are all admirably represented. The list of its poets is particularly large. Towards the end of the 18th c., literary activity abated among the southern or Illyrian Serbs, but at the same time began to increase in the north, especially in Croatia and Hungary.—See Ristitz, *Ueber die Serb. Literatur* (Berl. 1853), and, in English, Talvi's *Historical View of the Languages and Literature of the Slavic Nations* (New York, 1850); as also Schafarik's *Geschichte der Südslawischen Literatur* (1864), and Novakovitz's *Istorija srpske Knijzevnosti* (Belgrade, 1867). There are numerous grammars and dictionaries.

SERVICE (*Pyrus domestica* [see PYRUS], the *Sorbus domestica* of many botanists), a tree of fifty or sixty feet in height, with pinnated leaves, which are downy beneath, and their leaflets serrated upwards, and small white flowers in panicles, a rare native of England, found also in various parts of Europe, the west of Asia, and the north of Africa, and cultivated for its fruit, which is obovate, and about an inch in length, resembling a small pear, but pleasant only in a doughy and over-ripened state, like the medlar. It is more cultivated in Italy, Germany, and France than in Britain. The tree is of very slow growth, and attains a great age.

The timber is valuable, very heavy, fine-grained, and susceptible of a high polish, possessing a strength and durability which particularly adapt it for some purposes of the machine-maker. It is

used also for making mathematical rulers, &c.—The name WILD SERVICE is given to an allied species, *Pyrus torminalis*, also called the SORB, a common native of the middle and south of England, and of the middle and south of Europe—a small tree, with a spotted fruit, considerably larger than that of the common hawthorn, which, like the fruit of the true service, becomes mellowed and pleasant by keeping, and is regularly brought to the market in many parts of Europe. Large quantities are brought to London from Hertfordshire. The dried fruit is used in some places as a cure for diarrhœa. The wood is highly valued. It is hard and tough, yellowish-white, with browhish-red and dark-brown streaks.

Wild Service (*Pyrus torminalis*).
a, fruit; *b*, flowers.

SERVICE AND WORK is the name usually given to an action brought by a workman who has done work to order, or on request, or has been engaged for a specific time.

SERVICE OF HEIRS is a proceeding in the law of Scotland by which the heir of a deceased owner of land has his relationship recognized and declared, and his feudal title to the land completed.

SE'RVITUDE, a name borrowed by the law of Scotland from the Roman law, to denote that kind of right or interest which a person often has in land of which he is not the owner, as a right to cut turf, &c. Servitudes are divided into predial and personal. A predial servitude is a right constituted over one subject or tenement by the owner of another subject or tenement; while a personal servitude is constituted over a subject in favor of a person without reference to possession of property. The only kind of personal servitude is life-rent or usufruct. The predial servitudes are those usually referred to under the head of servitude. Such a servitude being constituted in respect of the ownership of property, passes to third parties with such ownership. The tenement over which the servitude exists is called the servient tenement, and the other is called the dominant tenement. Predial servitudes are again subdivided into rural and urban, according as they affect land or houses. The usual rural servitudes are those of passage or road, pasture, feal and divot, aqueduct, thirlage, &c. Passage or road is the right which a person has to walk or drive to his house over another's land. Pasture is the right to send cattle to graze on another's lands. Feal and divot is the right to cut turfs or peats on another's land. Aqueduct is the right to have a stream of water conveyed through another's lands. Thirlage is the right to have other people's corn sent to one's mill to be ground. The urban servitudes are stillicide, light, *oneris ferendi*, &c. Stillicide is the right to have the rain from one's roof drop on another's land or house. Light is the right to prevent another from building so as to obstruct the windows of one's house. *Oneris ferendi* is the right of the owner of the flat above to have his flat supported by the flat beneath.

SE'RVIUS TU'LLIUS. See ROME.

SE'RVUS SERVO'RUM DE'I (Lat. Servant of the Servants of God), a form of subscription adopted by the Roman pontiffs from the days of Pope Gregory the Great, by whom, according to his biographer, Paul the Deacon, it was assumed as a practical rebuke of the ambitious assumption of the title of 'Ecumenical (or universal) Patriarch,' by John, surnamed Nesteutes, or the Faster, the contemporary Patriarch of Constantinople. Gregory is said, indeed, by Paul to have been the first Christian bishop by whom this humble form was employed. This, however, is certainly a mistake, the same designation having been frequently used by bishops before the time of Gregory. Gregory was probably the first of the bishops of Rome to adopt it as a distinctive title. It is found in all the letters of Gregory which Venerable Bede has preserved in his History.

SE'SAMOID BONES are small bones met with in the substance of the tendons of muscles in the neighborhood of certain joints. They derive their name from the Gr. *sesame*, a kind of Indian grain, which they were supposed to resemble. In the human subject, the patella is the best example; and beside it, they are commonly met with only on the palmar aspect of the joint which unites the metacarpal bone with the first phalanx, and in the corresponding position in the toe, there being two in each position, and their object being to increase the leverage of the short flexor muscles of the thumb and toe. They are much more abundant in the great majority of mammals than they are in man.

SE'SAMUM, a genus of plants of the natural order *Bignoniaceæ*, suborder *Pedaliaceæ*, a suborder characterized by wingless seeds, and placentæ with woody lobes attached to the inner wall of the fruit. The calyx of S. is five-parted; the corolla bell-shaped and five-parted, the lowest lobe prolonged; the stamens four, two longer than the others, and a rudimentary fifth stamen; the capsule is oblong, almost four-celled, two-valved, many-seeded. The species are natives of India and Africa, and are annual plants, covered with hairs, their flowers solitary in the axils of the leaves, on very short stalks. They are so similar as to be sometimes reckoned mere varieties of one species, *S. Indicum*. The sweet oleaginous seeds are used in some countries, as in Central Africa, for making a kind of hasty-pudding. In Egypt, they are eaten, strewed on cakes. The bland fixed oil of S., obtained from the seeds by expression, is used as an article of food, and for medicinal purposes, like olive oil. It keeps long without becoming rancid. It is much used by the women of Egypt as a cosmetic. For the sake, chiefly of its oil, S. is much cultivated in India, China, Japan, and in many tropical and subtropical countries, and has been cultivated from very ancient times. It is too tender for the climate of Britain. The oil-cake, mixed with honey and preserved citron, is an oriental luxury. The leaves of S. abound in a gummy substance, which they readily impart to water, making a rich bland mucilage, which is used in the southern parts of the United States as a demulcent drink. S. is sometimes called *Tilseed*.

SESBA'NIA. See DHUNCHEE.

S'ESHA is, in Hindu Mythology, the great king of the serpent race, on which Vishn'u reclines on the primeval waters. He has a thousand heads, which also serve as a canopy to Vishn'u; and he upolds the world, which rests on one of his heads. His crest is ornamented with jewels. Coiled up, S. is the emblem of eternity. He is often also called *Vâsuki* or *Ananta*, the eternal.

SESO'STRIS, the Greek name of a celebrated Egyptain monarch, who is supposed to have conquered all Asia and Ethiopia. His name has passed into the series of those conquerors who have almost achieved universal empire. According to the Greek legendary history, when S. mounted the throne of Egypt, he began his scheme of conquest, first dividing Egypt itself into 36 nomes, placing his brother as regent, and laying on him injunctions not to assume the diadem, or interfere with the royal harem. S. then marched at the head of a large army, and invaded Libya, Arabia, Asia, penetrating further east than Darius. Advancing through Asia Minor, he invaded Europe, and subdued Thrace and Scythia, leaving a colony at Colchis on his return. In the south, he subdued Ethiopia, and placing a fleet on the Red Sea, conquered the adjacent isles, and extended his dominions to India itself. On his return to Egypt from his northern campaigns, his brother, who had disobeyed his instructions, endeavored to destroy him, by inviting him to a banquet at Daphnæ, and treacherously attempting to burn him and his whole family by firing the house. S. threw two of his children into the fire, and making a bridge of their burning bodies, escaped. S., in his triumphs, dragged his captives attached to the wheels of his chariot. The captives were employed on the public works, the enlargement of the Hephæsteum at Memphis (q. v.), and other temples, and in the construction of canals and mounds. Memorials of his reign, it was said, were left as steles or tablets in the conquered countries; and Herodotus saw some in Palestine, which are supposed to be the tablets of Ramesses II. (see RAMESSES), still existing in the pass of Nahr-el-Kelb, or the Lycus, and the sculptured rock at Nymphi, near Smyrna. S. is said to have grown infirm and blind after a reign of 33 years, and to have ended his days by his own hand.

Not only does the greatest confusion and difficulty about identifying this monarch exist among modern, but also in the classical authors. Herodotus places his reign long before that of Cheops of the 4th dynasty. Dicæarchus makes him rule 3712 B.C., and is followed by Aristotle and other authors. Bunsen supposes that there were more than one monarch of this name, and that one was Tosorthos, of the 3d dynasty; another, Sesortesen II., of the 12th dynasty. Lepsius conjectures that he is the Sethos I. and Ramesses II. of the 19th dynasty. But the exploits of Sesostris seem to be a conglomeration of the conquests of the kings of the 18th and 19th dynasty, especially the Thothmes and Ramesses

(q. v.), who extended the empire of Egypt far to the west and east. No one monarch of the Egyptian monarchy can represent Sesostris.—Herodotus, ii. c. 102; Diodorus, i. c. 55—57; Val. Flaccus, v. 419; Strabo, xvi.; Wilkinson, *Mann and Cust.* i. 99—106; ii. 70; iii. 190; Lepsius, *Einleit.* s. 278; Bunsen, *Aegyptens Stelle*, book ii. 85, 86, 312—324.

SESQUIA'LTERA, one of the compound stops of the organ, composed of either five, four, three, or two ranks of open metal-pipes tuned in thirds, fifths, and octaves to the diapason.

SE'SSA, a city of Southern Italy, province of Caserta, about 38 miles north-north-west of Naples. Pop. (1872) 6138. It has a fine cathedral, a theological seminay and colleges. There are manufactories of woollen cloth. The neighboring soil is fertile. S. is a very ancient city; it was the capital city of the Aruncii, was afterwards colonized by the Romans in 314 A. U. C., and was very flourishing under the Roman empire. It was raised to a duchy in the middle ages.

SESSION, COURT OF. See COURT OF SESSION.

SESSIONS. See JUSTICE OF THE PEACE, QUARTER SESSIONS.

SESTE'RTIUS, a Roman coin, was the fourth part of the *Denarius* (q. v.), and thus contained at first 2½ *asses* or *libræ*. The name is an abbreviation of the Latin *semis-tertius*, which was their mode of expressing 2½; and their custom was, to derive the names of all their coins from the foundation of their money-system, the *As* (q. v.). The symbols for it were indifferently HS or IIS, the former being only a modification of the latter, which expresses two units, and S for the additional half-unit (*semis*). In the Latin classics, the phrase *sestertius-mummus*, or merely *mummus*, is frequently employed to denote this coin. When the *Denarius* (q. v.) was made to contain 16 *asses*, the relation between it and the sestertius was preserved, and the latter from that time contained 4 *asses*, though the name, which was now no longer significant, was preserved. Up till the name of Augustus, when the relation of the denarius to the *as* was changed, the sestertius was worth 2 pence ¼ farthing sterling, but after this period it was reduced to 1 penny 3¼ farthings sterling. The sum of 1000 sestertii was called *sestertium* (after Augustus, = £7, 16*s.* 3*d.*), which was the 'money of account' (never a 'coin') used in the reckoning of large sums of money.

SE'STRI LEVA'NTÉ, a seaport of North Italy, 26 miles east-south-east of Genoa. It is situated on a little bay near the mouth of the Gromolo, and has five foreign consulates. Its Church of the Nativity has some valuable paintings. Pop. 2300.

SE'STRI PONE'NTÉ, a town of North Italy, 4 miles west of Genoa, stands on the high-road which runs along the sea-coast. There is a large government factory of tobacco. Pop. 9500.

SETA'RIA. See MILLET.

SETHE. See COAL-FISH.

SE'THITES, the name given to an obscure Gnostic sect of the 2d c., allied to the Ophites, or worshipers of the serpent; they belonged to that class of religionists who, in evolving what they regarded as their system, approached paganism. Accepting the Christian mode of thought and its terminology, they utterly disregarded the great facts of Scripture history, maintaining that Seth reappeared in the person of the Messiah, and affirming that they possessed books written by him.—See Neander's *Kirchengeschichte* (Bohn's translation, vol. ii. page 115).

SE'TON, in Surgery, is an artificially produced sinus or channel, through which some substance—e. g., a skein of cotton or silk, or a long flat piece of india-rubber or gutta-percha—is passed so as to excite suppuration, and to keep the artificially formed openings patent. (The term is, however, very often employed to designate the inserted material.) Setons are established in the subcutaneous tissue of the body (1) as counter-irritants, or (2) to act as a drain on the system at large, or (3) to excite inflammation and adhesion. For the purposes of counter-irritation, setons are usually inserted in the neighborhood of the affected parts; but when intended to act as a drain on the system at large—e. g., in threatened head-affections—the nape of the neck is the part always selected. The operation is very simple. A longitudinal fold of skin over the spines of the cervical vertebræ is raised by the fingers from the deeper structures, and is transfixed by the seton-needle rather obliquely, so that one of the openings shall be rather more dependent than the other. The needle must pass somewhat deeply through the subcutaneous tissue, as, if it passed immediately beneath the skin, the latter would probably slough over the whole track of the wound. The inserted material should be smeared with oil, and may be allowed to remain undisturbed for four or five days, till there is a free discharge of matter, after which a fresh portion should be drawn daily through the wound.

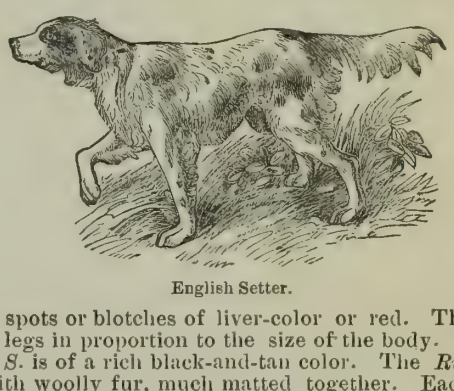
For the purpose of exciting local inflammation and adhesion (which is a result of the inflammation), setons are employed in the treatment of hydrocele, enlarged bursæ, ranula, bronchocele ununited fractures, &c. In the two last-named cases, their use is, however, not unattended by danger.

The word *seton* is derived from the Latin *seta*, a hair, because hairs were originally employed as the inserted material. Indeed, at the present day, it is the custom of many of the nomadic tribes of Central Asia to insert a hair into the heels of their prisoners, which lames them to such an extent as to prevent their escape.

SETT, in Scotch Law, was used to denote the constitution of a burgh, whether founded on immemorial usage or modelled by the Convention of Royal Burghs (q. v.).

SE'TTÉ COMMU'NI DI VICE'NZA, a district consisting of seven communes or parishes in the neighborhood of Vicenza, the language and population of which are plainly Teutonic, and have maintained themselves pure and unmixed in the midst of a Latin people from the days of the Roman republic. The inhabitants are believed by antiquaries to be descendants of the remnant of the Cimbrian army which was defeated with great slaughter by Marius, and are supposed to have escaped to the mountains, and there fixed a permanent settlement. Their language is perfectly intelligible to any German scholar. Specimens of this dialect, and of a similarly isolated Teutonic dialect which is found near Verona, are given by Adelung in the *Mithridates*, ii. p. 215.

SETTER, a king of dog which derives its name from its habit of *setting* or crouching when it perceives the scent of game, instead of standing, like the pointer. Setters, however, are now trained to adopt the pointer's mode of standing whilst marking game. The S. was originally used to assist in the capture of game by the net. It is supposed to derive its origin from a mixture of the pointer and the spaniel. It is larger than the spaniel; its hair is less smooth than that of the pointer, and has more of the waved character of that of the spaniel, to which there is a resemblance also in the ears. The tail is bushy. There are several breeds of the setter. The general color of the *English S.* is a white ground,



English Setter.

with large spots or blotches of liver-color or red. The *Irish S.* has larger legs in proportion to the size of the body. The *Scotch* or *Gordon S.* is of a rich black-and-tan color. The *Russian S.* is covered with woolly fur, much matted together. Each of these breeds has its peculiar merits. All setters have the soles of the feet well covered with hair, so that they can bear hard work on rough ground. They soon become exhausted, however, unless they have access to water. The S. is much employed by sportsmen. It is one of the most affectionate, gentle, and intelligent of dogs.

SETTLE, ELKANAH, was born at Dunstable, in the year 1648. He completed his education at Trinity College, Oxford, which he left without taking a degree, and repaired to London, to seek his subsistence by literature. In 1671, he made something of a hit by the production of his tragedy of *Cambyses;* and the Earl of Rochester and others, wishing to annoy and insult the great Dryden, loudly hailed in him the superior genius of the two. Through the influence of Rochester, to his next tragedy, *The Empress of Morocco*, the unwonted honor was accorded of being played at Whitehall by the lords and ladies of the court, and in this way a great run was secured for it when it came before the general public. In the insolence of success, the author printed along with it a Preface, in which Dryden was severely assailed. Solely in virtue of the quarrel thus engendered is S. now remembered. In his great satire, *Absalom and Achitophel*, Dryden scourged him with his scorn, so that in some sort he survives for us, if only as a shrieking ghost. Having no real strength of talent, he speedily relapsed into obscurity. The post of poet-laureate for the city he had obtained and he continued to retain. By writing in this capacity verses for city pageants and festivities, and producing pieces to be acted in the booths of Bartholomew Fair, the sometime rival of Dryden was fain to eke out a wretched subsistence. In his destitute age, he was admitted to the Charter-house, where in 1723 he died, his works having predeceased him.

SETTLED ESTATE, in English Law, means an estate held by some tenant for life, under conditions more or less strict, defined by the deed.

SE'TTLEMENT, in English Law, is used in two senses. In one case, it means the mode of securing property on married parties, so as to regulate the succession in the event of the death of either, or it may regulate the succession of parties not married. In poor-law matters, it means that kind of right which a pauper has to support by the parish by reason of his being born there, or of his renting a tenement or acquiring estate, &c. It often happens that a person becomes chargeable, that is, is entitled to be relieved by a parish in which he has no settlement, and the relieving parish can forthwith remove him to his parish of settlement. See REMOVAL OF PAUPERS.—In Scotland, settlement, besides the above meanings, also means the general will or disposition by which one regulates the disposition of his property after death.

SETU'BAL (frequently and erroneously called by the English ST. UBE'S) is an important seaport city of Portugal, in the province of Estremadura, 20 miles south-east of Lisbon. It stands on the north side of the Bay of Setubal, which forms a magnificent harbor, though the entrance to it is obstructed by sandbanks. The harbor is furnished with a light-house and with broad and handsome quays, and is protected by five forts; but the valley in which the town itself stands is completely commanded by the heights in the vicinity. The town owes its importance chiefly to its trade in the muscadel and white wines, in sea-salt, oranges, lemons, and cork bark, but fishing is also carried on with considerable activity. S. is the old Roman *Cetobriga*. In 1755, it was visited by an earthquake, from which it suffered severely. Pop. 17,000.

SEVEN: frequently used as a mystical and symbolical number in the Bible, as well as among the principal nations of antiquity (the Persians, Indians, Egyptians, Greeks, Romans, &c.). The reason for the preference of this number for sacred use has been found in its consisting of *three*—the number of the sides of a triangle—and *four*—the sides of a square, these being the simplest rectilineal figures :—or in other equally vague circumstances. The real reason, however, seems to be astronomical, or rather astrological, viz., the observation of the seven planets and the phases of the moon—changing every seventh day. (See WEEK.) As instances of the use of this number in the Old Testament, we find the Creation completed in seven days, wherefore the seventh day was kept sacred; every seventh year was Sabbatical, and the seven times seventh year ushered in the Jobel-year. The three *Regalim*, or pilgrim festivals (Passah, Festival of Weeks and Tabernacles), lasted seven days; and between the first and second of these Feasts were counted seven weeks. The first day of the seventh month was a 'Holy Convocation.' The Levitical purifications lasted seven days, and the same space of time was allotted to the celebration of weddings and the mourning for the dead. In innumerable instances in the Old Testament and later Jewish writings, the number is used as a kind of round number. In the New Testament we have the churches, candlesticks, stars, trumpets, spirits, all to the number of seven; and the seven horns, and seven eyes of the Lamb. The same number appears again either divided into half (3½ years, Rev. xiii. 5, xi. 3, xii. 6, &c.), or multiplied by ten—seventy Israelites go to Egypt, the exile lasts seventy years, there are seventy elders, and at a later period there are supposed to be seventy languages and seventy nations upon earth.

To go back to the earlier documents, we find in a similar way the dove sent out the second time seven days after her first mission, Pharaoh's dream shows him twice seven kine, twice seven ears of corn, &c. Among the Greeks the seven was sacred to Apollo and to Dionysos, who, according to Orphic legends, was torn into seven pieces; and it was particularly sacred in Eubœa, where the number was found to pervade, as it were, almost every sacred, private, or domestic relation. On the many ancient speculations which connected the number seven with the human body and the phases of its gradual development and formation, its critical periods of sicknesses—partly still extant as superstitious notions—we cannot here dwell. The Pythagoreans made much of this number, giving it the name of Athene, Hermes, Hephaistos, Heracles, the Virgin unbegotten and unbegetting (i. e., not to be obtained by multiplication), Dionysos, Rex, &c. The 'seven sacraments,' the 'seven Free Arts,' the 'seven wise men,' and many more instances, prove the importance attached to this number in the eyes not only of ancient but even of our own times. That it played an immense part in the superstitions of the middle ages need hardly be added.

SEVEN DOLOURS OF THE BLESSED VIRGIN MARY, FEAST OF, a modern festival of the Roman Catholic Church, which, although bearing the name of devotion to the Virgin Mary, in reality regards those incidents in the life and passion of Christ with which his mother is most closely associated. This festival is celebrated on the Friday preceding Palm Sunday (q. v.). The 'dolours' or sorrows of the Blessed Virgin have long been a favorite theme of Roman Catholic devotion, of which the pathetic *Stabat Mater Dolorosa* is the best known and most popular expression; and the festival of the Seven Dolours is intended to individualize the incidents of her sorrows, and to present them for meditation. The seven incidents referred to under the title of 'dolours' are: 1. The prediction of Simeon (Luke ii. 34); 2. The flight into Egypt; 3. The loss of Jesus in Jerusalem; 4. The sight of Jesus bearing his cross towards Calvary; 5. The sight of Jesus upon the cross; 6. The piercing of his side with the lance; 7. His burial. This festival was instituted by Pope Benedict XIII. in 1725.

SEVEN SLEEPERS, the heroes of a celebrated legend, which is first related by Gregory of Tours in the close of the 6th c. (*De Gloria Martyrum*, c. 95), but the date of which is assigned to the 3d c., and to the persecution of the Christians under Decius. According to the narrative, during the flight of the Christians from the persecution, seven Christians of Ephesus took refuge in a cave near the city, where they were discovered by their pursuers, who walled up the entrance, in order to starve them to death. A miracle, however, was interposed on their behalf: they fell into a preternatural sleep, in which they lay for nearly 200 years. The concealment is supposed to have taken place in 250 or 251; and it was not till the reign of Theodosius, 447, that they were reanimated. On awaking, they imagined that their sleep had been but of a single night; and on one of the party (supposing the persecution still in progress) going into the city to purchase provisions privately, he was amazed to find erected in triumph on the churches and other buildings, a cross, which, as it seemed, but a few hours before, he had seen the object of contempt and blasphemy. When their wonderful history became known, they were conducted in triumphant procession into the city of Ephesus; but they all died at the same moment, as if by one common and mysterious destiny. The same legend reappears with variations at later periods of Christian history.

SEVENTH-DAY BAPTISTS. See SABBATH.

SEVEN WISE MASTERS is the title of a medieval collection of novels, important both from its contents and its wide-spread popularity. The idea of the work is as follows: A certain prince's son, instructed in all kinds of wisdom by seven sages, finds, from an examination of the stars, on his return to his father's court, that he is in danger of losing his life, if he speaks a word within seven days. His stepmother, whose allurements he had repelled, endeavored in revenge to persuade his father to put him to death, and each day related an artfully constructed story, with the view of furthering her wicked purpose, but its effect was daily neutralized by a rival narrative told by each of the sages. At last, on the expiry of the seven days, the prince himself was enabled to disclose the base designs of his stepmother. —The work is undoubtedly of oriental origin, yet neither the period when it was composed, nor how far it spread through the East, can be ascertained with sufficient accuracy. According to Masudi, it existed in Arabic as a translation from Indian sources before the 10th c., but none of the extant Arabic versions go back so far. Nearest to the original form appears to stand the *Eight Nights* of Nakhschebi, a Persian adaptation of the Indian *Tutiname* (Brockhaus, Leip. 1845). It passed into the literature of Western Europe in the 11th or 12th c., through the medium of two redactions, a Hebrew and a Greek, the latter by Andreopulos, under the title of *Syntipas* (see *Das Buch von den sieben weisen Meistern*, translated from the Hebrew and Greek by H. Sengelmann, Halle, 1842; *Syntipas* being republished by Boissonade, Paris, 1828). The work was disseminated through Christendom; sometimes in a complete form; sometimes only particular novels were reproduced, under all sorts of names, and with all sorts of modifications; sometimes in verse, sometimes in prose. Latin versions began to appear about the beginning of the 13th c., and Keller has published a French metrical one, from a MS. of 1284 (*Li Romans des Sept Sages*, Tüb. 1836), and Henry Weber an English metrical one (third vol. of the *Metrical Romances*, Edin. 1810). There are several German versions, dating from the 14th century. In the 15th c., a popular German chap-book, *Von den sieben weisen Meistern*, was frequently reprinted (the first edition is dated Augsb. 1473), and is included by Simrock in his collection of German *Volksbücher*.

SEVEN WISE MEN, the collective designation of a number of Greek sages, who lived about 620—548 B.C., and devoted themselves to the cultivation of practical wisdom. Their moral and social experience was embodied in brief aphorisms, sometimes expressed in verse, sometimes in prose. The names of the Seven, as usually given, are Solon (q. v.), Thales (q. v.), Pittacus (q. v.), Bias (q. v.), Chilon, Cleobulus, and Periander of Corinth; but there is not absolute unanimity among the ancients either as regards the names, the number, the history, or the sayings of these famous sages. The fragments of wisdom attributed to them which have come down to us are to be found in Orelli's *Opuscula Græcorum Veterum, Sententiosa et Moralia* (Leip. 1819), and have been trans-

lated into German by Dilthey in his *Fragmente der sieben Weisen* (Darmstadt, 1835).

SEVEN WONDERS OF THE WORLD were, in ancient times, reckoned to be the Pyramids of Egypt, the Hanging Gardens of Semiramis at Babylon, the Temple of Diana at Ephesus, the Statue of Jupiter at Athens by Phidias, the Mausoleum (q. v.), the Colossus (q. v.) at Rhodes, and the Pharos of Alexandria. This cycle of seven wonders originated among the Greeks after the time of Alexander the Great, and they were described in a special work by Philo of Byzantium, which has been edited by Orelli.

SEVEN YEARS' WAR, THE, was the third, last, and by far the longest (1756—1763) and most terrible of the contests for the possession of Silesia (q. v.). During the two former wars, the Empress Maria Theresa had plenty of other work on hand in maintaining her claims to the Austrian dominions (see SUCCESSION, WAR OF AUSTRIAN) to offer any very effective resistance to the aggression of Frederick the Great of Prussia; but after emerging triumphantly from this contest, she took advantage of the circumstance that the king of Prussia was on bad terms with all the chief continental powers except Turkey and Spain, to renew the struggle for Silesia, which had been snatched from her at the moment of her greatest straits. She found the Czarina Elizabeth, the King of Poland and Elector of Saxony, and Louis XV. of France (or rather Madame de Pompadour), ready to enter into an offensive and defensive treaty with her.

On the other hand, Britain (then at war with France), engaged to assist Prussia with an army in Hanover, and with subsidies when necessary. Resolving to anticipate his enemies, and secure a safe basis for future operations, Frederick made a sudden advance (August, 1756) on Dresden with 60,000 men, took possession of the country, which he governed from this time with slight intervals to the end of the war, and cooped up the Saxon army 18,000 strong, between Pirna and Königstein. On the Austrians, under Browne, advancing to relieve their allies, they were met by Frederick at Lobositz (October 1), and after an indecisive contest, were obliged to retreat. The Saxons then surrendered (October 14), and were mostly incorporated with the Prussian army, which went into winter-quarters in Saxony and Silesia.—The *second campaign* (1757) began under more favorable auspices for the Austrian coalition, as the rapid action of Frederick had taken it somewhat by surprise in the preceding autumn; besides, Sweden (subsidized by France) became a fourth in the coalition, in order to recover Pomerania, and the German Reich or Empire raised an army, 33,000 strong, to assist Austria. A combined attack was now made by a French army (100,000) on Hanover; another French army (30,000) on Hesse-Cassel (an ally of Prussia), with a view to reach Saxony; an Austrian army from Bohemia on Saxony and another on Silesia, both of them at first united under Marshal Daun, but latterly (1760) separated, under Daun and Loudon; the Russians (100,000) on the east and north-east; and the Swedes (22,000) in Pomerania; while the imperial army sometimes joined the southern French, and sometimes the west Austrian armies. To oppose these armies, numbering in all 430,000, Frederick had the combined British-Hanoverian-Hessian army (60,000) in Hanover, and a Prussian army of 200,000 strong, which was distributed, as need required, over the various points attacked; but he relied much on the rapidity of his movements, and the harmonious completeness of his plans.

In April, Frederick, leaving a corps of 24,000 under Lewald to resist the Swedes and Russians, invaded Bohemia, drove in the advanced corps of the Austrians upon their main army, which he then completely routed at Prague (May 6), with a loss on his side of 18,000, and of 19,000 on the part of the Austrians. Marshals Schwerin (Prussian) and Browne (Austrian) fell in this conflict. Frederick immediately invested Prague, to which Prince Charles of Lorraine, with 46,000 men, had retreated; but Daun, who advanced from Moravia to its relief, inflicted on the Prussians a crushing defeat at Kolin (June 18), and forced them to retire from Bohemia. The north French army had meanwhile, under Marshal d'Estrees, advanced into Hanover, defeated the incapable Duke of Cumberland at Hastenbeck (July 26), and compelled him to capitulate, on condition that the whole of his army, excepting the Hanoverians, should be disbanded. But the British government refused to ratify this shameful treaty, and speedily raised another army of similar composition, which was placed under the command of Duke Ferdinand of Brunswick, an able leader, who again drove back the French, and proved himself so capable to hold them in check, that Frederick ceased to have any apprehensions from this quarter. The south French army under Soubise had also advanced in conjunction with the Imperialists under the Prince of Hildburghausen in the direction of Saxony, but Frederick was not prepared to lose this valuable vantage-ground, and falling upon them at Rossbach (q. v.) (November 5), he put them completely to rout. During his absence, however, the Austrians had broken into Silesia, routed his armies, and compelled them to retire; so, compelled to use the utmost expedition in returning, he collected a small army, defeated a thrice as numerous force of Austrians under Prince Charles of Lorraine at Leuthen (December 5), and recovered Silesia.

On the east, the Russians had appeared in great force, captured Memel, committing the most horrible devastations, and had routed Lewald at Grossjägerndorf (August 30), when the change of Russian policy due to the illness and apparently impending demise of the czarina, caused them to relinquish almost all their conquests; Lewald then attacked and defeated the Swedes, driving them under the walls of Stralsund. Thus closed the second campaign, leaving matters very much as they were at the commencement.—Duke Ferdinand opened the *third campaign* (1758) by driving the French from Lower Saxony, pursued them across the Rhine, and defeated them near Krefeld (June 23); but Contades, the new French commander, having obtained the co-operation of Soubise, compelled him to retrace his steps, till, receiving a reinforcement of 12,000 British, Ferdinand again advanced, throwing Contades between the Rhine and Meuse, and Soubise between the Rhine and Main. Meanwhile, Frederick had not been idle, for after being driven out of Moravia (which he had invaded in spring) by Daun, he marched northwards with a portion of his army to meet the Russians, who, the czarina having recovered, had again invaded Brandenburg, and defeated them in a desperate battle at Zorndorf (August 25), compelling them to retreat into Poland. Frederick's presence was next needed in Saxony, where his brother, Prince Henry, was being hard pressed by Daun with superior forces; but on his arrival the Austrians retreated eastward till October 14, when Daun turned, took Frederick completely by surprise, and gave him a severe defeat at Hochkirch (q. v.), though before the end of the year the Prussians were again in possession of Saxony. Thus passed another campaign with a slight advantage to the Prussians.—The *fourth campaign* (1759) preceded by fruitless attempts at negotiation with France, on the part of Frederick), though signalized by only two great actions, was more unfortunate for Prussia.

The French under Soubise had captured Frankfurt during the winter, and the Duke of Brunswick in attempting to recover it, was defeated at Bergen (April 13), by Broglie (the successor of Soubise), and compelled to resign the whole of Hesse to the French; but later in the year, his signal victory at Minden (August 1) over Contades and Broglie, and that of his relative, the hereditary Prince of Brunswick, at Gohfeld on the same day, recovered most of Westphalia, and drove the southern French beyond the Lahn and Rhine. But in the Saxon district, although Prince Henry invaded Bohemia (April), capturing immense supplies, and cleared Franconia (May) of Austrians and Imperialists, he subsequently evacuated Saxony, which was then occupied by the Imperialists, and Loudon's Austrians advanced into Lusatia. In Silesia, Fouqué gallantly kept the Austrians at bay; and Dohna continued to coop up the Swedes about Stralsund, keeping at the same time an eye on the Russians; but the latter soon gathered in such force that he was compelled to retreat. His successor, Wedel, in attempting to bar their advance, was routed near Züllichau (July 23), and though Frederick hastened to his assistance, attacked them at Kunersdorf (q. v.) (August 12), and had almost gained the day, the arrival of Marshal Loudon with an Austrian force turned the tide, and converted this almost victory into the most signal defeat suffered by the Prussians during the whole war. On the following morning, he could hardly muster 5000 men, but luckily, the Russians showed no inclination to follow up their victory, and by untiring perseverance, the Prussian monarch succeeded in raising another army 28,000 strong. Though it seemed almost impossible for him to prevent the meditated junction of the Russians and Austrians in Brandenburg; yet, by dint of skilful manœuvring, he succeeded in compelling the Russians to retire to Poland; and Prince Henry, by cutting off their supplies, forced the Austrians into Saxony. On November 21, however, he suffered a severe blow in the capture of Finck with 11,000 Prussians, at Maxen in Saxony.

With greatly diminished strength, an exhausted treasury (chiefly supplied by the English subsidy, the taxes of Saxony, and forced contributions on Mecklenburg, Saxony, and Anhalt), a desolated territory incapable of affording either men or supplies, and gloomy forebodings of the final issue, though with unfaltering resolution never to yield, Frederick prepared for his *fifth campaign* (1760).—His army in Prussia, now reduced to 90,000 men, mostly foreigners and raw recruits, was still further diminished by the capture of Fouqué with 8000 men in Silesia, followed by Marshal Loudon's conquest of that province, though the brilliant victory of Liegnitz (August 15) subsequently restored him the north-western division of it; he then joined his brother, Prince Henry, drove the Russians across the Oder, and Daun into Bohemia; but his strength was now becoming glaringly insufficient for the task to which he had set himself; the Russians and Austrians captured and plundered Berlin (October 3); the Swedes came down from the north, and Loudon's Austrians upwards

through Silesia, so that he was now fairly in the toils. But, like a lion in the midst of the hunters, he turned upon his most able and pertinacious adversary, Daun, terribly routed him at Torgau (November 3), in Saxony, then drove Loudon into Glatz, and frightened away the Russians to Poland, and the Swedes to Stralsund. In the west, the fortune of Prussia was in the ascendant, and the French, defeated by Prince Charles of Brunswick at Einsdorf (July 13), and by Duke Ferdinand at Marburg (July 31), were again confined to Hesse.—The *sixth campaign* (1761) on the Rhine commenced still more auspiciously for Frederick, as the French were driven in detail from their strongholds, had their supplies captured, suffered defeat by the Hanoverians at Langensalza (February 14), and by Duke Ferdinand at Villingshausen (July 15), though in the end Broglie and Soubise again gained possession of Hesse. In Silesia, Frederick attempted to bar the progress of the Austrians, so as to prevent their junction with the Russians, and so opposing 130,000 men to his poor remnant of 50,000; but in vain; however, the union was productive of no ill results to him, for scarcity of provisions speedily compelled the Russians to retreat to Poland, after which Loudon retired to Upper Silesia, capturing Schweidnitz with 3700 men on his way.

In Saxony, Prince Henry had to retreat before Daun, and the Prussians were ejected from Pomerania by the Russians and Swedes, all subsidies from Britain stopped by the Earl of Bute after George II.'s death, and the country ravaged in all directions, so that things were now in a desperate condition, and Prussia almost at its last gasp. Frederick's assailants had cooped him up within Southern Brandenburg and North-western Silesia, and though as resolute as ever to figlrt on, it seemed as if another campaign must bring him to final ruin. But the death of the czarina (January 5, 1762) converted the most powerful of his enemies into a fast friend; Sweden, which had suffered uninterrupted reverses during the whole war, also retired from the alliance—and the *seventh campaign* (1762) commenced on equal terms, as Austria and France were almost as much exhausted as Prussia. On the refusal of Austria to submit her cause to arbitration, the Czar Peter III. joined his army to that of Frederick; but his successor, Catharine II., ordered the return of the army, though her strict nutrality was of itself an immense benefit. Frederick had now no fears for the result. Nor had he any reason, as subsequent events showed, for on July 21 he drove an Austrian force from its intrenchments at Burkersdorf, and following up his success, routed Daun at Reichenbach (August 16), and took Schweidnitz (October 9); while Prince Henry, by a series of fortunate manœuvres, possessed himself of the passes of the Erzgebirge, and with the valuable aid of Seidlitz, completely overthrew the other Austrian army at Freiberg (October 22); and the two Brunswicks nobly sustained the glory of Prussia at Wilhelmsthal (June 24) and Luternberg (July 23), capturing Cassel, and recovering the whole of Hesse.

France now gave up a contest from which she had gathered nothing but military disgrace, and concluded treaties with Britain and Prussia; while Prussia and Austria agreed to an armistice with regard to Saxony and Silesia, of which the astute Frederick took advantage to send Kleist on a raid through Franconia and Bavaria, which had the effect of withdrawing the minor German states from the coalition. Maria Theresa was now left alone, and sorely against her will, was compelled to conclude the peace of Hubertsburg, 15th February 1763, which finally acknowledged Frederick as the lord of Silesia. This long and desperate conflict made no change in the territorial distribution of Europe, but it increased tenfold the moral power of Prussia, and gave its army a prestige which it retained till the battle of Jena. It cost Europe a million lives, and prostrated the strength of almost all the powers who had engaged in it.—See for a complete account, Carlyle's *History of Frederick the Great*.

SE'VERALLY, in English Law, is the enjoyment by an individual of an estate, in contradistinction to joint (q. v.).

SE'VERN, one of the most important and beautiful, and after the Thames, the largest of the rivers of England, rises from a chalybeate spring on the eastern side of Plinlimmon, about 11 miles west of Llanidloes, in Montgomeryshire, North Wales. Flowing eastward from its source to Llanidloes, to which town it retains its original British name of Hafren, it afterwards flows north-east to the eastern boundary of Montgomeryshire, then east-south-east, past Bridgenorth in Salop, and finally southward through Worcester and Gloucester, in which last it begins to form its estuary. It is navigable for barges to Welshpool in Montgomeryshire, 180 miles from its mouth. Its entire length is 210 miles, and it drains an area of more than 6000 sq. miles.

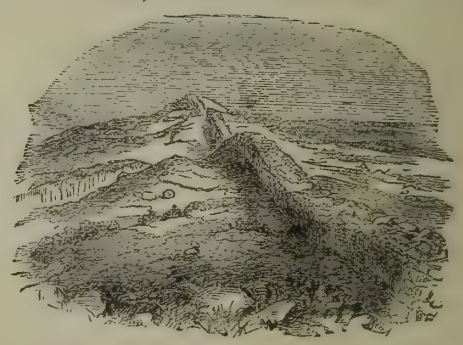
The chief affluents of the S. are the Terne, and the Upper and Lower Avon on the east, and the Teme and Wye on the west. A canal 18½ miles long, and nagivable for vessels of 350 tons, extends from Gloucester to the upper portion of the estuary of the river, and thus materially shortens the navigation of its lower course. The Montgomery Canal extends from Welshpool to Newton, and other canals establish communication between the S. and the Thames, Trent, Mersey, and the other important rivers of the middle districts of England. The *bore*, or tidal wave, which rushes up the S. with a velocity at times of 14 miles an hour, raises the water 9 feet in height at Gloucester, below which embankments have been constructed. The estuary of the S. is, since 1879, spanned by a long railway bridge near Burton Passage, which cost £400,000.

SEVE'RUS, ALEXANDER. See ALEXANDER SEVERUS.

SEVERUS, L. SEPTIMIUS, Roman emperor, was born 11th April 146 A.D., near Leptis Magna, on the north coast of Africa, of a family of equestrian rank; and after receiving an excellent education, removed to Rome, where he became prætor, 178 A.D. He was subsequently commander of a legion in Gaul, and governor of Gallia Lugdunensis, Pannonia, and other provinces. After the murder of Pertinax, he was proclaimed emperor, 193 A.D., at Carnutum, and promptly marched upon Rome, where the puppet Julianus had by purchase obtained the imperial purple. His arrival before Rome was the death-signal for Julianus; and after taking vengeance on the murderers of Pertinax, converting his most formidable rival, Clodius Albinus, into an ally by creating him Cæsar, and distributing an extravagant largess to his soldiers, he marched against Pescennius Niger, and conquered him at Issus, 195 A.D.

A glorious campaign in the East, and a three years' siege, followed by the capture of Byzantium, were followed by a desperate struggle with his jealous rival, Clodius Albinus, whom, after an obstinate conflict at Lyon, in which 150,000 were engaged on each side, he conquered, 197 A.D. The usual games to the degenerate citizens of Rome, and largesses to the troops, followed, after which S. returned to Asia, accompanied by his sons Caracalla and Geta, met with the most brilliant success in the campaign of 198 A.D. against the Parthians, and took and plundered their capital, Ctesiphon. After a war with the Arabs, in which S.'s usual good fortune deserted him, and a general visit to his various eastern dominions, he returned to Rome, 202 A.D., and gratified the popular taste by the exhibition of shows of unparalleled magnificence, also distributing another extravagant largess to the citizens and prætorians. A rebellion in Britain drew him to that country in 208 A.D.; and at the head of an immense army, he marched, it is said, to the extreme north of the island, encountering enormous hardships, to which no less than 50,000 of his soldiers succumbed, and securing no permanent advantages. To secure to some extent the natives of South Britain from the incursions of the Meatæ and Caledonians, S. repaired or partially built the wall which bears his name, and died soon after at York, 4th February 211 A.D. S. was an able vigorous, and just ruler, and a skilful warrior, but totally devoid of high moral sentiment.

SEVERUS, WALL OF, as it has been erroneously called, was a rampart of stone which seems to have been built by the Emperor Hadrian in 120 A.D., between the Tyne and the Solway. On the first subjugation of Britain by the Romans, a line of forts had been constructed by Agricola, extending from the Forth at Edinburgh to the Clyde at Dumbarton. The Emperor Hadrian, on visiting Britain, 120 A.D., threw up for the protection of the Roman province a wall of stone extending across the island, between Tyne and Solway. Twenty years later, Antoninus Pius, whose lieutenant, Lollius Urbicus, had gained fresh advantages over the northern tribes, endeavored to check the inroads of the



A Portion of the Wall of Severus or of Hadrian, near Housestead, Northumberland.

Caledonians by erecting a rampart between the Forth and Clyde, connecting Agricola's line of forts. But after a vain struggle of 60 years, the Romans found it necessary to abandon the whole district between the walls, and in 208 Septimius Severus repaired the wall of Hadrian, which has hence been erroneously called the wall of Severus. Towards the close of the 4th c., Theodosius, for a brief period, reasserted the Roman dominion over the district between the walls of Antonine and Hadrian, which, in honor of

the Emperor Valens, obtained the name of Valentia. But this newly-established province was soon lost, and it was not long before the Romans finally abandoned Britain. Many remains of the Roman walls are yet to be traced. See Bruce's *Roman Wall*, 3d ed. 1867.

SEVIGNÉ, MADAME DE, MARIE DE RABUTIN-CHANTAL, was born at Paris, 6th February 1626. She was the only daughter of the Baron de Chantal, Celse-Benigne de Rabutin, and his wife, Marie de Coulange. She was left early an orphan; and at the age of six the care of her education devolved on her maternal uncle, the Abbé de Coulange, an excellent and amiable man, who most conscientiously acquitted himself of his charge, and for whom through life his niece entertained the tenderest affection. She was carefully instructed in all the knowledge which then appertained to the education of a French gentlewoman; by the eminent scholar Menage she was taught Latin, Italian, and Spanish; and M. Chapelain, another literary notability of the time, also assisted in her culture. At the age of 18 (Aug. 1, 1644), she was married to the Marquis Henri de Sevigné, the representative of an ancient House in Brittany. The union was not a happy one. The marquis was 'a man of wit and pleasure,' of the type of the period; his wit he exhibited by his happy way of squandering his wife's fortune, and he took his pleasure in neglect of her, and addiction to other women. After a time, he was killed in a duel (5th February 1651), by a certain Chevalier d'Albret, his rival in a love-affair. Left with a son and daughter, S. now for a few years retired almost wholly from society, and devoted herself to their education. In 1654, she returned to Paris, where her beauty, her wit, her happy social tact and vivacity, concurred, with the charm of her sweet and kindly nature, to insure her unrivalled success in the brilliant society of the period. Her lovers were legion, and among them were numbered some of the most distinguished men of whom France could then boast, as the Prince de Conti, Turenne, Fouquet the Superintendent of Finance, and others. But they sighed in vain: all offers of marriage she steadily declined; and from any of those lighter ties, there and then most leniently looked on—if not almost considered *comme il faut*—she has left no spot upon her reputation.

For her virtue she must have credit as virtue, and not merely the coldness which simulates it; for she was obviously of a warm, eager, even somewhat impulsive nature. Her numerous and warm friendships, with her absolute devotion to her children, may have sufficed as food of a heart not unlikely, in lack of these, to have craved a more perilous diet. Her affection for her daughter in particular, who in 1669 became Madame de Grignan, was the ruling passion of her life; and to the separation of the mother, over long periods, from 'this infinitely dear child,' the world is indebted for by much the larger moiety of the collection of Letters which has given fame in perpetuity to Madame de Sevigné. Madame de Grignan was one of the most beautiful and accomplished women of her time, and every way worthy of the love thus lavished without stint upon her. If she did not reciprocate its full fervor, *that*, as the shrewd mother well knew, was simply in the nature of the case; and not to have demonstrated in return more rapture than she really felt, ought to count as a point in her favor, rather than reverse-wise as it has been held to do. If it was the one main grief of Madame de S. to be forced to live apart from her daughter, the happiness of dying beside her, may perhaps have a little consoled her for it. In 1696, while on a visit to the Château de Grignan, she was seized with malignant small-pox, and died at the age of 70.

The Letters of Madame de S., on which her fame securely rests, are charming in the *abandon* and easy *naïve* frankness with which they reveal her beautiful nature. They sparkle with French *esprit*, and spontaneous gaiety of heart; and their writer is scarce anywhere quite equalled in the delicate *finesse* with which, in a few careless rapid words, she flings off a scrap of light narrative, dashes in a little graceful picture, or points a dramatic situation. Above all remarkable is the lightly-moved and ever-active sympathy which keeps her exquisitely *en rapport* with the interest of whatever may be passing before her.

SEVI'LLE (Span. *Sevilla*, the *Hispalis* of the Romans), a famous city of Spain, formerly capital of the ancient kingdom, and now of the modern province of the same name, stands on the left bank of the Guadalquivir, 94 miles by railway north-north-east of Cadiz. The city is almost circular in shape, is surrounded by Moorish walls, surmounted with 66 (formerly 166) towers, and pierced with 15 gates, and is five miles, or, including its 10 suburbs, 10 miles in circumference. Held by the Moors for five centuries, and entirely rebuilt by them from the materials of former Roman edifices, S. was long a purely Moorish city, and the old Moorish houses, which age, in this dry climate, has done little to destroy, are still the best houses to be seen. Half of the city still preserves its ancient character; but changes are taking place every year. The narrow tortuous streets that kept out the sun, with their wide spacious mansions, with ample courts and gardens, so perfectly suited to the climate, are giving way to spacious straight streets of small, hot houses, open to the blaze of noon. The cathedral, one of the largest and finest in Spain, is an imposing edifice, of which the solemn and grandiose are the distinctive qualities. It was completed in 1519, is 431 feet long, 315 feet wide, has 7 aisles, and an organ with 5400 pipes. The pavement is in black and white checkered marble. The cathedral is superbly decorated. Its painted windows are among the finest in Spain, and it contains paintings by Murillo, Vargas, the Herreras, &c. Attached to the cathedral is one of the most remarkable towers in the world. It is called the Giralda (i. e., a weathercock in the form of a statue), and is in all 350 feet high. This Moorish tower was built in 1196, and was originally only 250 feet high, the additional 100 feet being the rich filigree belfry added in 1568. The pinnacle is crowned by a female figure in bronze, 14 feet high, and 2800 lbs. in weight, and which veers about with the slightest breeze. From this great tower the *Mueddin* (q. v.) of Mohammedan days called the faithful to prayers. The royal residence, the (*Al-Kasr*, house of Cæsar), contains several noble halls, and much delicate ornamentation, that rivals that of the Alhambra.

The house in which Murillo lived and died is still to be seen here. The finest pictures in S. are to be seen in the cathedral, the Caridad, the Museo, and the University. S. contains 74 churches; but prior to the suppression of monasteries, it contained 140. Besides the university (of four faculties), there are many educational institutions. The city contains upwards of 100 squares. The Fabrica de Tabacos, where tobacco is made into snuff and cigars, employs several thousand hands, mostly females. The Plaza de Toros can accommodate upwards of 12,000 spectators. There is regular communication with Cadiz by river and rail. There are here several royal foundries and factories for arms, and porcelain and iron and machine works. Weaving, soap-making, and other branches of manufacture are carried on. Pop. about 134,000.

The Hispal of the Phœnicians, the Hispalis of the Romans, was corrupted by the Moors into Ishbilliah, of which it is supposed the modern name is a modification. It was a place of great importance in the later period of Roman dominion; became the capital of Southern Spain during the ascendency of the Vandals and the Goths, when it was the scene of two notable church councils (590 A.D. and 619 A.D.); and fell into the hands of the Moors in the 8th c., under whom it rapidly rose to a splendid prosperity, and reckoned 400,000 inhabitants. In 1026, it became the capital of the Moorish kingdom ruled by the Abadides, from whom it passed, in 1091, to the Almoravides, and in 1147, to the Almohades. In 1248, it was taken by Ferdinand III. of Castile, when 300,000 Moors left for Grenada and Africa; and from this time to the removal of the court to Valladolid, in the reign of Charles V., S. was the capital of Spain. The city rose to its climax of prosperity after the discovery of the New World, when it became the residence of princely merchants and the mart of the colonies, but its trade was afterwards transferred to Cadiz. In 1810, it was taken and ravaged by Soult. It capitulated to Espartero in 1843.

SÈVRES, a small town of France, in the dep. of Seine-et-Oise, six miles south-west of Paris, on the Paris and Versailles Railway. It is celebrated for its manufacture of porcelain wares, which are unsurpassed for elegance of design and beauty of painting. Painted glass is also manufactured. The Porcelain Museum, which was destroyed during the war of 1870, contained a large and curious collection of articles in china and earthenware from all parts of the globe. Pop. (1876) 6512.

SÈVRES, DEUX-, an inland dep. in the west of France, between the deps. Vienne on the east and Vendée on the west. Area, 2315 sq. m.; pop. (1881) 350,103. The dep. takes its name from two rivers of the same name, the Sèvre-Niortaise, which flows west into the sea, and the Sèvre-Nantaise, an affluent of the Loire. It is traversed from south-east to north-west by a chain of hills, called in the south-east the Monts du Poitou, and in the north, the Plateau de Gatine. This ridge forms the water-shed between the Loire on the North and the Charente on the south. The climate is generally healthy, and the soil, two-thirds of which is arable, is very fertile. There are numerous iron mines, and good quarries of freestone and marble. The arrondissements are Niort, Bressuire, Melle, and Parthenay. Niort is the capital.

SEW'AGE. It is of the first importance to health for houses, both in the town and in the country, that all filth should be removed from them as speedily as possible, and disposed of in such a manner as to cease to be injurious to mankind. It may be taken as a pretty safe general guide, that all matters which give off a disagreeable smell are dangerous if allowed to remain near our dwellings; nature thus giving us warning of the presence of something that may do us harm. Many people have thought that if, by using certain deodorizing materials, they could either fix this effluvium permanently or for a time, they had surmounted

the difficulty; but this is scarcely half a cure, and a palliative like this is much less advisable than a radical measure of removing the filth by suspension in water, and rendering of it not only innocuous, but beneficial, by incorporating it with the great deodorizer—living vegetation. It seems as if nature had planned all this for us, if we will only follow her teaching.

During the first two or three days after sewage is deposited in water, the smell is unpleasant, but not dangerous to mankind; after that, putrefaction begins, and the gases given off become deleterious. Here, then, is time for removal, and a punishment for neglect. Fevers, gangrene, ophthalmia, and many other diseases, especially among children, are certain to break out and become malignant if the emanations from such filth exist in the air around human habitations. Until within the last 50 years, privy-pits and cesspools prevailed everywhere. In the country, the former were generally placed in the garden attached to the house, and at some distance off, so that there was not much danger attached to them. In the towns, cesspools existed among the houses, but they were very objectionable and dangerous, and constantly neglected. These cesspools were large underground tanks built in brickwork, into which all the sewage from the house was discharged. In them the filth accumulated and putrified until it was periodically removed by manual labor. They acted like an immense brewing vessel, sending up deadly vapors which had no escape, except back into the house among the inhabitants. The cesspools also frequently leaked, and so if any wells were near, poisoned the water. When Bramah invented the water-closet, and a larger supply of water had to be found for towns, the cesspools began to overflow at such a rate, that a general revision of the whole system became necessary; and at the same time, medical men insisted upon the continuous and perfect removal of filth as the only reliable sanitary process of dealing with the matter. A return to the use of cesspools in any form would therefore be a step in the wrong direction, and would lead to disastrous results.

We may divide the subject as follows: 1. The Management of the Sewage of Cottages; 2. Dwelling-houses and Public Buildings in the Country; 3. Towns; and 4. The Utilization of Sewage.

1. *Cottages.*—It is obvious that in the case of single detached cottages, expensive arrangements such as those necessary for water-closets could not be provided, and some simpler plan must be followed.

It is very objectionable to allow either cesspool or privy-pit, if they can be avoided, as they are constantly neglected, and overflow into some stream, or poison the wells and the air. The privy should be placed, wherever that can be managed, on the north or east side, and to the rear of the house, so as not to be between the people and the sun and softest winds. The whole sewage-matter should be received in a square galvanized iron pail underneath a seat, which pail can be removed from the outside, and into which a small quantity of house-ashes should be placed, either daily, or as often as the closet is used. This will quite fix the ammonia. The iron pail must be removed by the cottagers at least once a week, and emptied into their garden. No danger can possibly arise from this, if strictly followed, and all the sewage-matter is placed to its best purpose. The sketch attached

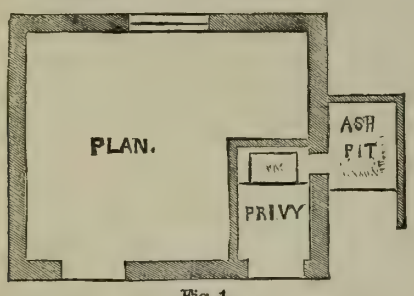


Fig. 1.

(see fig. 1) will show the way of doing this. There has not been found any difficulty in introducing this system among cottagers.

2. *Dwelling-houses and Public Buildings in the Country.*—It would be useless to discuss a dry-earth system like what has been mentioned anywhere but for outhouses attached to cottages; the general feelings of the inhabitants would not tolerate it. We must therefore accept the water-closet as the system universally adopted. In planning the position of water-closets for a house, the first thing to be thought of is, that they shall be if possible on the north or cool side of the house, and upon exterior walls. If they are placed in the interior of the house, it is troublesome to get at the drains when required, and the closets themselves cannot be sufficiently ventilated. If the closet is inside the house, then Bramah's patent with a D trap underneath is the only form that should be used; but if a closet is outside, then a less expensive one with a syphon earthenware trap may be adopted. It is desirable that the closet should be surrounded with brick walls, and, in fact, isolated from all other parts of the house. The window of the closet when inside the house should always reach the ceiling; and a ventilating shaft in the manner shown in the accompanying sketch is desirable where the closet is much used, and the window must be shut occasionally. The ordinary water that passes into the drains leading from any closet—such as is discharged each time that the handle is raised—is not sufficient to sweep out thoroughly all the solid matter from the drain-pipes, and therefore a flushing apparatus at the highest point of all sets of drains is essential, so that a body of water may be allowed to pass down with a rush at least twice or three times a week. It is also desirable that the foul air engendered in the drain-pipes themselves should have some free outlet into the air at some point where it will not be injurious. The gas given off under such circumstances is of a very light character, and has a great tendency to ascend and draw towards heat.

During the greater part of the year, especially since the system has been introduced of heating houses by hot air, the temperature of living-rooms is much higher than the atmosphere outside; a pumping action is exercised upon the drains, or indeed, upon any outlet, for a fresh supply. If, therefore, some safety-valve is not provided, the gas will force an entry either through the traps or some imperfection in the joints of the drains. The sketch, Fig. 3, will show the best plan that has yet been devised both for flushing and ventilating the soil-pipes of water-closets. In constructing

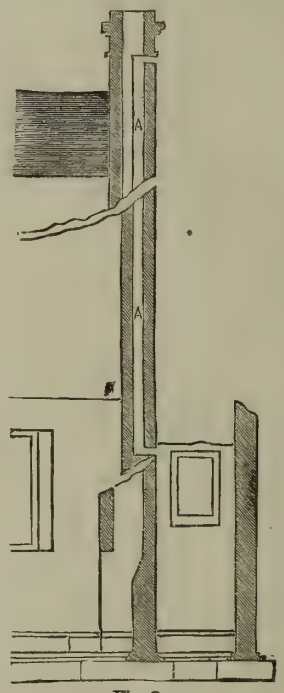


Fig. 2.

AA is the ventilating shaft by which any foul air in the closet itself can pass upwards into the open air. By placing it alongside of a chimney a draught is created which will empty the closet of any effluvium that may be in it.

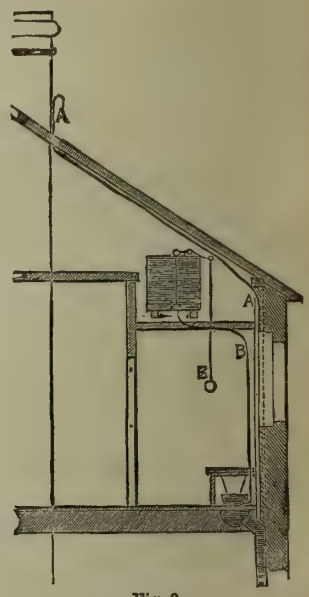


Fig. 3.

AA is the ventilating pipe communicating with the soil-pipe; BB is the flushing apparatus for discharging a quantity of water at once.

the drains from houses or large public buildings, it is now a well-decided point that there should be an entirely separate system for the sewage or foul water, apart from that for rain and surface-water. The reasons are many and obvious, but they will be given more appropriately under the head of the Drainage of Towns. Stoneware pipes are the best material to be used for drains, because they are perfectly non-absorbent; but in many cases glazed earthenware will answer very well. The smallest size of pipes of any description that should be used for removing sewage from a house is six inches in diameter. This size, then, may be gradually increased as is necessary, and one of 9 inches will remove the sewage of 500 people. The best fall to be given to a sewage-drain is 1 inch in 10 feet; but all will work well from 1 inch in 5 feet up to 1 inch in 60—provided the flushing arrangements are as they ought to be. In order to keep the drains clean, not less than 10 gallons of water daily should pass down the drain for every person in the house; while anything over 25 gallons is superfluous.

At every 20 yards there should be a pipe laid from which the upper half can be removed, and the interior inspected at any time, and any stoppage remedied without the necessity of breaking the pipes. Greasy water, such as is poured down from the kitchen and scullery of a house, is one of the constant causes of such

stoppages. The fat, as it cools, congeals on the sides of the pipes, and forms a hard cake. The best method of preventing this is to form a small cesspool, into which the kitchen water is poured first, and then to take an overflow through a syphon into the foul drain, so that the liquid only enters, while the fat can be removed by hand from the cesspool. The sewage-matter having been thus all thoroughly removed from the house, a sewage-filter should be built on the principle shown in the sketch, Fig. 4. This was originally the design of the late Prince Consort. The solid and

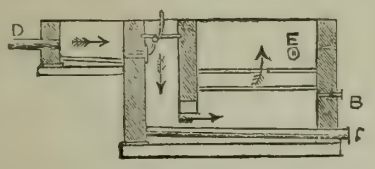


Fig. 4.

The whole sewage matter enters at D; flows in the direction of the arrows; the solid matter becomes arrested in the bottom chamber, while the liquid rises and passes off at E through filtering beds. By opening a tap at B the liquid in the tank or filter can be drawn off, and by opening that at C, the solid matter can be removed. The whole must be water-tight and air-tight. A is a valve for shutting the pipe during cleaning.

liquid matters of the sewage are here mechanically separated, and the former can be removed from time to time—say once in six weeks or two months—while the latter must be passed on for irrigation. It is clearly illegal to pass it into any stream; and it is apt to become a serious nuisance if anything else is done with it. We shall treat of the best method of utilizing this liquid under the fourth head. It is always advisable to get space for all these arrangements on the north and east side of a house, when possible, so as to run no risk of contaminating the air on the south or hot side of a dwelling; and if a belt of trees can be placed between the sewage-filter and the irrigated land and the house, it will also be advantageous.

3. *The Drainage of Towns.*—Until within the last forty years, the only drainage which existed in towns was for the rain-water and surface-water alone, and the inhabitants were strictly watched to prevent their passing any sewage-matter into these drains. The introduction of the water-closet, however, gradually increased the water which overflowed from the old cesspools to such an extent that it was impossible to prevent overflows of this description, and systems of drainage were designed to carry off the whole, both sewage and rain-water. A very composite system of drainage then arose. Generally, the bed of some stream or natural rivulet passing through the town was covered over, and the whole filth passed into that along with the rainfall of the district. This soon was found unsatisfactory, because the flood-waters of the stream were not to be relied on to keep the channel clean, and so the filth remained festering underneath the ground, giving off deadly gases in the midst of the population. The next arrangement which succeeded to that system was to plan large drains for the rain and surface-water, and sewage, and still keeping the idea of the size of the bed of a natural stream before them, engineers thought it necessary to make all the main drains large enough for a man to pass through them, and keep them clean. Seeing the vast quantity of sand and grit that was occasionally washed off the streets, something might be said in defence of this system. Vast numbers of these great main sewers still exist. Into these sewers all the smaller house-drains were to enter, and the surface-water through street-gratings as well. The ordinary water used for domestic purposes, and the occasional rainfalls, were relied upon to flush those large main sewers; but their great size made this an exceedingly difficult and uncertain process, and they, in fact, became only cesspools elongated. In dry weather, the filth was retained in them to such an extent, that after heavy rains, chemical analysis showed that the water which was discharged contained frequently twenty times the amount of human fæcal matter per gallon more than it did in dry weather.

The state of matters, added to the fact that long-continued dry weather was always attended by an increase of deaths from typhus and other fevers, clearly showed that something more must be done. A further step was then taken by sanitary engineers. The idea of men passing up the drains was set aside, and the smallest possible drains were constructed, until these have arrived at such dimensions as an 18 inch main drain for a town of 10,000 inhabitants. The rainfall was still to be relied on to a certain extent for flushing purposes, but a supplementary assistance was to be given at some points by flushing with water from the ordinary regular supply of the town. As these smaller drains were not sufficient to carry off all the surface and rain-water, as well as the sewage, overflow weirs have been provided at certain points, where the excess must go over, and pass away into some other channel. This is the system now most generally adopted, and is better than its predecessors; but it is now decided that it, in its turn, must give way to something better, and the change has commenced. The necessity of dealing with the sewage at the main outfall, and the utilization of it for agricultural fertilization, while, in nine cases out of ten, pumping must be employed to lift the sewage of a town at the discharging point for such a purpose, have gradually forced upon us the conviction that the sewage and household water must be kept quite distinct from the surface-water, subsoil water, and rainfall.

The outfall of the sewage drain, and subsequent disposal of the filth, are in reality the first things to be considered. Hitherto, engineers in general have taken the nearest stream, and polluted it to such an extent, that perpetual lawsuits, nusiances, and diseases have been the result. Fever of the worst class is certain to follow the drinking of water tainted in this manner, and there is scarcely a stream in the interior of the country which has not been injured more or less from this cause.

Again, where the sewage has been emptied into the sea, tide-locked drains are objectionable, and the sewage, when mixed with salt water, generally gives off more stench than ever. We may briefly say that all attempts at deodorization by chemical processes have hitherto failed, and as far as our present knowledge goes, are not to be relied upon. The utilization of the sewage on the fields by irrigation is, therefore, the true solution of the problem, and we must arrive at the simplest, cheapest, most certain, and most perfect system of accomplishing this. When sewage and rainfall all go together in the same drains, as they do in all the older systems, all is uncertainty; while, when the two are separated, rain and surface-water can be discharged at any point into the natural water-courses of the country, and a fixed quantity of sewage, with household and flushing water, would be passed to the main outlet, to be there dealt with. The opponents of this system say that it is too expensive and troublesome to plan; that it is unnecessary, as it is sufficient if engineers provide for the dry-weather flow of the sewage, and use that for irrigation; and that when the overflows come into action in floods, the whole is so much diluted, that no harm is done to any one. The advocates of this double system of drainage have proved the total separation of the two is the most sanitary system, because the street-gratings and rain-water pipes, which at present let down the rain-water into the sewage-drains, act, in fact, as so many ventilating shafts, and discharge the stench in the midst of the inhabitants; while, under a separate system, the sewage-pipe would be entirely sealed up, and only ventilated at such places as could safely be done; that the rain-water as a flushing-power ought to be entirely discarded, as it fails in dry weather, just when it is most wanted; that in wet weather, and winter again, when the discharging of the sewage on to the surface of land is carried out, the great quantity of water sent down through the drains by the present system is agriculturally a serious injury; that when pumping has to be employed for lifting the liquid for irrigation, as it is in most cases, all is uncertainty, and that no machinery can be economical and efficient under such circumstances, and that the planning of the irrigation also becomes difficult to manage, and irregular.

With regard to the expense, it has been proved that, as the rain-water and surface-water can be discharged at the nearest point, all the drains may be much lessened in size; and further, that the flushing-power of the water in the sewage-drains will be much more efficient, while the corresponding lessening of the expense in carrying out the process of utilization will completely compensate any additional outlay that may be incurred in laying the drains in towns. If we take the case, which is a common one, of a population of 10,000 people living upon a square mile, the first-mentioned system, where rain and sewage water go together, would require pumping-machinery, in dry weather, of, say, five horse-power, to lift the liquid; and it would further be necessary, for wet weather, to have in reserve a lifting-power of 150 horses; while, on the separate system, where the sewage alone would have to be dealt with, the five horse-power engine would be regularly and constantly employed, and its work would be almost entirely confined to the daytime, whereas the other must be ready at any time, and for every emergency. The system of sending sewage and rain-water together has been hitherto adopted in all towns; but except in one or two cases where gravitation has been available to utilize the discharge from the drainage, all engineers have failed to prevent the pollution of rivers, and it is obvious that something else must be tried, as that cannot be permitted to go on much longer. The system of separating the sewage and rain-water has been carried out in several large asylums and public buildings, many barracks, the town of Eton, and Windsor Castle—where every consideration, both of expense and sanitary influence, was brought to bear on the subject. Reading, Oxford, and several other towns speedily followed on the same principles, and the results were most satisfactory, and highly economical.

4. *The Utilization of Sewage.*—The whole of the sewage of a house or town having been conveyed away in the manner we have described, the next important step is to know what to do with it.

Above all things, it is desirable to add to the productiveness of the soil, so as to compensate in some degree for the constant supply we are drawing from that source.

The liquid nature of sewage, adopting as we may the ordinary amount of dilution in dry weather at the rate of 25 gallons per head, has been a great obstacle in the way; while also the vast quantities of road-grit, and the great gluts of rain that come down along with the sewage when there is only one system of drains in a town, have upset all arrangements and calculations. Many attempts have been made, especially at Leicester, some years ago, to precipitate all the valuable qualities of the sewage by impregnating the whole with milk of lime; but the process was unremunerative to those who did it, as so much sand was precipitated at the same time, that the product obtained was almost worthless as a manure; while, as the greater part of the ammonia escaped in the water, the discharging of it into any stream was still, strictly speaking, quite illegal. As far as chemical knowledge can guide us, there seems at present to be no hope in this direction.

At Edinburgh, again, and at Croydon, the irrigation of land by gravitation has rendered the process a simple one, because the whole has been poured over the land with many excellent results. These, however, are clearly exceptional cases, and we must look to pumping as being necessary in by far the greater proportion of towns; while for the two places we have mentioned, the results would, in all probability, have been better still if the strength of the sewage had been more concentrated. Agriculturally speaking, any dilution above 25 gallons per head of the population is not desirable, but is injurious and expensive to distribute; while, again, human fæcal matter is too strong to be applied to land, unless diluted in something like ten gallons of water. The Chinese teach us an important lesson in this respect. They place all the solid matter, when they remove it from the towns, in small wells in their fields, and then take a scoopful and mix it in about ten or twelve times its volume of water before they apply it to their crops. If any one attempts utilizing sewage when mixed with rainwater, and has to pump the whole all the year through, he will find himself in endless difficulties.

Presuming, then, that we can arrive at a fixed quantity of 20 gallons per head of the population, or what may be taken as the dry-weather flow of the drainage from a town, the first step is to pass the whole through a strainer, so that all materials may be intercepted which will be likely to interfere with the pumping, or choke the smaller pipes used for irrigation. This is necessary, also, because in its unstrained state we cannot depend upon sewage going down and up again, and so passing over a valley, and the sphere of operations then becomes more limited.

Great part of the solid matter can also be removed by this process, and common house-ashes are the best mixing and deodorizing material to facilitate the stuff being carried away.

A piece of land should then be sought out, with a slope, if possible, of one foot in 30 at least, and the filtered liquid, which will be full of strength, conveyed either by pumping or gravitation to the highest point of that land. Iron pipes should not be used, if possible; and when the land is very flat, it must be ridged and levelled. From the highest point of the land selected, the liquid must be conducted by open channels or through common drain-pipes laid on to the surface to all the different points where it is wished, and utilized for irrigation. The land adopted should be moderately porous, and then for every 100 people an acre may be allowed, but this varies much according to the nature of the soil. The land must be thoroughly drained and prepared. The best crops to be grown are Italian rye-grass, with alternately crops of vegetables, such as potatoes, cabbages, rhubarb, mangold. All these will luxuriate on the liquid, and we think we may safely say that the command of such liquid would be worth to any person from £5 to £10 an imperial acre, according to local circumstances.

Milch cows thrive remarkably well on this grass, and it has been proved by chemical analysis that the milk is of the best quality, while the vegetables are also quite wholesome.

Could such a system be carried out in the neighborhood of all our large towns, the results would be highly beneficial. The difficulties in the way, principally arising from ignorance on the subject, have been great; but to this system, or something like it, there can be no doubt, before many years, we must come, to prevent pollution of the rivers, and to make the most of the sources of fertility which are at our command, but which we are at present recklessly wasting. Many committees have been appointed by the House of Commons to inquire and take evidence on this subject. In 1857, a commission was issued by the crown to certain gentlemen, at the head of whom was Lord Essex, to inquire into 'the best mode of distributing the sewage of towns, and applying it to beneficial and profitable uses.' This commission went to work principally at Rugby, and have made a vast number of experiments, the general result of which may be stated to be, that ordinarily diluted sewage may be said to produce such increased crops as to warrant an agriculturist in giving one halfpenny a ton for it, a ton of water containing 224 gallons. The third Report was issued in April 1865, and the following recommendations are given as the results of their labor:

'1. The right way to dispose of town-sewage is to apply it continuously to land, and it is only by such application that the pollution of rivers can be avoided.

'2. The financial results of a continuous application of sewage to land differ under different local circumstances; first, because in some places irrigation can be effected by gravity, while in other places more or less pumping must be employed; secondly, because heavy soils (which in given localities may alone be available for the purpose) are less fit than light soils for continuous irrigation by sewage.

'3. Where local circumstances are favorable, and undue expenditure is avoided, towns may derive profit, more or less considerable, from applying their sewage in agriculture. Under opposite circumstances, there may not be a balance of profit; but even in such cases a rate in aid, required to cover any loss, needs not be of large amount. Finally, on the basis of the above conclusions, we further beg leave to express to your Lordships that, in our judgment, the following two principles are established for legislative application: First, that wherever rivers are polluted by a discharge of town-sewage into them, the towns may reasonably be required to desist from causing that public nuisance. Second, that where town-populations are injured or endangered in health by a retention of cesspool matter among them, the towns may reasonably be required to provide a system of sewers for its removal; and should the law as it stands be found insufficient to enable towns to take land for sewage application, it would, in our opinion, be expedient that the legislature should give them powers for that purpose.'

It is obvious, however, to any one perusing the above paragraphs, that they are exceedingly vague, and form but little guide to any one who must go into the question of whether money invested in utilization of sewage-schemes will pay an adequate return upon the outlay. The uncertainty attending the dilution of the sewage; the necessity of making the earth take it at all seasons; the distance that the liquid has to be pumped—have all been such difficulties in the way, that the commission could not well arrive at any other result than they actually did.

Experience has now proved, what was formerly a matter of presumption, that, until we arrive at fixed quantities, no reliable principles can be laid down that would in all cases enable us to overcome the difficulties attending the sanitary management and utilization of sewage.

SEWAGE, LIERNUR SYSTEM OF. The pneumatic system of Captain Liernur for dealing with the sewage of a town has been in operation for some years on the Continent; and Amsterdam, Leyden, Prague, Dordrecht, St. Petersburg, and some other towns, are now either partly or wholly drained on this plan. A town so drained is divided into districts of from 250 to 1000 acres, according to circumstances. Each of these districts is again divided into small sewage areas, varying from 10 to 50 acres, also according to local circumstances. These small areas have each an air-tight cast-iron tank, from which extend along the several streets air-tight pipes of the same material, 5 inches in diameter, and independent of each other. The closets of the houses are connected by branches with these pipes.

An air-pump engine, or more usually two or three of these steam-engines, are placed in some central station, and in the under portion of the building air-tight iron reservoirs are situated, in which a vacuum of about three-fourths atmospheric pressure is maintained. Pipes, also air-tight, and called central pipes, connect these reservoirs with the street tanks. Like the outer series, these are five inches in diameter, and each pipe has two connections with its street tank, by one of which only air can be sucked out; but the other dips into the well of the tank, thus enabling its contents to be removed by suction to one of the central reservoirs. When a vacuum is made in one of the street tanks, the contents of the closet pipes are drawn towards it; and on a second vacuum being created, the charge is drawn into it. This tank is then in due time emptied into a central reservoir by exhausting the air in the pipe connecting them.

We may state here that, although no water is used for flushing, it is found that the fæcal matter is reduced almost from the first to the consistency of thin pulp by the atmospheric pressure. Now as it is impossible to propel liquid any great distance along a horizontal tube simply by air pressure—the air column always breaking through and destroying the vacuum—the pipes require to be set at inclines varying from 1 in 5 to 1 in 250 according to circumstances. This admits of a series of vertical risers being formed from which the liquid matter can never be altogether removed, and therefore these form a complete lock-off of one gradient from another, so that the vacuum cannot be destroyed. The residual liquid in these risers corresponds to the left quantity of water

which a pump can never completely remove from a receptacle. When the apparatus is at rest, this minimum quantity of liquid matter arranges itself partly in the riser and partly in the lower end of the sloping pipe.

To show what takes place when there is a much larger amount of excreta to remove in one direction than in another, we may take the case of two branches from one main pipe each 100 feet long, the gradient 1 in 100, and each having a riser of one foot. One of these pipes may have to deal with a single house producing only one foot of fæcal matter; the other may be connected with a barrack producing 100 times as much. 'We have, therefore, in the barrack pipe a mass filling both pipe and riser, and ready on the slightest force to discharge into the main or street pipe. On the other hand, in the branch pipe of the single family, there is the minimum quantity collected at the foot of the riser. The sucking action is now put in operation in the main pipe. The pressure of the atmosphere begins to act, and the barrack pipe rapidly discharges into the main pipe, while the smaller quantity is simply climbing up the riser, and before it has got to the top of the riser to be in a position to discharge, all the surplus quantity in the barrack pipe is gone, and that which is left is simply equal to that minimum which cannot be withdrawn. In this way the fullest pipe always begins to discharge first, the next more full waiting for it, and so on, until the minimum is reached, when simply air breaks through.'

During the day the air-pumps maintain a vacuum in the central reservoirs and throughout the whole extent of the central pipes connected with them. Patrols of two men each visit the district tanks, one of whom, by opening a valve, makes a tank communicate with the central pipes, and so exhausts the air from it. He then shuts the valve, and the second man immediately opens another which allows the vacuum to act on one of the street pipes and its branches. A second, third, and fourth street pipe is dealt with in the same manner—the vacuum meanwhile being frequently renewed in the tank—till all the sewage in a district is collected and transferred to a central reservoir.

The pneumatic system of Liernur admits of ordinary water-closets being used. As, however, the water has afterwards to be got rid of, he prefers, on the score of economy, a form of closet devised by himself which is used without water. It has no movable mechanism at all. The space into which the excreta falls is one arm of a short bent tube or siphon trap discharging into a soil-pipe. Each new deposit by its own weight forces out the former one, and there are special arrangements for the ventilation of the closet.

Captain Liernur aims at making the sale of the fæcal manure cover the working expenses of the system. The process, or at least one process, by which he converts the sewage material into a marketable manure, is as follows, leaving out some of the minor arrangements for saving heat. Mixed with a little sulphuric acid, it is placed in a large boiler through which pipes pass, and through these pipes waste steam, after being superheated, circulates, by which a rapid boiling takes place. The material is afterwards transferred to a trough in which a long hollow drum of thin metal, heated internally, revolves. The drum takes up and dries a thin layer of the manure, which is scraped off by a fixed knife and sold under the name of *poudrette*. It contains from 7 to 10 per cent. of ammonia; and it is affirmed that this method of converting the liquid manure into a dry powder is highly remunerative.

We need hardly explain that wherever the Liernur system is adopted, the mere water-drainage such as that required for rain, waste water of houses, and the like, is provided for by separate drains formed of earthenware pipes, but of much smaller size than in cases where all kinds of sewage pass through them. Existing sewers in a town may of course be used for this purpose.

The details of the Liernur system have been so recently brought to much perfection, that we shall probably have to wait for some years yet before any decided opinion can be formed of its merits as compared with other methods of treating sewage. As yet no sanitary engineer has adopted it in England even on a small scale, but if it succeeds on the Continent no doubt any existing prejudice against it will soon be overcome.

SEWAGE EARTH-CLOSET. In addition to the arrangements noticed under SEWAGE, and under LIERNUR SYSTEM on previous page, for getting rid of excreta, there is partially in use an *earth-closet*, in which the powerful deodorizing and other properties of dry earth are taken advantage of to deprive refuse of offence or harm, and to retain it in a fit condition for agricultural use. There are numerous forms of this kind of closet. Perhaps the simplest kind is that which consists of nothing more than a seat and a pan, the latter being lined round with earth by the help of a movable central mould or core. More convenient forms consist of a pail or a square-shaped pan on wheels under the seat and an earth box rising above it at the back. The box may be made to hold as much earth as serves for twenty or thirty sittings. By one of several devices in use, a valve is opened at the bottom of the earth-box, which allows the proper quantity of earth to descend through a spout and cover the deposit. The mechanism of one kind is such that the seat descends with the person, thereby bringing a charge of earth to the bottom of the spout, and when he rise it is dropped upon the fæces.

The earth-closet system is, of course, scarcely practicable in large towns, as it would be very difficult to plan an economical arrangement by which the large quantities of earth required could be carried to and fro. But it is in use in many villages, and in some large isolated buildings, such as jails and hospitals. It has been much adopted in India, where, owing to the warmth of the climate, the rendering of fæcal matter innoxious from the first must give it a peculiar advantage. It also appears to have been tried on a considerable scale in America; and a competent authority there reports, that 'experience has taught that its power for usefulness is restricted by the difficulties involved in procuring, preparing, and removing the dry earth required in its use, and to some extent by those which attend, mechanically and chemically, the application of the earth to the dejecta. The inherent defects of the earth-closet reside in the seeming impossibility of obtaining just such perfection of mechanism as will completely do the required work automatically. It should never operate by weights, which act badly, and interfere with the space beneath.' In America it seems to be believed that the earth-closet will before long undergo great improvements, and play an important part in sanitary problems. In England during recent years it has received little attention compared with other systems of dealing with sewage.

SEWARD, WILLIAM HENRY, American statesman, was born at Florida, New York, May 16, 1801, of Welsh and Irish descent. His father was a physician and merchant, who, after accumulating a moderate fortune, was appointed judge of one of the inferior courts. S. entered Union College at 15; in 1819, he visited the south, and was engaged for six months as a school teacher in Georgia. Called to the bar in 1822, he settled at Auburn, Western New York, and became the partner and son-in-law of Judge Miller. In 1825, his political abilities were manifested in an oration delivered at Syracuse, and in 1828 he was chosen president of a state convention. At this period, New York was the center of a wide-spread excitement against Free-masons, and S., as a leading anti-mason, was elected to the state senate. In 1833, he visited Europe, and wrote a series of letters, which were published in the *Albany Evening Journal*. In 1834, he was a candidate for the office of governor of New York, but was defeated by the democratic candidate. About this time he received the lucrative appointment of agent of the Holland Land Company, which gave him wealth and influence. In 1838, he was elected governor of New York. In this position, he recommended the increase of education, internal improvements, a liberal policy toward foreign immigrants, and took the side of abolition in the growing controversies on slavery. In 1849, he was elected to the senate of the United States, where he became the acknowledged leader of his party, and in the debate on the admission of California he promulgated what was called his 'higher-law' doctrine, in saying that there was 'a higher law than the Constitution which regulated the authority of Congress over the national domain—the law of God, and the interests of humanity.'

In a speech at Rochester, N. Y., in 1858, he declared that there was 'an irrepressible conflict between opposing and enduring forces,' and that 'the United States must become either entirely slave or entirely free.' In 1859, he revisited Europe, and extended his tour to Egypt and the Holy Land, and in 1860 was the most prominent candidate of the republican party for nomination for the presidency, but personal and local interests finally secured the election of Abraham Lincoln, while Mr. S. accepted the important post of Secretary of State, in which he guided the diplomacy of the Federal government through the perils of the War of Secession with an almost unparalleled industry, energy, and success. On the 14th of April 1865, as the war approached its termination, and while S. was confined to his room by a fall from his carriage, President Lincoln was assassinated by John Wilkes Booth, an actor at a theater in Washington. At the same time, another assassin, named Paine, penetrated to the room of Mr. S., dangerously wounded his son, and with a piognard inflicted wounds upon him which were at first believed to be fatal, but from which he slowly recovered, and continued in office, as Secretary of State for Foreign Affairs, throughout the presidency of Lincoln's successor, Andrew Johnson, when he conducted the negotiations by which the United States purchased from Russia those territories in North America which are now called Alaska. S. resigned his office in 1869, on the accession of President Grant. In the autumn of 1871, he went on a foreign tour through Southern Europe, Turkey, Palestine, Egypt, India, China, and Japan, and was everywhere received with much distinction. S. published speeches and orations in 4 vols., a Life of John Quincy Adams, and a Life of De Witt Clinton. He died in October 1872.

SEWING-MACHINE, one of the most important inventions of this century. Like the stocking-frame, which in principle it closely resembles, we owe it to the ingenuity of a poor mechanic, striving to lessen the labor which he saw was a real hardship upon his wife and other poor women. Elias Howe, a native of Massachusetts, surrounded by a young family, for whom he was obliged to labor during the day, devoted his after-hours to the construction of a sewing-machine. This was about the year 1841, and his career since that period up to the present time forms a striking chapter in the annals of intelligent labor, and furnishes another proof of the saying that 'fact is stranger than fiction.' After incessant labor, during the latter part of which he and his family were indebted to a friend for the means of subsistence, he completed the first working sewing-machine, the patent for which was granted to him in May 1841. He did not succeed in inducing the people of his own country to see the value of his patent, and came to England, where, after patenting it here also, he met with so much discouragement that he sold the patent for £250 and a royalty of £3 per machine to a staymaker, Mr. Thomas of Cheapside, London, who used it successfully in his own business, but did so little towards making it public that for several years its existence was only known to a very few individual manufacturers. When Howe reached his own country again, he found his American patent pirated by a wealthy company; but with admirable spirit he asserted his rights, and succeeded in establishing them; and it is gratifying to know that his talent, industry, and perseverance were rewarded, for he became a wealthy man.

Howe's machine worked what is called the lock-stitch, but since his invention became known, numerous improvements and modifications have been introduced by other inventors. The principal of these are as follows: 1. *Machines which sew with one thread;* of which one kind makes the *through-and-through* or *shoemaker's stitch* (fig. 1), the thread being held and pushed through

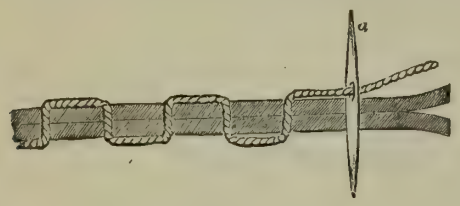


Fig. 1.

with pincers, one pair on each side of the material to be sewn. The needle, *a*, is pointed at each end, and being pushed through by the pincers on one side, is taken hold of by the corresponding pair on the other, and the thread is thus pulled through backwards and forwards. Only a small length of thread can be used by this machine, hence it is of but limited application. 2. Another single-thread machine makes the *running-stitch* (fig. 2). In this, the

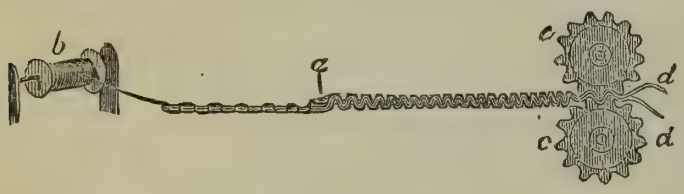


Fig. 2.

needle, *a*, is stationary, and receives a continuous supply of thread from a reel, *b;* the two small-toothed wheels are so arranged, that their teeth, pressing into one another, crimp the two

Fig. 3.

pieces of cloth, and push them forward against the point of the needle, which, as it gets filled, is relieved by the operator, who keeps drawing the sewn cloth off at the eye-end of the needle. This machine answers admirably in cases where loose tacking is required. It is the invention of an American of the name of Bostwick, who introduced it into England in 1844. 3. The *chain* or *tambour stitch* is also a single-thread stitch (fig. 3), the machine for which was invented by M. Thimmonier, a Frenchman, in 1848. In this, the thread is looped upon itself by means of a curved shuttle after it has passed through the cloth. This kind of stitch, though very useful for some kinds of work, is easily pulled out. 4. Fig. 4 represents Wheeler and Wilson's sewing-machine, another American invention, which has acquired the greatest reputation in Great Britain. It is a double-thread machine, and besides the vertical eye-pointed needle, has a curved shuttle or hook (fig. 5, *a*) working below, with a revolving reel, *b*, inside its curve. The reel is of metal, each side being convex externally; and so adjusted on the axle, that the edges are so near together as to

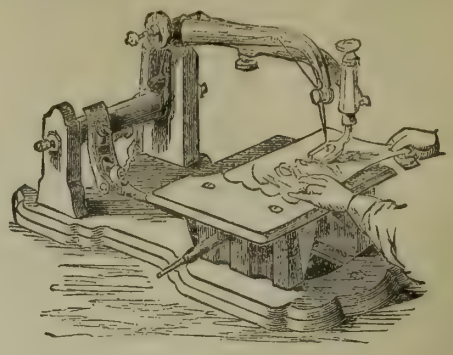


Fig.

admit only one thickness of the thread to pass through (fig. 6). The side view of the whole arrangement is seen in fig. 7. It fits easily within the nearly circular hook, and gives off its thread as required. The thread passes partly round the outer edge of the hook upon a slightly-grooved bevel (*a*, fig. 7), which forms a loop, and passes it between the needle and the thread which it carries

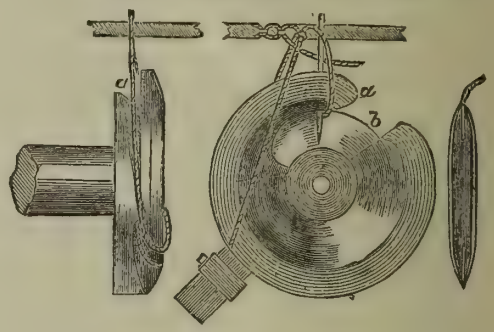


Fig. 7. Fig. 5. Fig. 6.

with it in descending; the loop is held in position as the needle ascends, and the cloth being moved on, the next descent of the needle takes it through the loop and receives another below it, which renders the first one tightly-locked, as in fig. 8. For such

Fig. 8.

work as male and female dressmaking generally, this kind of machine is at present unrivalled, both for the efficiency of its work, and also for the neatness and finish of the machines made for private use. Sewing-machines have beeen patented in America and England by another American named Blake for sewing the soles on boots and shoes; and so rapid are they in their work, that it is said during the war in the United States as many as 150 pairs of soles have been sewed on army boots in one day by a single machine. Special sewing-machines are also in use for sewing the upper leathers of boots and shoes, for gloves, for embroidery, and various other purposes.

SEXAGE'SIMA SUNDAY (Lat. *sexagesima*, i. e., *dies*, the sixtieth day), the second Sunday before Lent, and roughly reckoned the 60th day before Easter.

SEXAGE'SIMALS, a mode of arithmetical calculation introduced by the ancient Greek astronomers, especially by Ptolemy (q. v.) into astronomical and geometrical reckoning. It was founded upon the division of the circle into 360 parts, and the radius being nearly $\frac{1}{6}$th of the circumference, was considered to contain 60 of these parts or degrees. Continuing the same mode of subdivision, each degree (°) on the radius was divided into 60 minutes (′), each minute into 60 seconds (″), and thirds (‴), fourths (⁗), &c., followed in the same relation to each other. Addition and substraction are not altered in this method, but multiplication, division, and the extraction of roots are so to a considerable extent. Multiplication, the most used of these three operations, was carried on in the descending scale, as in the following example.

where $\lambda\alpha^{o}\ \delta'\ \kappa\zeta''$ is to be multiplied by $\kappa\theta^{o}\ \iota\eta'\ \nu\delta''$, or (substituting Arabic numerals) 31° 4′ 27″ by 29° 18′ 54″.

31°	4′	27″		
29°	18′	54″		
899°	116′	783″		
	558′	72″	486‴	
		1674″	216‴	1458⁗
899°	674′	2529″	702‴	1458⁗ = 910° 56′ 21″ 6‴ 18⁗

Here, each of the three numbers, 31, 4, 27, is multiplied by 29; the same three by 18, and the results placed in the line below, one step to the right; and again by 54, and the results placed another step to the right. This arrangement proceeds on the principle that the product of degrees by minutes gives minutes; of minutes by minutes, seconds; of minutes by seconds, thirds; and, in general, the denomination of a product is indicated by the sum of the marks superposed on the two factors. The columns are added and rearranged by Reduction (q. v.) This system, though clumsy and intricate, was a great improvement, as regards facility and accuracy, on the former Greek method; and so much was it admired, that succeeding geometers founded on it a complete system of general calculation, and a work on sexagesimal computation was written by Barlaam, who died in 1348.

It is almost unnecessary to state, that the terms minutes, seconds, thirds, &c. here employed only denote sixtieths, sixtieths of sixtieths, &c., and *have no other signification*; further, that the degrees, minutes, and seconds in the multiplier are, for the time being, merely abstract units and parts of units. The operation of modern arithmetic known as *duo-decimal multiplication* is effected in the same way, the subdivisions being twelfths in place of sixtieths.

SE′XTANT, an instrument for measuring the angular distance of objects by means of reflection. The principle of its construction depends upon the theorem, that *if a ray of light suffer double reflection, the angle between the original ray and its direction after the second reflection is double of the angle made by the reflecting surfaces.* Thus let A and B (fig. 1) be two mirrors perpendicular to the same plane, and inclined to each other, and let SA be a ray of light, which falling upon A is reflected on B, and reflected in the direction BC, then ACB is the angle between the original and finally reflected rays, and ADB is the angle between the mirrors. Now, as the angle of reflection is equal to the angle of incidence $\angle SAF = \angle BAD$, and $\angle GBA = \angle DBC$; but $\angle EBC = \angle BAC + \angle BCA = (\angle BAD + \angle DAC) + \angle BCA = (\angle BAD + \angle SAF) + \angle BCA = 2\angle BAD + \angle BCA$; and $\angle EBC$ also $= \angle EBD + \angle DBC = \angle EBD + \angle GBA = 2\angle EBD = 2\angle BAD + 2\angle BDA$; therefore $\angle BCA = 2\angle BDA$, which proves the truth of the theorem. The instrument of which this theorem is the principle is a brass sector of a circle in outline; the sector being the sixth part of a complete circle, for which reason the instrument is called a *sextant*. Fig. 2 shows the essentials of its construction, AMN is the sector whose curved side, MIN, is the sixth part of a circle; A is one mirror wholly silvered, placed perpendicular to the plane of the sector, and on, and in line with, the limb AI, which is movable round a joint at or near A; B is the other mirror, also perpendicular to the plane of the instrument, and silvered on the lower half only, the upper half being transparent; E is an eyelet-hole or small telescope.

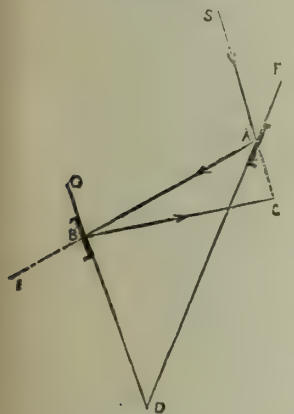


Fig. 1.

The graduation runs from N to M (on a slip of silver, platinum, or gold let into the rim), and is so adjusted that when the movable limb is drawn towards N till the mirrors A and B are parallel, the index, which is carried at the foot of the movable limb is opposite zero on the graduation. If we suppose that this zero-point is at N, it is evident that the angle between the mirrors is equal to the angle NAI; and again, if instead of graduating from 0° at N to 60° at M, which is the proper graduation for the sixth part of a circle, the graduation be made from 0° to 120°, that is, each half degree being marked as a degree, and similarly of its aliquot parts, then the angle NAI, read off by the index at I, will show at once the angle between the incident and finally reflected rays. The mode of using the sextant consists in placing the eye to the telescope or eyelet-hole, and observing one object directly through the unsilvered part of B, and then moving the index till the image of the other object, reflected from A upon the silvered part of B, coincides with, or is opposite to the first object, then the angle, read off at I, gives the angle between the objects. For additional accuracy, a vernier is attached to the foot of the movable limb.

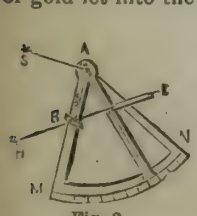


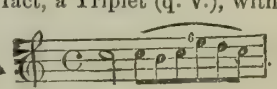
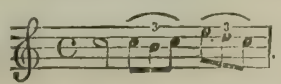
Fig. 2.

The sextant is capable of very general application, but its chief use is on board ship to observe the altitude of the sun, the lunar distances, &c., in order to determine the latitude and longitude. For this purpose, it is necessary to have stained glasses interposed between the mirrors A and B, to reduce the sun's brightness. These glasses (generally three in number) are hinged on the side AM, so that they may be interposed or not at pleasure. B is the glass through which the horizon is perceived, and has hence received the name of the *horizon-glass;* while the other mirror, from its being attached to the index-limb, is called the *index-glass.*

The sextant is liable to three chief errors of adjustment; 1° if the index-glass be not perpendicular to the plane of the instrument; 2° if the horizon-glass be not perpendicular to the plane of the instrument; and 3° if, when the mirrors are parallel (which is the case when a very distant body, such as the sun or moon, is observed directly through B, and found to coincide with its image in the lower part of B), the index does not point accurately to 0°; this last is called the *index-error*, and is either allowed for, or is remedied by means of a screw, which moves the index in the limb AI, the latter being stationary. The first two errors are also frequently remedied by means of screws working against a spring, but in the best instruments the maker himself fixes the glasses in their proper position.—The *quadrant* differs from the sextant only in having its arc the fourth part of a circle, and being consequently graduated from 0° to 180°; the *octant* contains 45°, and is graduated from 0° to 90°; while the *repeating-circle*, which is a complete circle, is graduated from 0° to 720°. A common form of the sextant is the 'snuff-box' sextant, which is circular in shape, and as it can be conveniently carried in the pocket, is the form most frequently used by land-surveyors.

The idea of a reflecting instrument, on the principle of the sextant, was first given by Hooke about 1666; but the first instrument deserving the name was invented by John Hadley (q. v.) early in the summer of 1730, and a second, and much improved form of it, was made by him a short time afterwards. Halley, at a meeting of the Royal Society, claimed for Newton the priority of invention; and in October 1730, a Philadelphian, named Godfrey, also asserted his claim as the original inventor, but that learned body decided that Newton's claim was unsupported by even probable evidence, and that Hadley's and Godfrey's inventions were both original, but that the second form (which is almost the same as the common sextant now employed) of Hadley's instrument was far superior to his first form and to Godfrey's.

SE′XTON (corrupted from SACRISTAN, q. v.), is a parochial officer in England, whose duty is to take care of the things belonging to divine worship. He is usually chosen by the inhabitants, but often also by the minister or the churchwardens, the mode of appointment being regulated by the custom of each parish. He sometimes also holds the office of parish-clerk. Women have occasionally been appointed sextons, this being one of the offices which women may fill, and they also have a vote in elections. The office is a freehold office for life, except in the new parishes under Church-building Acts; the duty is to keep the church clean, swept, and adorned; to open the pews; to make and fill up the graves; to prevent any disturbance in church. The salary is paid by the churchwardens, and as to amount depends on custom. In Scotland, the beadle performs similar duties, and is appointed by the heritors.

SE′XTUPLET, in Music. When a note is divided into six parts instead of the usual division into four—as, for instance, a minim into six quavers, or a crotchet into six semiquavers—the group is called a sextuplet, and the figure 6 is generally placed above it. The proper sextuplet is composed of three groups, of two notes each, being, in fact, a Triplet (q. v.), with each of its notes subdivided into two :  . But a group composed of two successive triplets is sometimes, though not very correctly, also called a sextuplet, and written as such, though it is more correct to divide it into its component two triplets, thus :  .

SEYCHE′LLES COCOA-NUT, or DOUBLE COCOA-NUT (*Lodoicea Seychellarum*), a palm, of which the fruit has some resemblance to a cocoa-nut, although it belongs to a different tribe of palms, being allied to the Palmyra Palm. It is found only in

the Seychelles Islands; and the fruit, wafted by the winds to the shores of the Maldive Islands, or found floating in the Indian Ocean, was long the subject of many ridiculous fables, and is still an object of interest and curiosity, and as such one of the minor articles of commerce. The tree grows to the height of 50 or 60 feet, with a tuft of immense leaves. The wood and the leaves are used for a variety of purposes, like those of other palms. The 'cabbage' or terminal bud is eaten. The fruit is often a foot or a foot and a half long, in shape like a melon, its outer husk green. the interior near the base divided into two parts, at first filled with a white sweet jelly, which changes into a white horny kernel. The shells are used for making vessels of various kinds, often beautifully carved and ornamented.

SEYCHE'LLES ISLANDS, situated nearly in the center of the Indian Ocean, between 3° 40′—5° 35′ S. lat., and 55° 15′—56° 0′ E. long., a group of more than thirty isles, resting on an extensive bank of sand and coral, and forming the most important of the dependencies to the colony of the Mauritius. The principal are Mahé, Praslin, Silhouette, La Digne, Curieuse, St. Anne, Aux Cerfs, Frégate, Marianne, Longue, and Du Sud Est. Mahé, the most considerable and populous of the group, and the seat of government, is 18 miles long, and from 3 to 5 broad. The islands are mountainous, often rising abruptly from the sea, and are clothed with the most luxuriant verdure; one of the peaks, named Mont Blanc, in Mahé, attains an altitude of 3000 feet. The principal port is Victoria, on the north-eastern side of the island of Mahé, the houses of which used to be built chiefly of wood; but now coral is universally employed. Coral is growing very rapidly all round this group of islands. At Port Victoria, where the soundings were recently given at 7 fathoms, the coral has piled itself up to within 2¼ fathoms of the surface. In the neighborhood of Port Victoria there is a beautiful church built of coral. Many improvements have been made also in others of these small islands.

The S. were known to the early Portuguese navigators, who bestowed on them the titles of Isles de Mascarenhas; subsequently, the French renamed them Iles La Bourdonnais, and finally changed their appellation in honor of the Count Herâult de Seychelles. They were first settled by the French in 1756, who commenced the cultivation of spices, under circumstances so favorable as to induce a belief in a lucrative competition with the more easterly colonies of the Dutch. The immunity of the S. from the hurricanes which periodically visit the neighboring seas rendered them peculiarly suited for this purpose, which, however, received a severe blow by the suicidal destruction of the spice-plants by the French occupants, to prevent their falling into the hands of the English in 1778. The cultivation is now checked by insufficiency of labor. On the cession of Mauritius, the S. were finally taken possession of by Great Britain. The islands produce a large quantity of timber suitable for ship-building purposes; and the S. cocoa-nut, which is indigenous only in the S., and the nuts, leaves, &c. of which are applied to a great variety of domestic purposes by the natives. Sugar is cultivated to a small extent. Cotton flourishes here, but its cultivation has declined since the abolition of slavery. The chocolate plant and vanilla are grown, and tortoise-shell is among the articles of commerce.

The population of the S. was, in 1881, about 12,000 souls, many of whom are employed in the ship-building yards and factories.—See Sir Edward Belcher's *Account of the Seychelles;* Owens's *Voyage of H.M.S Leven and Barracouta;* Horne's *Report on the S. Islands* (1875); *Nature*, vol. xiv.

SEYMOUR, FAMILY OF. This family, whose history is largely interwoven with that of England, was originally settled at St. Maur—whence its name—in Normandy. Coming over to England, the Seymours obtained lands in Monmouthshire as early as the beginning of the 13th century. They acquired estates at Hatch Beauchamp, Somersetshire, by marrying an heiress of the Beauchamps early in the 15th century. In 1497, we find the head of the family, Sir John Seymour, employed in suppressing the insurrection of Lord Audley and the Cornish rebels, and subsequently accompanying King Henry VIII. to his wars in France, and to the Field of the Cloth of Gold. Of the issue of this worthy knight one daughter became the wife of Henry VIII., and mother of Edward VI.; one son, Thomas, created Lord Seymour of Sudeley, became Lord High Admiral of England, and the second husband of Henry's widow (Catherine Parr), and ended his life on the scaffold, being attainted to high treason. Sir John's eldest son, Edward, who held many high positions in the court of Henry, was created Lord Seymour of Hache, and Duke of Somerset in 1546—1547. He had been sent into France by Henry to settle the disputed question of the border of the English possessions there, and secured the confidence of the king so far, that he was left by him one of his executors and one of the council of the young Prince Edward. He was subsequently made Lord High Treasurer, and eventually 'Protector and Governor of the King and his realms.' (See EDWARD VI.). His subsequent fall, after a two years' tenure of his all but regal power, by the influence of Dudley, Earl of Warwick and Duke of Northumberland, was followed by an attainder of his honors, which was not reversed for more than a century.

The eldest son of the Protector by his second marriage, being created by Elizabeth Earl of Hertford, married the Lady Catharine Grey, a grand-niece of Henry VIII., sister of the unfortunate Lady Jane Grey—a marriage which entailed on him a long imprisonment and a heavy fine. His grandson, who succeeded him in the Earldom of Hertford, was also sent to prison in the Tower of London for marrying the Lady Arabella Stuart, cousin of James I. of England; but subsequently, playing a conspicuous part in the royal cause in the civil wars, obtained in his own favor a reversal of his ancestor's attainder (see above), and in 1660 took his seat in the House of Peers as second Duke of Somerset, although the descendants of the first duke, by his first marriage, were then in existence. He died in 1675, and his ducal title passed to a cousin, on whose death it was inherited by Charles Seymour, known in history as the 'Proud Duke of Somerset,' a nobleman whose style of living was ostentatious and haughty in the extreme, and who filled several high posts in the courts of Charles II., William III., and Anne. He married the heiress of the Percies, by whom he had a son, Algernon, 7th duke, who was created Earl of Northumberland, with remainder to his son-in-law, Sir Hugh Smithson, the ancestor of the present Percy line. On the death of this duke, a curious peerage case arose, the title being claimed by the descendants of the first duke by his first marriage, on the failure of the younger branch; and the attorney-general having reported in favor of the claim, Sir Edward Seymour took his seat in the House of Peers as 8th Duke.

SEYNE, LA, a seaport of France, on the shore of the Mediterranean, in the dep. of Var, three miles south-west of Toulon. Pop. (1876) 8152.

SE'ZZE, or SEZZA, a city in the province of Rome. There are remains of a Cyclopean wall surrounding the rock on which it stands. Pop. 6600.

SFAX, or SFA'KES, the chief town and port of Southern Tunis, 150 miles south of the town of Tunis, with which it is connected by telegraph. There is a trade in dates, cloth, olive-oil, esparto grass, and jessamine and rose oil. Pop. 40,000, of whom 2000 are Jews.

SFORZA, a celebrated Italian family, which played a most important part in the affairs of Italy during the 15th and 16th centuries, swayed the destinies of Northern Italy for many years, and allied itself with the first sovereign houses in Europe. Its founder was a peasant of Cotignola, in the Romagna, by name *Giacomo*, or *Muzio* (sometimes combined by historians into *Giacomuzzo*) *Attendolo* (born 1369), who deserted his trade of wood-cutting to become a 'condottiere,' and by his intelligence and courage rose to a high position in the band to which he belonged. Count Alberigo de Barbiano, the founder of Italian 'condottierism,' bestowed upon him, on account of his prowess, the name of SFORZA (Ital. 'the forcer'); and such was his reputation among his comrades, that he speedily found himself the independent leader of a band of condottieri, and offered his services to the king of Naples. Queen Joanna II. made him constable of that kingdom, and in exercise of his office, he chased away the Aragonese, and others, who attempted to deprive her of her dominions; but dying soon after (4th January 1424), he left his devoted followers to the chieftainship of his natural son, FRANCESCO S., then 23 years of age, who was as brave and enterprising as himself.

Francesco, as was the custom of the time, sold his sword to the highest bidder, and without the slightest scruple fought for or against the pope, Milan, Venice, and Florence. He invented an improved system of tactics, and it soon came to be taken for granted that victory was certain for the party which he supported. It was thus no great act of condescension in the Duke of Milan, the haughty Visconti, to confer upon him the hand of his daughter, Bianca, with Cremona and Pontremoli as a dowry, and the promise of succeeding to the duchy itself. Meantime, S. took the march of Ancona from the pope (1434), added to it Pesaro (1443), and by a judicious combination of force and stratagem, obtained his elevation to the dukedom of Milan (26th February 1450), after the decease of his father-in-law. He solidly established his authority over all Lombardy, and several districts south of the Po; acquired the esteem of Louis XI., who gave up to him Savona and Genoa; and after gaining the universal love of his subjects, died 8th March 1466. Though uninstructed, he possessed considerable eloquence, and loved and protected letters. The successors to his power possessed few or none of his distinguished talents. His son, GALEAZZO-MARIA S. (1466—1476) was a true tyrant, gloating over the torments of his victims, and a monster of debauchery, prodigality, and ferocity, without a single redeeming feature in his character. He was assassinated (26th December) at the porch of the cathedral of Milan. His son GIOVANNI-

GALEAZZO S. (1476—1494) succeeded, under the regency of his mother, Bona of Savoy, who held the reins of government with a firm hand. But she was forced to give up (1480) her able co-adjutor, Simonetta, to the vengeance of her brother-in-law, Lodovico Maria, surnamed 'the Moor,' from his dark complexion; and three days after Simonetta's execution, the ambitious Lodovico banished herself, and assumed the regency. Finding the young duke in his way, Lodovico put him and his wife, Isabella of Calabria, in prison, and was immediately threatened with attack by the king of Naples, a danger which he attempted to ward off by giving his daughter, Bianca, with a dowry of 400,000 ducats, to the emperor Maximilian I., and by stirring up Charles VIII. of France to assert his claims to Naples. Soon afterwards, Duke Giovanni-Galeazzo died, poisoned, as some believe, by his uncle, 20th October 1494.

LODOVICO-MARIA (1494—1500) obtained his investiture as duke, and becoming alarmed at the rapid progress of the French in Italy, he joined the league against them, and was rewarded for his perfidy by being driven from his duchy, which was seized by the troops of Louis XII. (1499). The following year he made an ineffectual attempt to regain possession, was made prisoner, and carried to France, where he died in 1508. He possessed great talents, combined unfortunately with a low morality, which led him to value astuteness more than everything else; but his encouragement of letters and of the fine arts, will preserve his name to posterity. His eldest son, MASSIMILIANO S. (1512—1515), regained the duchy of Milan after the reverses suffered by Louis XII., and with the aid of the Swiss steadily repulsed the various energetic attempts of the French to recover it; but after the battle of Marignan (1515), he abandoned his rights to the French for a pension of 30,000 ducats, glad to be free from the insolence and exactions of his allies, and the attacks of his enemies. His brother, FRANCESCO-MARIA S., succeeded nominally to the Milanese after the battle of Pavia, but he was a mere puppet in the hands of Charles V., and on his death, 24th October 1535, and the extinction of the main line of the house of S., the duchy was quietly swallowed up by Austria. The Lords of Pesaro (extinct in 1515), the Counts of Santa-Fiora, in Tuscany, still existing, and the Dukes of Sforza-Cesarini, descend from collateral branches of the family.

SFORZA'TO (Ital. forced), in Music, often contracted *sf*, a term used to indicate that the note over or under which it is placed is to be played with strength and emphasis. A higher degree of emphasis is indicated by *sff*, or *sforzato assai*.

SHAD (*Alausa* or *Alosa*), a genus of fishes of the family *Clupeidæ*, differing from *Clupea* (the Herring, &c.) in having the upper jaw deeply notched. The teeth are very small, on the jaws only, and often wanting, at least in the adult fish. The species are numerous, inhabiting the sea, but some of them ascending rivers like the salmon, and spawning there. They are very like herrings in form and appearance, and on this account, and their large size, the British species receive from Scottish fishermen the name of *King of the Herrings*. The herrings of extraordinary size, of which the capture is sometimes reported are probably always shad.—The COMMON S., or ALLICE S. (*A. communis*), is rather thicker and deeper in proportion to its length than the herring. It is found on the British coasts, and in the lower part of some of the large rivers, more abundantly in the Severn than in any other British river. It attains a length of two, or even three feet, and a weight of from four to eight pounds. It has no teeth. There is a single black spot behind the gills. Its flesh is of good flavor.—The TWAITE S. (*A. finta*) is more plentiful on the British coasts, and is the common S. of the Thames, but the foul state of the river has now made it of very rare occurrence above London. It is smaller than the Allice S., seldom exceeding 16 inches in length; there are small teeth in both jaws, and a row of dusky spots along each side of the body. The flesh is coarser, and less esteemed than that of the Allice S , but much used for food wherever the fish is plentiful. This species spawns later in the year than the last, and in order to permit it to deposit its spawn, its capture in the Thames is prohibited after the end of June. It abounds in many of the rivers of France, and other parts of Europe.—A species of S., generally weighing about four or five pounds, but sometimes twelve pounds, is very abundant during some months of the year in some of the North American rivers, as the Hudson, Delaware, Chesapeake, and St. Lawrence, and is now bred successfully, and in immense numbers, in the U. S. pisicultural establishments.

SHA'DDOCK (*Citrus decumanus;* see CITRUS), a tree, which, like the other species of the same genus, is a native of the East Indies, and which has been long cultivated in the south of Europe. It is said to derive its English name from a Captain Shaddock, by whom it was introduced into the West Indies. It is readily distinguished from most of its congeners by its large leaves and broad-winged leaf-stalk; it has very large white flowers, and the fruit is also very large, sometimes weighing 10, or even 14 pounds, roundish, pale yellow; the rind thick, white and spongy within, bitter; the pulp greenish and watery, subacid, and subaromatic. It is a pleasant, cooling fruit, and much used for preserves. The tree is rather more tender than the orange, but with proper care is often made to produce fine fruit in orangeries in Britain.

SHADOW is a portion of space from which light is debarred by the interposition of an opaque body. If the luminous body be too near, or too large to be considered as a mere point, then each atom of the light-giving surface throws its own shadow independent of the others. We have thus in reality a multiplicity of shadows overlapping each other, and forming what in common parlance is 'a' shadow of the opaque body, which is darkest at those places where all the separate shadows overlap each other, and becomes lighter as it gradually falls beyond the limits of more and more of these separate shadows. See PENUMBRA. The depth of a shadow depends from mere force of contrast on the intensity of the light around it; it also depends much on the nearness of the object, as compared with its size, to the surface upon which the shadow is thrown; for the rays of light by their properties of reflexion, refraction, and dispersion tend to bend 'round' the opaque object, and the increase of distance between an object and its shadows allows more scope for this action.

SHADWELL, THOMAS, a dramatic writer of some note in his day, though now only remembered as the 'Mac-Flecknoe' of Dryden's satire, was born in 1640 in Norfolk. He was educated for the law, but not finding it a pursuit to his mind, he deserted it, and after an interval of foreign travel, betook himself seriously to literature. His first comedy of *The Sullen Lovers* (1668) had great success, and he continued from year to year to entertain the town with a succession of similar pieces, a complete edition of which was published after his death in 4 vols. 12mo. The immortality which these must have failed to achieve for him, he was fated to attain in a way somewhat less desirable. With Dryden he seems, in the earlier portion of his career, to have been on terms of friendly intimacy; but literary jealousies divided them, and the quondam friend became a favorite butt for the shafts of Dryden's deathless ridicule. Though his works—hasty and careless as they are—exhibit lively talent and considerable comic force, all that the literary world now knows of S. is, that 'Shadwell never deviates into sense.' It might a little console him, under the satire of his enemy, that he succeeded him in the post of poet-laureate, which in 1688 it became necessary for Dryden to resign. He did not long survive to enjoy it, however, as in 1692 he died, it is said of an overdose of laudanum, a drug in which he was wont to indulge himself.

SHA'FIITES, the name of one of the four principal sects of the Sunnites (q. v.), or 'orthodox' Muslims. Its name it received from its founder, Abu Abdallah Mohammed Ibn Idris, called Al-Shafei, from one of his ancestors who descended from Mohammed's grandfather.

SHAFT, the body of a column, extending between the base and capital. In Gothic architecture, the term is applied to the small columns clustered round piers, or in the jambs of doors and windows. In the early styles, the shafts are frequently of finer material than the pier, such as Purbeck marble, and polished and banded. In later examples, the shaft is generally attached, and of the same piece as the pier. For illustration, see COLUMN.

SHA'FTESBURY, commonly called SHASTON, a very ancient town of England, a municipal and parliamentary borough in Dorsetshire, 27 miles north-north-east of Dorchester. It stands on the narrow ridge of a chalk hill, and commands extensive and beautiful views of the counties of Dorset, Somerset, and Wilts. The date of its foundation is unknown, but it seems to have been a Roman station. In the reign of Athelstan (924—940) it contained two mints and an abbey of Benedictine nuns. Here Canute the Great died in 1036. Pop. (1871) of municipal borough, 2472; (1881) 2312

SHAFTESBURY, ANTHONY ASHLEY COOPER, EARL OF, English stateman and philanthropist, is descended from a family intimately associated with the political history and literature of England. Sir John Cooper of Rockbourne, Hampshire, married Anne, daughter and sole heiresss of Sir Anthony Ashley of Wimborne, St. Giles, Dorsetshire, secretary-at-war in the reign of Queen Elizabeth. Their eldest son, Sir Anthony Ashley Cooper (born 1621), was actively engaged in public affairs during the civil wars. He first espoused the cause of royalty; he then became one of the most eminent of the Parliamentary leaders in the council, and not the least active in the field. When he saw that the restoration was inevitable, he took so prominent a part in bringing back Charles II. that he was raised to the peerage as Baron Ashley. He was a member of the justly infamous 'Cabal' Ministry, and was afterwards appointed to be Lord Chancellor, with the earldom of Shaftesbury. He was the Achitophel of Dryden, by whom his character is drawn with as much truth as power. He hated a calm, lived all his life in intrigues, and in his 62d year

his 'fiery soul' wore out his small and fragile body. He will be honored for all time by men of English race and descent as the author of the Habeas Corpus Act. He also first introduced a bill rendering the judges independent of the crown.—His grandson, ANTHONY COOPER, third earl (born 1671, died 1713), author of the *Characteristics*, the friend of Pope, and the other celebrities of the Augustan age, obtained from Voltaire the questionable praise of being the boldest of the English philosophers.—The sixth earl was for many years Chairman of Committees of the House of Lords.

His son, ANTHONY ASHLEY COOPER, seventh earl of S., was born in Grosvenor Square, London, April 28, 1801. He was sent to Harrow, and thence to Christ-Church, Oxford, where he obtained a first-class degree in classics in 1822. He represented the borough of Woodstock from 1826 to 1830; the county of Dorset (in which the family estates are situated), from 1831 to 1846; and the city of Bath from 1847 to 1851, when he succeeded to the earldom. During his long career in the Lower House, he held one or two subordinate posts. He is better known by his attempts to improve the social condition of the laboring classes. As he belonged to the Conservative party, and represented an agricultural county, the manufacturers, and their organs in the press, received his allegations respecting the condition of their operatives in a hostile and antagonistic spirit, and retorted that the wages of families engaged in factories amounted to twice and three times the sum paid to the Dorsetshire laborers. Yet Lord Ashley returned again and again to the charge; and on the death of Mr. Sadler, M.P., took charge of the Ten Hours' Bill. The manufacturers declared with alarm that any reduction in the hours of labor would be fatal to our manufacturing supremacy. Successive governments naturally believed these prophecies, and almost all the leading statesmen of the day opposed the Ten Hours' Bill. But public opinion declared in favor of a limitation of the hours of labor. Lord Ashley carried his bill through parliament, and has the satisfaction of knowing that the opponents of the measure admit, without an exception, that it was an act of wise and beneficent legislation, and that their alarms were groundless. When he visited the manufacturing districts, he was honored with an enthusiastic ovation. He refused to join Sir R. Peel's administration in 1841, because that statesman refused to countenance the Ten Hours' Bill.

In 1846, he supported Sir R. Peel in his proposal to repeal the Corn Laws, an act which cost him his seat for Dorsetshire. When he successfully contested Bath against Mr. Roebuck in 1847, he appeared on the field of politics as a 'Liberal Conservative.' After his accession to the earldom, S. took a more prominent part in connection with various religious, social, and philanthropic societies. These are so numerous that a list of the associations with which he is in some way officially concerned, would include almost every scheme having for its object the physical, moral, and spiritual improvement of society. He belongs to the Evangelical party in the Church of England, and is a prominent member of the chief church societies. He is married to a daughter of the fifth Earl Cowper, and being thus a connection by marriage of the late Viscount Palmerston (whose government he steadily supported), many of the ecclesiastical appointments and promotions of Evangelical clergymen made by that minister were attributed to his influence. He has followed up the Ten Hours' Bill by obtaining the assent of parliament to other measures regulating defective workshops and factories, night-work, and the treatment of children by their employers. Among honors that have been conferred on S. are the Oxford Degree of D.C.L. in 1841, and the honorary citizenship of Edinburgh in 1878.

SHAG. See CORMORANT.

SHAGREE'N is generally understood to mean shark skin dressed and rubbed down smooth or not; but the Oriental shagreen, formerly in so much repute, consists of portions of the skins of horses, asses, camels, and oxen, the part used being strips taken from head to tail along the center of the back. These strips are prepared by soaking in water and currying; and when in the proper condition, they are laid on the ground, and the seeds of *Chenopodium album* are sprinkled over them; a board or piece of felt is then placed on the seeds, and by pressure the hard seeds are forced deeply into the skin, which is then hung to dry. When dry, the seeds are removed by shaking, and the skin pared down with a proper knife nearly, but not quite as low, as the bottom of the depressions caused by the seeds. After this the skin is again soaked, and the parts compressed by the seeds now rise up and form elevations, which are increased by washing in a solution of salt. The last operation is dyeing them of various colors, green being the favorite one. Owing to the difference of texture produced by the operations of compressing by the seeds, paring, &c., the color, is taken irregularly; and when dyed green, the material somewhat resembles malachite in appearance when dried and polished. It was at one time a very favorite material in Britain for covering small cases and caskets of various kinds, especially spectacle-cases.

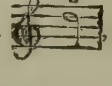
SHAH (Persian, *prince, king*), the general title of the supreme ruler in Persia, Afghanistan, and other countries of Southern and Central Asia. The sovereign, however, may, and frequently does, decline the title, assuming it its place that of *Khan* (q. v.), an inferior and more common appellation. The same title can also be assumed by any of the shah's sons, and upon all the princes of the blood the cognomen *Shah-zadeh* is bestowed.

SHAH-JEHAN, or 'King of the World,' the title assumed on his accession to the throne by Khorrum Shah, the third son of Selim Jehan-Ghir, and the fifth of the Mogul emperors of Delhi. He was during his father's reign employed in military expeditions against that Rajputs, the independent Mohammedan states of the Deccan, and the Afghan tribes around Candahar, in which he greatly distinguished himself by bravery and military skill; but on his return, he was forced into rebellion (1623) by the intrigues of his enemies at court, and was still unreconciled to his father at the latter's death in 1627, when he was at once saluted as emperor by the nobles. At his accession, the empire had reached the summit of its greatness, but the causes which led to its rapid decline at the same time unmistakably showed themselves: the territory was too extensive for the system of government which was generally pursued by the Moguls; the discordant parts were unconnected by any bond of union; the supreme ruler was looked upon in many provinces as a mere tax-collector; and with the thus necessary absence of any spirit of loyalty, insurrections were frequent in all the provinces. The chief events of S.-J.'s reign were—the war against the Deccan sovereignties, which resulted in the complete destruction of the kingdom of Ahmednuggur (1631), and the subjugation (1636) of those of Beejapur and Golconda; an indecisive contest against the Uzbeks of Balkh (1644—1647); two unsuccessful attempts to recover Candahar from the Persians; and a second successful war, conducted by his third son, Aurungzebe, against the Deccan princes (1655). But in 1657 the emperor fell dangerously ill, and his four sons, who were ambitious of attaining supreme power, immediately commenced to dispute regarding the succession. See AURUNGZEBE. Ultimately, S.-J. was taken prisoner, and confined in the citadel of Agra till his death, December 1666.

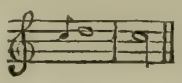
S.-J. united the voluptuous profligacy so common in Eastern monarchs with great sagacity, and the strict administration of justice to Moslem and Hindu alike. In his later years he became avaricious, increased the taxes, and confiscated the property of his wealthier subjects on the slightest pretexts. The magnificence of his court was unequalled; the splendid 'peacock-throne' was constructed by his orders at a cost of about £7,000,000, and many magnificent public buildings executed under his direction remain as monuments of his greatness. Chief of these are the city of Shahjehanabad, and the suberb mausoleum of Tajmahal (see AGRA). Yet so strict was his financial management, that he left a well-appointed army of 200,000, and a treasury containing £24,000,000 to his son Aurungzebe.

SHAHJEHANPO'RE, a town of British India, the principal place of a district of the same name, North-west Provinces. It stands on the Gurrah, a feeder of the Ramgunga, 94 miles north-west from Lucknow. Pop. (1872) 72,140.

SHAH NAMEH, Book of Kings, the title of several Eastern works, the most celebrated of which is the Persian poem of this name by Firdusi (q. v.), containing the history of the ancient Persian kings in about 60,000 distichs, and written by the order of Sultan Mahmud of Ghizni, in the space of thirty years. Another work, in Turkish, under the same name, comprises the history of all the ancient kings of the East, and was written by Firdusi Al-Thauil. Bajazet II., to whom the book was dedicated, ordered the author to reduce it from its original bulk of 300 volumes to 80. Firdusi, however, felt so mortified at this proposal, that he preferred leaving the country altogether, and emigrated to Khorassan, in Persia.

SHAKE, in Music, an embellishment produced by the continued and rapid repetition of one note alternately with another either a whole tone or semitone above it. Its sign is *tr* (the first two letters of the Italian *trillo*), placed over or under the principal note. For example:  , is played thus:

; the exact number of repetitions

being indefinite. A shake is often preceded by an Appogiatura (q.v), and is very generally finished with a turn, as  , played: . We may have shakes on two notes at once; and a series of shakes is called a chain of shakes.

SHAKERS, the name commonly given to a small religious sect existing in the United States of America. The proper or official description of this sect is the United Society of Believers in Christ's Second Appearing; but its members seem to have accepted the designation of Shakers, though it was originally applied to them in ridicule, on account of certain rhythmical movements of the hands and arms which form part of the ceremonial of their worship. Though the Shaker Societies are found only in the United States, their creed had an English origin. The founder of the sect, in whose person they believe that Christ has appeared a second time, was an Englishwoman, named Ann Lee, a native of Manchester, who emigrated to New York with a small band of disciples, shortly before the outbreak of the revolutionary war.

Ann Lee was the daughter of a blacksmith, who lived in Toad Lane in Manchester; a very poor man, who gave her no education, and sent her while a mere child to work in a cotton-mill. She seems to have been a violent, hysterical girl, ambitious of notice, and fond of power, and to have always possessed, in virtue of her strong will and vehement temper, a great deal of influence over the people around her. She married, while very young, a blacksmith named Stanley. She had four children, all of whom died in infancy—to this, perhaps, may be ascribed the preference of the celibate to the married life, which she ultimately raised into a part of her religious system. She became one of the earliest believers in a prophetess, who appeared about a hundred years ago, in the town of Bolton-on-the-Moors, in Lancashire—a poor woman, named Jane Wardlaw, the wife of a tailor, who believed she had 'received a call' to go forth and testify for the truth. The burden of Jane Wardlaw's message was, that the end of all things was at hand, that Christ was coming to reign upon the earth, and that his second appearance would be in the form of a woman, as prefigured in the Psalms. In subordination to this, she took up several of the tenets of the Society of Friends, to which she and her husband originally belonged; especially, she raised her voice against war and against profane swearing. Her followers believed that she was filled with the Holy Spirit; they received her utterances as the voice of God; and she acted as if all the powers of earth and heaven had been given into her hands. Ann Lee, on her conversion, began to preach the same message in Toad Lane and the adjacent streets of Manchester; but she soon went beyond her teacher, and gained the leadership of her co-believers for herself. It happened that she was brought before a magistrate, charged with an obstruction of the streets, caused by the crowd collected to hear her preach, and she was sent to the Old Bailey Prison in Manchester.

When she came out of prison, she gave forth, that one night a light had shone upon her in her cell; that the Lord Jesus stood before her; and that He became one with her in form and spirit. Her pretension was, that Christ was come to reign in her person. It was favorably entertained by the followers of Jane Wardlaw; and they acknowledged her as their Head, or Mother, in place of Jane, whose pretensions had never gone so far. She found, however, that among her neighbors and fellow-workers, her claim to be the Bride of the Lamb, the Queen described by David in the Psalms, excited only jeering and ridicule; and she received a revelation that she should seek in America a home for herself and her few disciples—that it was in America that the foundations of Christ's kingdom were to be laid. So she went to New York, accompanied by seven disciples—five males and two females. Her husband also went with her; but he seems to have had no faith in her, and he left her soon after their arrival, in consequence of one of the features then introduced into her system. This was the practice of celibacy, which she had not previously enforced upon her followers, though she had enjoined it as a duty. Her teaching was, that men called into grace must live as the angels do, among whom there is no marrying or giving in marriage; that no form of earthly love could be allowed in the Redeemer's kingdom. Finding a populous city unfavorable to her designs, she removed, with her followers, first to Albany, then far into the wilderness to Niskenna, and there founded the settlement which still exists, of Water Vliet. It was in the spring of 1780—when she had been three years and a half at Niskenna, looking for new believers to come in, but making no attempt to win them—that the first American converts joined her society.

A revival had taken place at Albany, and had spread through the surrounding districts; and from Hancock and New Lebanon a deputation was sent to Niskenna, to see what light its inhabitants enjoyed as to the way of salvation. The deputation consisted of Joseph Meacham and Lucy Wright—subsequently the heads of the Shaker Society. These persons became believers in Ann Lee; and through their agency, other converts were won, and a Shaker Society established at New Lebanon. Towards the close of 1780, the revolutionary war being then in progress, notoriety was given to Ann Lee's pretensions, through an incident seemingly unfavorable. Owing to her British origin, her denunciations against war, and her refusal to take the colonial oaths, Ann was imprisoned for some time at Poughkeepsie, on suspicion of being a British spy. Before she was let out of prison, in December 1780, all the colonies had heard of 'the female Christ.' In the following year, she started upon a missionary tour through New England and adjacent colonies; she found the people everywhere curious to see her, and she made not a few converts. She did not return to Water Vliet till September 1783; and about a year after, she died. Her death was a surprise to many of her followers, who believed that she was to live among them forever; but her successors—the Joseph Meacham and Lucy Wright already mentioned—to whom, on her death-bed, she had made over the headship of the Society, were ready with a theory accounting for it. 'Mother Ann,' they said, could not die, and was not dead, and had not ceased to live among her people. She had only withdrawn from the common sight; she was still visible to eyes exalted by the gift of grace; she had cast the dress of flesh, and was now clothed with a glory which concealed her from the world. So it would be with every one of the saints in turn; but the spirits of those who 'passed out of sight' would remain near and be in union with the visible body of believers. This explanation was generally accepted, and has become a vital part of the Shaker creed.

By Joseph Meacham and Lucy Wright, the successors of 'Mother Ann,' the S. were gathered into settlements, ten in number; and a covenant was drawn up embracing the chief points of their creed, and of the social system since associated with it. Their head was, of course, 'Mother Ann'—that is, Christ—of whom Joseph and Lucy were temporarily the representatives; elders, and deacons, male and female, were appointed; the institution of celibacy was confirmed; and a community of goods was introduced. On the death of Joseph Meacham in 1796, 'Mother Lucy' became the sole head of the Society, and she governed it with ample powers for 25 years. She named a female successor with the title of Elderess; and the name of 'Mother' has not, since that time, been applied to the female head of the community. Eleven societies were formed between 1787 and 1792. Early in the present century, a remarkable religious excitement took place in Kentucky. The Shakers, taking advantage of this movement, sent three representatives thither, and received sufficient additions to found five new societies. (See Nordoff's *Communistic Societies of the United States*, 1875.) The S. were, at the census of 1870, about 2500 in number, included in 18 societies; of which three are in the state of New York, four in Massachusetts, two in New Hampshire, two in Maine, one in Connecticut, four in Ohio, and two in Kentucky. Their numbers have increased since 1870; the influence of their opinions has extended; and the 18 separate settlements continue to form a united and peaceful Society.

Their doctrine has been to some extent developed as well as systematized since the death of 'Mother Ann.' They believe that the kingdom of heaven has come; that Christ has come upon earth a second time, in the form of 'Mother Ann,' and that the personal rule of God has been restored. Then they hold that the old law has been abolished, and a new dispensation begun; that Adam's sin has been atoned; that man has been made free of all errors except his own; that the curse has been taken away from labor; that the earth and all that is on it will be redeemed. Believers, on going 'into union,' die to the world, and enter upon a new life, which is not a mere change of life, but a new order of being. For them, there is neither death nor marriage; what seems death is only a change of form, a transfiguration which does not hide them from the purified eyes of the saints; and in union, as in heaven, there is no marrying or giving in marriage—the believer owes love to all the saints, but his love must be celibate in spirit and in fact. The believer, living in union, *is* in heaven. The S. believe that the earth, now freed from the curse of Adam, is heaven; they look for no resurrection besides that involved in living with them in 'resurrection order.' The believer, upon entering into union, leaves behind all his earthly relationships and interests, just as if he had been severed from them by death. And since to be in union is heaven, the S. hold that no attempts should be made by them to draw men into union: God, they say, will draw to them those whom he has chosen at his own time. Those who have 'passed out of sight' are still in union; and the S. live in daily communion with the spirits of the departed believers.

The belief in a communion with angels and spirits, is no mere theory; it has a most important influence upon their lives; they profess to be more familiar with the dead than with the living. It being the work of the saints to redeem the earth from the effects of the curse, labor is a sacred and priestly function, especially when bestowed in making the earth yield her increase, and in developing her beauty. It should be done in a spirit of love; the earth, they say, yields most to those who love it; and love and labor will in time restore it to its primitive state. According to Mr. Dixon, they bestow upon their gardens and fields the affections which other men bestow upon family or worldly goods. Their country they regard only as it is a part of the earth, which they love, and as the favored land in which God's kingdom is first to be established. In its politics and its fortunes, they take no interest; and, indeed, their whole system is a protest against the existing constitution of society, as well as against the ordinary lives of men. Consistently with their belief in the second appearance of Christ in the form of a woman, the S. seem to believe that there is a female as well as a male essence in the Godhead—in the motherhood as well as the fatherhood of God.

A Shaker settlement is, for convenience, divided into families, consisting of the brothers and sisters, who live in the same houses, each governed by an elder and an elderess. There are two orders of members, Probationers and Covenanters—that is, novices and full members. It is on becoming a covenanter that the Shaker puts his property into the common stock. On entering upon residence, he becomes subject to all the rules of the Society; but he is free—whether a covenanter or a probationer—to leave the body whenever he pleases. Both men and women wear a prescribed dress. The men wear a sort of Arab sack, with a linen collar and no tie; an under-vest buttoned to the throat, and falling below the thighs; loose trousers, rather short; and a broad-brimmed hat, usually of straw. The women wear a small muslin cap, a white kerchief round the chest and shoulders, a skirt dropping in a straight line from the waist to the ankle, white socks, and shoes. Some latitude is allowed as to the materials of the dress.

Men and women, it is said, have the look of persons at peace with earth and Heaven. 'Apart from a costume,' says Mr. Hepworth Dixon, 'neither rich in color nor comely in make, the sisters have an air of sweetness and repose, which falls upon the spirit like music shaken out from our village bells.' [*New America*, by W. Hepworth Dixon (Lond. 1867), from which the materials of this sketch have in a great measure been derived.] All labor with their hands, both men and women; but the latter do only indoor work. Every man, whatever his rank in the church, follows some manual occupation, and most of them have more than one. Working not for gain, but with loving care, and with the sense that they are exercising a priestly function, the S. are unrivalled among their neighbors in the arts to which they apply themselves, especially the culture of their land, and the production of fruits and flowers. They pay great attention to ventilation and to all sanitary conditions; they live almost entirely upon the produce of the soil, and drink only water; they employ no doctors, and take no drugs and are, nevertheless, among the healthiest of communities. Their Society is recruited mostly by young men and girls; but occasionally married persons with their children come 'into union,' and make, it is said, 'very pretty Shakers.' Husbands and wives, when they have come 'into union,' become as brothers and sisters: it would be thought a weakness, says Mr. Dixon, and almost a sin, for them to feel any personal happiness in each other's company—they live for God alone, and their love ought to be shed on all the saints alike. The education of the children attached to the Society is the work of the sisters, and they do it exceedingly well. The brothers and sisters take their meals in a common room, eating at six in the morning, at noon, and at six in the afternoon. Their meals are taken in silence, any direction that has to be given being given by a gesture or in a whisper. In their church-service, music bears a prominent part; the hymns and chants which are used being all of Shaker origin, communicated to believers in dreams and reveries by the spirits with whom they have communion. A deputation of Shakers visited England in 1871, and made many converts.

SHAKSPEARE, WILLIAM, the chief literary glory of England, was born at Stratford-on-Avon, in Warwickshire, it is believed, 23d April 1564. Certain it is, as vouched by the parish register, that his baptism took place three days after, on the 26th. His father, John Shakspeare, seems to have belonged by birth to the class of yeomen. His mother, Mary Arden, was of more distinguished origin. She came of a good old Warwickshire family; and when married, she brought to her husband as dower a property called Asbies, 54 acres in extent, besides an interest in certain other lands at Wilmecote, and a small sum of money. In a contemporary document, John Shakspeare is described as a *glover;* and this trade, at that time a more important one than it has since become, there is evidence to show that he conjoined with that of a farmer and rearer of stock. His earlier career was one of steady prosperity, and the consideration in which he came to be held as a citizen, is shown in the fact of his having, in 1569, been elected chief magistrate of Stratford. Of a family of four sons and four daughters born to him, William was the third child. At the free grammar-school of Stratford there can be little doubt the young S. received his entire education. As to the precise character and amount of this, there has been much controversial conjecture; some writers maintaining, on the internal evidence of his works, that he must have enjoyed a thorough classical training, whilst others represent him as probably destitute of any such youthful advantage. The celebated 'And though thou hadst small Latin and less Greek' of his friend Ben Jonson, which has been frequently quoted as certifying his almost utter ignorance, seems, if anything, to tell the other way. It assures us that, of both languages, he knew something; as to *how much* of either he may have known, it affords us scarce a ray of light, inasmuch as it is impossible for us even to guess at the amount of classical attainment sufficient, in the eyes of a scholar, and something of a pedant, like Jonson, to entitle a man to the praise of having *much* Latin and Greek. What Ben might contemptuously style 'small Latin' was, in all probability, as it seems to us, a fair working allowance of it.

Meantime, misfortune had overtaken, and more and more come to press heavily on John Shakspeare; in consequence of which, William, now somewhat over fourteen, was withdrawn from school, and set to do something for his living. How he was employed from this time till his departure for London, it is impossible to make out with distinctness. One tradition informs us, that, for a time, he served as apprentice to a butcher; and it is said that, 'when he killed a calf,' the poetry of his nature prompted him to ennoble the operation as he could to himself, by 'doing it in a high style, and making a speech.' Unhappily, none of his speeches have come down to us, so that rather more of a mythical atmosphere than might be wished surrounds this pursuit of the ideal under difficulties. But that he was for some time a butcher's assistant, is as likely to be true as not. Another story has it, that for some years he was a schoolmaster; whether or not in birching his boys he dignified the act as in the calf's case, tradition has omitted to inform us. Both stories are not unlikely to be true; the fact of the matter probably was, that in those years young S. lived miscellaneously as he could. Out of the cloud of uncertainty which shrouds this period of his life, two facts, however, emerge as beyond question—his marriage, and the birth of his eldest born. As soon as may be after the 28th November 1582—on which day the license was procured at Worcester—Shakspeare, a lively lad going nineteen, was married to Anne Hathaway of Shottery, a hamlet some mile or so out of Stratford, a damsel about eight years older than himself; and six months afterwards a daughter was born to him, whose baptism bears record 26th May 1583. The obvious inference from this promptitude on the part of his spouse certain of his admirers have sought to evade. It is said, and we believe it is certain, that a mere betrothal before witnesses, to be followed within some reasonable undefined period by the religious ceremony, was then and there held to constitute a valid marriage; and this, it is conjectured, may in S.'s case have prefaced the more formal sanction. And of course it may; the license of conjecture is unlimited; and all to whose comfort in admiring a great genius it is essential to regard him at every point of his career as also a pattern of everthing that is proper, must of course be made welcome to this one. The only other children born of the marriage were twins, a boy and a girl, baptized 2d February 1585. The boy (Hamnet) did not survive his father, dying in his twelfth year.

As nearly as can be made out, in the year 1586, S., then 22, left the neighborhood of Stratford, and betook himself to London. A local tradition assigns as his reason for doing so a mishap which befel him, and a little imprudence consequent on it. The future poet, it is said, while out on a nocturnal poaching expedition in the deer-park of a neighboring magnate, Sir Thomas Lucy of Charlecote, was caught by the keepers, kept for the night a prisoner, and arraigned before Sir Thomas—a justice of peace—in the morning. What passed, is not recorded; but—as the old rumor goes—whatever it was, it excited the ire of S., who avenged himself, as a bard naturally might, by circulating 'a bitter ballad' in which the good knight was satirized. A further prosecution was for this irreverence directed against him, to escape which it was that he is said to have fled to London. No anecdote concerning S. has been more widely accepted than this, or, on the whole, seems better to deserve acceptance. An obvious allusion to the Lucies of Charlecote in the *Merry Wives of Windsor*, which identifies their coat of arms with that of Justice Shallow, would of itself afford strong confirmation of it. Further, Oldys, an antiquary who died in 1761, and had busied himself much about materials for a life of S., certifies the story on something like fair evidence, and gives the first verse of the obnoxious pasquinade, as remembered in the district. It is more coarse and scurrilous than witty; but inasmuch as it would be easy to adduce passages from

the admitted writings of S., in which the coarseness to at least an equal extent preponderates over the wit, this will scarcely of itself amount to proof that he could not possibly have been its perpetrator. The indisposition which more lately has been shown to attach any credit to the tale, seems to rest entirely on a foolish horror of admitting anything as possible in the conduct of the poet which might any way seem to conflict with the reverence now universally accorded to his genius.

No certain details have come down to us as to S.'s earlier relations with the London theater. According to one tradition, he was content at first to turn a penny by holding horses at the door. According to another—which seems in a natural sequence with the foregoing—we find him admitted inside on his promotion, though as yet only in the humble capacity of prompter's attendant. What is certain in the matter is this, that if at any time he was thus meanly occupied, it could have been only for a brief period, as very speedily we have note of him as a man of some importance, at once dramatist, actor, and shareholder in the Blackfriars Theater. As an actor—though we find one contemporary allusion to him as 'excellent in the quality he professes'—he seems at no time to have shone especially, being rather respectable than eminent. As dramatist, his magnificent powers were at once recognized, and in no long time had won for him the very foremost rank among the writers for the stage of his time. The extraordinary rapidity of his rise is shown in this indubitable reference to him in Spenser's *Tears of the Muses*, published so early as 1591, only some five years after S.'s arrival in London:

> And he, the man whom Nature's self had made
> To mock herself, and truth to imitate,
> With kindly counter under mimic shade,
> Our pleasant Willy, ah, is dead of late.

The reference here has indeed been surmised to point at Sir Philip Sidney, by Spenser elsewhere alluded to under the figure of Willy a shepherd; but the surmise is, on various grounds, inadmissable. The first two lines have the closest critical pertinence to the character of S.'s genius; as applied to that of Sidney, they are, by comparison, vague and unmeaning. Further, the 'mimic shade' in the third line, together with the whole context of the passage, makes it certain a dramatic writer is alluded to; and this Sidney was not.

Moreover, the stanza which follows, wherein of 'that same gentle spirit' it is said that he

> Doth rather choose to sit in idle cell,
> Than so himself to mockery to sell,

must needs be held to indicate a man at the time living; and Sidney had died in 1586. The 'Ah, is dead of late!' which, literally taken, would suit Sidney, and not S., must, in the light of the succeeding couplet, be interpreted as referring to some temporary remission on the part of the latter of his wonted dramatic productiveness; and this, if not otherwise to be accounted for, we might explain by supposing him at this time engaged on his two elaborate poems, *Venus and Adonis*, and *The Rape of Lucrece*, published not long afterwards. The year after (1592), we find a contemporary and brother dramatist, Henry Chettle, making the *amende* to S. for an offence given, in terms most respectfully appreciatory of his excellences at once as a man and an author; and in 1598, Francis Meres, in his *Wit's Treasury*, writes of him as admittedly the 'most excellent among the English for both kinds of tragedy and comedy.' We have ample evidence besides of the unrivalled acceptance his works obtained from all classes; not only were they in the wider sense popular, but they brought him special marks of favor and approval from Queen Elizabeth and her successor, James—who is said to have honored the poet with an 'amicable letter' from his own hand—and procured him the patronage and friendship of some of the most accomplished men of rank of the time, more notably, Henry Wriothesley, Earl of Southampton, to whom he dedicated his *Venus and Adonis*, and *Rape of Lucrece;* and William Herbert, Earl of Pembroke, commonly held to be the 'Mr. W. H.' to whom, as their 'only begetter,' his *Sonnets* are addressed.

S. was plainly—as men of *consummate* genius mostly are—a man of shrewd solid business ability; and throughout, his material prosperity kept pace with the growth of his poetical reputation. He became early, as we saw, a considerable shareholder in the Blackfriars Theater. In the Globe, subsequently erected, he was also a part proprietor. To both he contributed dramas, and from his gains in the triple capacity of actor, author, and sharer of the general profits, he rapidly amassed a fortune. His local attachments were strong, and it seems to have become, as his wealth increased, one main object of his ambition to settle himself as a substantial country gentleman in his native district, to which annually he made a visit. We find him, with this view, from time to time making purchases there of house and landed property. By and by, his visits to Stratford became more and more frequent; and it is positively certain that previous to the year 1613, he had ceased to reside in London, and finally established himself at Stratford. Of his last years there spent, further than that they lapsed peacefully in honor, and the exercise of a liberal and kindly hospitality, nearly nothing is known. There is evidence of his having more or less occupied himself in agricultural pursuits, and good reason to believe that, though withdrawn from other active concernment with the stage, he still continued to write for it. His death took place on his 53d birthday, the 23d April 1616. In the diary of a Mr. Ward, the vicar of Stratford, writing *apud* 1660, the cause of it is thus given: 'Shakspeare, Drayton, and Ben Jonson had a merry meeting, and, it seems, drank too hard, for Shakspeare died of a fever then contracted;' but that of this drinking the poet's death was a consequence is at best a doubtful inference.

That S. erred and sinned at times like others, we know from the passionate confessions of his *Sonnets*, in considerable portions of which the self-reference is too plain to be denied; but that, whatever his occasional frailties, he was essentially a man of noble and estimable character, there is a complete concurrence of testimony. He was obviously of most kindly and lovable dispositions; his 'pleasurable wit and good nature' made him delightful as a companion; and it was as 'gentle Will Shakspeare' that he was familiarly known to his contemporaries. In particular, with his associates and rivals in writing for the stage, his relations would seem to have been of the most cordial and even endearing kind. The gruff Ben Jonson writes of him after his death: 'He was honest, and of an open and free nature,' assures us that in 'his well-turned and true-filed lines' we see but an authentic reflex of his beautiful 'mind and manners;' and avers that he 'honors his memory only on this side idolatry.' As a slight shadow on this pleasing picture, it has been shrewdly surmised that he was not very happy with his wife. Evidence of this has been sought in certain passages in his dramas; but obviously any inference from these is most precarious. The neglect of her in his will, except in one curt clause interlined, dismissing her with a legacy of 'his second-best bed,' might well seem much more decisive, till Mr. Charles Knight greatly reduced its importance by showing that, the will apart, by the mere operation of the English law, the poet's widow was entitled to *dower*, and thus amply provided for. There is thus (though the query of why *second*-best, if a bed at all was to be left her, may perhaps have a certain pertinence) no very firm basis of proof for the domestic unhappiness of Shakspeare. Still, if anything in his life is certain, it is this, that, spending great part of his time in London, the poet did not find it essential to his felicity there to have the society of his wife; as probably she, on the other hand, though her husband had gone to the metropolis, was content to abide in Stratford, since it seemed to him the desirable arrangement. It is fair, we think, to infer from this that the affection subsisting between the two was a little on the hither side of enthusiasm.

To discourse here at this date of the genius of S. would be only to promulgate platitudes. The lofty eulogy of Dryden—'He was the man who, of all modern and perhaps ancient poets, had the largest and most comprehensive soul'—has since been generally acquiesced in. As dramatist, he is admittedly in the world without a peer; as poet (abstracting the differental forms), there are but one or two names in literature even to be named beside his; and dismissing his claims in either kind, we have in his works such a treasury of gnomic wisdom on all matters of human concernment as no other writer has ever bequeathed to the world. If we add, that this greatest of writers is one of the most unequal—that his works contain more than might be wished of what, as the product of such a mind, we need not scruple to call rubbish—and that nearly every vice in writing might be illustrated from them almost at will, we say simply what is patent to every reader not blinded by the stupid and mindless idolatry which too often of late in many quarters has displaced a rational admiration.

The only works of S. certainly published under his own hand were the two poems *Venus and Adonis* and *The Rape of Lucrece*, which appeared in 1593—1594 respectively. As was naturally to be looked for in the case of pieces on the stage so popular, certain of his dramas found their way from time to time into print, but no authoritative edition of any of them was issued during his lifetime. The first collected edition of his dramas was issued in 1623, by Heminge and Condell, his friends and co-proprietors in the Blackfriars and Globe theaters. A second edition followed in 1632; a third, in 1664; and a fourth in 1685.

In 1709, appeared the edition of Rowe, with a prefatory sketch of the poet's life. Of the 'Shakspearian literature' which followed, and the various re-issues of the dramas, with such masses of critical commentary and emendation as no other writer has ever perhaps been made the subject of, it would be hopeless to attempt an account. It must suffice to mention as successive editors Pope, Theobald, Sir Thomas Hanmer, Warburton, Capell, Stevens, Malone, and Dr. Johnson, whose elaborate introductory essay—whatever may be thought of the insolence of much of his criticism of the plays in detail—is perhaps, on the whole, as an estimate of the genius of the poet, as satisfactory as any that has since been writ-

ten. Down to our own time, there has been no remission of activity in this field of literary labor. More recently, the intelligent industry of Mr. Charles Knight specially deserves mention; and along with his may be given the names of Mr. Dyce, Mr. John Payne Collier, and Mr. Singer—all of whom have put forth elaborate and valuable editions of the dramas. An important edition was issued from Cambridge in 1863—1866, under the superintendence of two gentlemen of unquestioned scholarly competence, W. G. Clark and W. Aldis Wright.

In Germany, S. has long been thoroughly naturalized; and the German enthusiasm in regard of him is, if possible, even greater than our own. It was the celebrated Lessing who first decisively introduced him to notice in a series of essays, exhibiting the immeasurable superiority of his art to that of the pseudo-classical models of the French stage. Since his time, many of the most gifted of his countrymen have devoted themselves to the work of Shakspearian criticism and elucidation. From Goethe we have some exquisite fragments, most notably the criticism of *Hamlet*, occurring in his *Wilhelm Meister;* and after his, the names of Tieck, A. W. Schlegel (whose *Lectures*, of date 1809—1811, almost constitute an era in this special department of literature), Franz Horn, and Gervinus (an English translation of whose elaborate Commentaries has been published), occur as the most illustrious in connection with the present topic.

By Tieck and Schlegel together, the work of translation was undertaken; and the result of their joint labors, which takes rank as the standard German S., ranks also, in the opinion of competent judges, as a consummate and almost *unique* specimen of excellence in the translator's art. It has not unfrequently been alleged that, till the Germans made the discovery for them, the English people knew nothing of the greatness of Shakspeare. This is on the face of it ridiculous. The single sentence we have cited from Dryden, and the practical acceptance of it implied in the unexampled attention and industry which never ceased to be directed to the subject, sufficiently of themselves confute so idle a notion. What the Germans really did (and along with their services in the matter, must be included those of our countryman Coleridge, whose impulse and point of view, at least, if not something considerably more, were derived from German sources) was somewhat to methodize and enlighten for us an admiration never deficient, but always, like Jonson's regard for the memory of his friend, 'only on this side idolatry.' The old notion of S. was that of a genius in power and plentitude unrivalled, but licentious in its modes of operation, and more or less chaotic in its results; 'wild above rule or *art*, enormous bliss.' The new German criticism exhibited in the chaos the orderly outlines of a world; co-ordinated the confusion under rules till then unsuspected, and showed in what before had seemed irregular exercise of power admitted to be magnificent, obedience not less magnificent to a law of artistic evolution. It made calculable, in a word, the orbit of a luminary which had somewhat uncomfortably seemed to be sweeping at random through space. But the English people did not need it to *reveal* the luminary to them; throughout and from the first, they had seen and devoutly worshiped it. Also, to a great extent, it is due to the German enthusiasm of exposition, that over the whole continent, and wherever literature is intelligently studied—some little lingering, dying remnant of French prejudice except—the poet *par excellence* of England is now finally enthroned as the poet also *par excellence* of our whole modern world. The expositors and critics of S. at home and abroad are innumerable; amongst recent English writers are Dowden, Furnivall, and Swinburne.

SHALE, or SLATE-CLAY, an indurated clay, which often forms beds in the coal measures. It is chiefly composed of silica and alumina, in variable proportions, but also frequently contains a considerable amount of carbonate of lime and of oxide of iron. It is of a gray or grayish-black color, or brownish-red when containing much iron. Its structure is more or less slaty. It is soft, and easily reduced to powder. It is used for making slate-pencils. When free from lime and iron, it is reduced to powder, and used for making fire-bricks, for which it affords an excellent material. S. very often contains a notable quantity of bitumen, and when this is so much the case that the mineral has a shining resinous streak, and crackles and blazes in the fire, emitting a black smoke and a bituminous odor, it is known as *Bituminous Shale*. This variety sometimes passes on the one hand into common S., and on the other into coal. Impressions of ferns and other plants are very frequently found in shale.

Slate, Schist, and Shale are names employed to denote those kinds of rock which are laminated or fissile—that is, which possess a structure readily splitting into thin layers. Shale and schist are also synonymous, although the latter should be restricted to rocks with their layers irregular or foliated. True slate differs from them in not having its lamination produced by bedding. See SLATE. Nevertheless, all three names are often applied to the same substance.

Shale varies much in its composition. Clay, sand, lime, bitumen, and other bodies, either singly or any mixture of them, are included under the name, if they form rocks which split into layers in the direction of their bedding; clay, however, being an ingredient in most shales. Strange as it may seem, the line between even coal and some kinds of shale is not well defined; and in the case of the Torbanehill mineral, found near Bathgate, the question by which of the two names it should be called, led to a lengthened and costly litigation.

The importance of certain decomposing shales through which sulphuret of iron is disseminated, for the manufacture of alum has been long known, and the quantity raised for that purpose from the carboniferous beds of Lancashire and Lanarkshire and the lias beds of Yorkshire is very considerable, yielding about 16,000 tons of manufactured alum annually. Shales of a similar kind are worked in France, Germany, and North America.

Bituminous shales—that is, shales more or less less rich in carbon and hydrogen—form another class of these bodies which have, in recent years, attracted much notice as sources of oil for illuminating purposes. It is now more than thirty years since a Frenchman, named Du Buisson, introduced a method of distilling certain bituminous shales in France, at a comparatively low temperature, so as to obtain burning oil and other products. The process was afterwards tried in England, being used for a time in distilling a Dorsetshire bituminous shale, sometimes called 'Kimmeridge coal.' From this mineral, a burning oil, a lubricating oil, and a naphtha for dissolving caoutchouc, were obtained. But neither in France nor in England did the attempt to make a profitable manufacture succeed: in the former country, the poverty of the shales was the chief drawback; in the latter, the disagreeable smell of the oil, which could not be effectually removed, prevented it from obtaining favor in the market.

On account of these failures, the process fell into abeyance, until it was revived again by the success of the well-known patent of Mr. James Young (see NAPHTHA), secured in 1850 for the production of paraffin and paraffin oil from coal. With the exception of the solid paraffin, which Mr. Young was the first to obtain on the large scale, and the employment of coal instead of shale, the processes of Du Buisson and Young are essentially the same. This process has created a new and rapidly-increasing branch of industry, paraffin oil and paraffin being economically obtained by it from either coal or shale of certain kinds. Those who have paid any attention to the various beds of minerals which go to form what is geologically called the Coal Measures, are aware that it is only the seams of coal, ironstone, fire-clay, sandstone, and limestone, which until very lately have been looked upon as of any industrial importance. Interstratified between these and the other minerals of the series, are numerous beds of carbonaceous or bituminous shale, until recently considered useless. Many of these shales were found upon trial to yield from 30 to 50 gallons of crude oil per ton; and works—several of them of great size—have accordingly been started in many places over the entire area of the coal formation in Scotland, and also at various localities in England and Wales, for the manufacture of mineral oil, paraffin, &c., from this material.

Owing partly to the comparative cheapness of shale, and partly also to the fact that these products are obtained from it in a state more easily purified than when they are got from coal, the use of the latter as a source of them is now almost entirely given up. In Scotland, where the manufacture of paraffin oil is chiefly carried on, the shales used are called 'oil shales,' and it is estimated that there are now 800,000 tons of this material annually distilled. Such a quantity yields the following products:

Crude oil	25,000 gallons.
Paraffin	5,800 tons.
Lubricating oil	9,800 "
Sulphate of Ammonia	2,350 "

In the refining process, the crude oil is reduced to about one-half of its bulk before it is fit for burning. Besides the above, there is also a considerable quantity of 'coal gas,' unavoidably produced, and partly wasted. But for the distance of the oil-works, this would be consumed in some of the larger Scottish towns. Shales found in the Lias and some other formations, likewise yield mineral oil.

SHALLOO'N, a light worsted cloth, said to have been first made at Chalons in France, and to have derived its now corrupted name from that place.

SHA'LLOP (Fr. *chaloupe*), a large, open, old-fashioned boat, carrying two masts, rigged as in a schooner. Its principal use was in the fisheries, but it has now nearly given place to luggers and yawls.

SHA'LLOT (*Allium Ascalonicum*), a species of *Allium* (q. v.), a native of the East, introduced into Europe by the Crusaders—from Ascalon, it is said—and much cultivated for its bulbs, which are used like those of the onion, and sometimes for its leaves, which are used like those of the chive. The leaves grow in

tufts like those of the chive, but are larger. The S. is generally propagated by the cloves, which are planted just beneath the surface of the ground, or only partially beneath it, in spring, and the crop is ready for gathering in July or August. The flavor resembles that of garlic, but is much milder. In the vineyards of Italy the S. is naturalized.

SHA'MANISM is the ancient religion of the Tartar, and some of the other Asiatic, tribes. It is a belief in sorcery, and a propitiation of evil demons by sacrifices and frantic gestures. The following account of it is extracted from the *Asiatic Journal*. The priests are men or women, married or single. The character is acquired by pretending that the soul of a deceased priest has appeared to the individual in a dream, appointing him or her his successor. If the priests are in function, they wear a long robe of elk-skin, hung with small and large brass and iron bells; moreover, they carry staves carved at the top into the shape of horses' heads, also hung with bells; and with the assistance of these staves, they leap to an extraordinary height. The followers of the Shaman religion have neither altars nor idols, but perform their sacrifices in a hut raised on an open space in a forest or on a hill. Nor are there fixed periods for the performance of their ceremonies; births, marriages, and sickness, uncommon appearances in the atmosphere, or public calamities, are generally the occasions which call for them. The animal to be sacrificed is generally fixed upon by the Shaman or the donor; and after the persons uniting in the ceremony have assembled, the Shaman enters the hut, chanting certain words, sprinkles on all the sides of the hut, and over the fire, spirits and milk, and then orders the animal to be killed, which is done by its heart being torn out. The skin of the victim is then stripped off, and its flesh with the exception of a few pieces which are thrown into the fire, is consumed by the persons assembled. See also LAMAISM.

SHAMMAI (not, as has often been done, to be confounded with Sammeas), an eminent doctor of the Jewish law at the time of Herod, head of a most important school, and supreme judge of the Sanhedrim (Ab-Beth-Din) during the presidency of Hillel (q. v.), along with whom he is, indeed, generally mentioned, and of whom he was, as it were, the very counterpart. Very little is known of the history of his life. He most probably was born in Palestine, and most energetically participated in all the political and religious complications of the country. There was a harshness and rigidity in his character, which constrasts most strikingly with Hillel's proverbial patience. His religious views were painfully strict, and he even tried to extend the rigor which he imposed upon himself, to the youngest children; but the zealotism with which later times have charged him, is not his, but his school's, 'the House of Shammai,' as it was called. This seems, under the adverse circumstances of the commonwealth—sedition within, and the approaching enemy without—to have developed a fanatical zeal that at times surpassed all bounds, and chiefly tended to foster that exceptional exclusiveness which proved both the bane and the saving of Judaism. The discussions of the two rival schools, of which that of S. preponderated long after the master's death, turned exclusively upon points of positive law. There is only one curious metaphysical debate recorded, viz., whether, as one school held, 'it was better for man to have been created or not;' or, as the other asserted, 'it would have been better if he never had been created.' Finally, they both agreed in the latter axiom, but with the addition—'but since he is now in this world, let him be careful in his actions.' We need hardly point to the strange light which this discussion and final decision throw upon the times of unequalled national misery that begot them.

SHA'MMOY. See LEATHER.

SHAMO, or GOBI, the Chinese and Mongol names respectively for a wide region of steppe and desert in the eastern part of Central Asia. It extends from the Thian-Shan Mountains to the Kuen-Lun and Nan-Shan Mountains, bordering on Eastern Turkestan to the west, and occupying great part of the area between 40° and 45° N. lat., and 90° to 118° E. long. The 'desert' is by no means sterile throughout. On the north and on the south is a wide belt of firm steppe, consisting for the most part of vast green levels covered with abundance of pasture, but broken by numerous ridges of hills. Between these two belts, each at a height of from 4500 to 5500 feet above the sea, lies a depressed tract, not more than 2500 to 3000 feet above sea-level, and varying in breadth from 230 to 460 miles. This alone is properly called S., or 'sea of sand;' it is a perfect wilderness of sand and stones, and is probably the bed of an ancient sea. The salt sand of which its soil is mainly composed produces nothing but a few scrubby plants. The fauna of the S., even in the wider sense, is limited, including little save hamsters, dziggetais, a few wild sheep, and antelopes. There are no fixed habitations even in the steppe country; the inhabitants, chiefly Mongols, are all nomads. Yet in various places there are traces of ancient cities buried in the shifting sand (see *Ocean Highways* for 1873). The winter here is intensely cold and stormy, and the summer excessively hot. Yet the wandering hordes of Mongols have no difficulty in keeping large herds, which find plenty of rich pasture on the steppes, and even in winter contrive to pick sufficient food from beneath the snow. From want of wood, the nomadic tribes have to use dried dung as fuel. Little is known of the S., save in the neighborhood of the main tracks across it, of which the chief is from Maimatchin to Pekin.

SHA'MROCK, a national emblem of Ireland, a leaf with three leaflets, or plant having such leaves, sometimes supposed to be the Wood Sorrel, but more generally believed to be some species of Clover, or perhaps some common plant of some of the nearly allied genera, as the Bird's Foot Trefoil, or the Black Medick. It is not improbable that the name has a sort of general reference to plants with trifoliolate leaves, and that a more exact determination of the species may be as difficult as the attainment of botanical accuracy in regard to the emblematic thistle of Scotland.

The small-leaved clover (*Trifolium repens*) has had a superstitious respect attached to it from early times. According to the elder Pliny, no serpent will touch it. It is said to have been first assumed as the badge of Ireland, from the circumstance that St. Patrick made use of it to illustrate the doctrine of the Trinity. See TREFOIL.

SHAMYL, or SCHAMYL (Eng. 'Samuel'), the celebrated leader of the independent tribes in the Caucasus, was born at Aul-Himry, in Northern Daghestan, and belonged to a wealthy Lesghian family of rank. He was one of the zealous disciples of Kasi-Mollah, the great apostle of Muridism, and ably seconded his endeavors to compose the numerous feuds of the various Caucasian tribes, and unite them in a bond of antagonism to their common enemy, the heretical Russians. He was one of the foremost in the defence of Himry against the Russians, October 30, 1832, and after the fall of his chief, Kasi-Mollah, and most of his adherents, fought his way alone and severely wounded through the besiegers' ranks.

After the assassination of Hamzad-Bey, the successor of Kasi-Mollah, in the end of 1834, S. was unanimously elected 'imaum,' and being absolute temporal and spiritual chief of the tribes who ackowledged his authority, he made numerous changes in the religious creed and political administration, for the purpose of more fully concentrating in himself the whole power. These changes were certainly the chief cause of the great successes which subsequently attended the mountaineers, but it is none the less certain that they produced that sudden collapse of the spirit of independence which took place when the great leader was removed. S.'s change of military tactics, from open warfare to surprises, ambuscades, &c., brought numerous and sometimes great successes to the arms of the mountaineers. General Ivelitch was severely defeated in 1837, the worst reverse the Russians had yet sustained, and his coadjutor Hafi was forced to make a disastrous retreat. They succeeded, however (1839), in hemming S. into Akulgo, in Daghestan, took the fortress by storm, and put every one of the defenders to the sword, in order to be quite certain that S. should not escape. How he did so is not known, his own followers and the Russians believed him to be dead, when, to the joy of the one and the bitter confusion of the other, he suddenly appeared, preaching with more vigor than ever the 'holy war against the heretics.' In 1843, he conquered all Avares, besieged Mozdok, foiled the Russians in their subsequent campaign, and gained over to his side the Caucasian tribes which had hitherto favored Russia. This accession of power rendered necessary some change in the government; a civil and a criminal code were promulgated, a regular system of taxation established, and Dargo was made the capital of this Caucasian monarchy, the population of which now (1844) exceeded 1,000,000. But the Russians, under Prince Woronzoff, having changed their tactics, assailed the country on various points at the same time, and the advance gained was secured by chains of forts.

The fortune of war, however, steadily alternated till 1852, when Bariatinsky compelled S. to confine himself to the defensive, and deprived him of his victorious prestige. Some of the tribes now returned under Russian authority, and S. (probably owing to his diminished power and resources) was unable to take advantage of the diversion in his favor afforded by the Crimean War; after the conclusion of which the Russians resumed their attacks with more energy, opened a road over the mountains, thus cutting off one portion of the patriots, and compelling their submission. The following year was still more disastrous; 100 villages were destroyed, the inhabitants transplanted to Russian districts, and S. himself defeated, August 11. On April 12, 1859, his chief stronghold Weden was taken after a seven weeks' siege, and his authority, except over the small band of followers who still devotedly adhered to him, was wholly destroyed. For several months he was a mere guerilla chief, hunted from fastness to fastness, till at last (September 6, 1859) he was surprised on the plateau of Gounib, and after a desperate resistance, in which his 400 followers were reduced to 47, he was captured. His wives

and treasure were spared to him, and he was sent to St. Petersburg, where he experienced a generous reception from the czar. A few days afterwards, he was assigned a residence at Kaluga, with a pension of 10,000 roubles. Thence he went, in 1870, to Mecca, remaining a parole prisoner of the Russian government; and died at Medina in March 1871, in the 74th year of his age.

SHANGHAI', the most important maritime city of China, situated on the left bank of the Hwangpoo or Woosung River, 12 miles from where it debouches into the southern portion of the mouth of the Yangtse-kiang, in lat. 31° 14′ N., and long. 121° 30′ E. Though it is now one of the first emporiums of commerce in the East, only a quarter of a century ago it was but a third-rate Chinese town. It is a *heen* or *district* city, having a wall 3 miles in circuit, through which 6 gates open into extensive suburbs. The low alluvial plain on which it is situated is of great extent, and intersected by innumerable creeks, which environ the walls, and permeate the city in various directions. It is a dirty, poorly-built town, the houses are brick, the streets are very narrow, and constantly crowded with people. Few of the buildings rise above the low walls of the city; the only conspicuous objects are the Roman Catholic cathedral, a massive edifice, and the lofty spire of the Baptist chapel. The temples present the same general appearance met with in all Chinese cities. Every city has its Chinghwang, or temple of the tutelary gods; that of S. is in a picturesque position on a rocky islet, surrounded by a serpentine sheet of water, which is crossed by zigzag bridges. A little further down the river stand the foreign settlements, English, French, and American. The whole of the mercantile *hongs* are built upon the English concession; while the French concession is mainly occupied by *go-downs*, wharves, and Chinese houses. There are no French merchants in Shanghai. The river in front of the Chinese town is thronged with junks, lashed side by side for a couple of miles. The reach in front of the foreign settlement was formerly crowded with sailing-vessels; but since the opening of the Suez Canal, the steamers of the P. and O. Steam Navigation Company and of private companies have largely taken their place.

Lower down are the ship-yards, machine-shops, and dry-docks, which foreign commerce has called into existence; and here the Chinese government has at work an arsenal where war-vessels of the largest tonnage are built and equipped. Under the arrangement by which the foreign custom-house dues are collected by foreigners, facilities have been created for the navigation of the Yangtse by stationing a light-ship, buoys, and signals, rendering safer the approach to this important mart. One or two lighthouses have also been recently erected, giving additional security to vessels entering and leaving the port. There are a chamber of commerce, reading-room, library, and literary institution—nothing being wanting to render the port of S. the metropolis of Eastern commerce. The municipal government of the foreign settlement is highly creditable to the mercantile traders. Several gentlemen are elected annually by the land-holders, for the purposes of local government—police, public improvements, and repairs requiring much management, and entailing much expense, the funds for which are obtained by taxation. S. is also the seat of various missions for converting the natives—the schools, dispensaries, and other benevolent objects meeting with generous support from foreign merchants. The products of S. itself are not of much value, but the city is a most important entrepot for goods passing between the north and south provinces of China, as well as for the imports and exports from and to foreign countries. It was in the possession of the Tae-ping rebels from 1853 to 1855, and the prosperity both of the native town and the foreign settlements was in peril for a time; but it enormously advanced after their expulsion —the English quarter in particular becoming a refuge for the Chinese from all parts of the province of Kiang-su, which the Tae-pings continued to desolate up to 1862. The trade of the port increased threefold between the years 1860 and 1863, owing to the large and increasing trade of the ports opened on the Yangtse. S. was connected with Tien-tsin by telegraph in 1881.

Between 1870 and 1880 the imports of foreign produce had a value of £12,000,000 to £14,000,000 (about half from Britain), and of native produce over £10,000,000; the exports of native produce, about £8,000,000. The articles of import and export are of a most miscellaneous description; the chief articles of import being opium, English cotton and woollen goods, and metals; and of exports, tea and silk. Great quantities of the opium imported into S. are re-exported to the other parts of China. The mercantile importance of S. has increased greatly through the opening of the Yangtse River to commerce. In 1876, the first railway in China was opened from S. to Kangwang, but it has since been bought up by the government and closed. The population is estimated at 250,000.

SHA'NNON, the largest of the rivers of Ireland, rises in the Cuilcagh Mountains, county of Cavan, and after a course of 230 miles, falls into the Atlantic Ocean between the headlands of Loop and Kerry Head. It is commonly divided into two portions, the Upper S. from its source to Limerick, and the Lower S. from Limerick to the sea, a distance of 56 miles. In its upper course it passes from its source in Cavan to Lough Allen in the county of Leitrim; thence through a difficult channel, where the navigation is in part transferred to a canal, to a small expansion called Corry Lough, and, with alternations of river and lake, to Lough Forbes, in the county of Longford, on leaving which the river for a time attains an average width of 250 yards as far as Lanesborough. Here it is again merged in a lake called Lough Ree, which stretches ten miles southwards to within two miles of Athlone. At this point great natural difficulties have been overcome, and the course of the river, by Shannon Harbor and Portumna, and through the picturesque Lough Derg to Killaloe, has been so deepened and improved that a regular passenger and goods traffic is maintained.

From Killaloe to Limerick the navigatian, owing to the rapid fall, is again in part transferred to a canal. On approaching Limerick the river divides into two branches, and on the island thus formed stands what is known as the Irish Town, in contradistinction to the English town, of Limerick. From the city, where an extensive and commodious range of quays has been built, to the sea, the S. is navigable to sea-going vessels; and though near the city very shallow at low water, the navigation for the last 40 miles is free at all times of the tide. The entrance between Kerry Head and Loop is seven miles across. About ten miles from the entrance the river narrows to about a mile and a half in width. At present, however, the outward navigation commences at Foynes, which is connected by railway with Limerick, and from which steam-boats daily ply to Kilrush, Tarbert, and the intermediate stations. Several rivers of considerable size fall into the S. during its course, as the Suck, the Brosna, the Fergus, the Maigue, and the Feale. The improvement of the S. was commenced under the Irish parliament. In 1837, the work was placed under a board of commissioners, by whom a sum of more than half a million was expended. It has since been transferred to the Board of Works or Local Government Board. The navigation is open from the head of Lough Allen to Limerick, a distance of 143 miles in a direct course, but by the addition of the Boyle branch of 9 miles, and the Strokestown branch of 6 miles, a total length of river and canal navigation of 158 miles is now open, over 129 miles of which large river-steamers freely ply. This important system of navigation, which occupies a position almost midway between the east and west coasts of Ireland, is connected with Dublin by means of the Grand and Royal Canals. The amount of tolls, &c. received in 1880—1881 was £3728; and expenditure in same year, £5324.

SHAN-SE' (West of the Hills), a province of North-Western China, is of rugged surface, and lies on the western limits of the plain. In the north are imperial hunting-grounds. It supplies the purest iron ore and the best coal in China, besides cinnabar, copper, marble, and other minerals.

SHAN STATES, a number of tributary states in Indo-China, lying between Munnipur on the west and Yun-nan on the east, and from the parallel of 24° N. lat., south to Bankok and Cambodia. Of these the northern states are tributary to Burmah (q. v.) and the southern to Siam (q. v.). A great portion of the mountainous region of these states is called the Laos Country. The Laos races are divided into two curiously distinct subdivisions. The northern race, beyond the northern frontier of Siam, are called *Black-bellies*, from the circumstance that they tattoo themselves with figures in ink, printed on their bodies, with sharp needle-like points; the southern race, mostly on and within the eastern frontier of Siam and tributary to that kingdom, are called *White-bellies*, and do not tattoo. Xieng Mai, the capital of Laos, stands on a wide plain on the right bank of the Meinam, 500 miles north of Bankok, and is said to contain 50,000 inhabitants. The number of Laocians included in Siam alone is estimated at 1,000,000. They are meek, gentle, unwarlike, and superstitious. Their chief employment is agriculture; and the principal crops raised by them are rice, maize, the sweet potatoe, calabashes, red pepper, melons, and other fruits. In religion they are Buddhists.

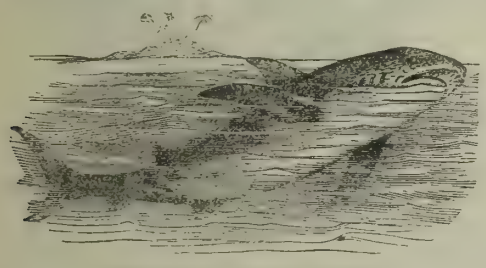
SHA'PINSHAY, one of the Orkney Islands, about 5 miles north-east of Kirkwall. It is 5 miles long and 4¼ miles in extreme breadth. The fine natural harbor of Elwick Bay on the south side is overlooked by a pleasant modern village. Pop. (1881) 974.

SHARI (i. e., *river*), the principal feeder of Lake Tsad or Tchad (q. v.).

SHARK (*Squalus*), a Linnean genus of cartilaginous fishes, now forming in Müller's system a suborder of *Plagiostomi* (q. v.), and divided into a number of families and many genera. The sharks have generally an elongated form, tapering gradually to the tail, and not much thickened in the middle. The muzzle projects over the mouth; the nostrils are situated on the under-side of the muzzle. The males have claspers. The gill-openings are lateral. There is no cartilage between the snout and the pectoral fin, as in

the rays. Some of the sharks are ovoviviparous; others lay eggs, generally a pair at a time, more being produced in succession. The eggs are large in comparison with those of osseous fishes, and are of a square or oblong form, with a tough horny coat, each corner prolonged into a tendril, the tendrils being apparently of use for their entanglement amongst sea-weeds. These eggs, or at least their empty cases, are very frequently cast up by the waves on the sea-beach, and are popularly known as *Sea Purses* or *Mermaid's Purses*. Near the head of the enclosed embryo there is a slit in the case through which water enters for respiration, and there is another at the opposite end, by which it is discharged. The young fish ruptures the case at the head, where it is weaker than at any other part, and on issuing from it, carries a yolk-bag attached to its belly for its nourishment until it is able to seek food. At this stage of its existence, its respiration is also aided by filaments projecting from the gills through the gill-openings, which are absorbed as it grows older. The teeth are generally large, sharp, and formed for cutting, with the edge often serrated; but in the genus *Cestracion* (q. v.) the teeth are pavement-like; and in some genera they are small and numerous. The Angel-fish (q. v.) is ranked among the sharks, but differs from the rest in its flattened form. Some of the smaller sharks are popularly known by the names Dogfish, Hound, Tope, &c. In the articles Cestracion, Dogfish, Fox Shark, Hammer-head, Por-beagle, and Tope, some of the S. tribe are noticed. It only remains here to notice a few of the more interesting of those which do not come under any of these heads.

The WHITE S. (*Carcharias vulgaris*) is the most dreaded of all the monsters of the deep. The family *Carcharidæ*, to which it belongs, have two dorsal fins, the first dorsal placed over the space between the pectoral and ventral fins; they have a nictitating membrane; and have no spout-holes. In the genus *Carcharias* the snout is flattened. The white S. attains a great size; one has been caught of 37 feet in length. The body is covered with a



White Shark (*Carcharias vulgaris*).

hard skin, and is grayish-brown above and whitish below. It is a very rare visitant of the British coasts, if indeed another species has not been mistaken for it; but is found in the Mediterranean, and is plentiful in the seas of many of the warmer parts of the world, often following ships to feed on any animal substance that may be thrown or may fall overboard, and often in its indiscriminate voracity swallowing things which are indigestible. A lady's work-box has been found in a S.'s stomach; and the papers of a slave-ship, which had been thrown overboard, in that of another. Human beings are not unfrequently its prey, and a large S. is not only capable of biting off the limb of a man, but of snapping the body in two, and has even been known to swallow a man entire. Its head is large, the mouth large and wide; furnished with a terrible apparatus of teeth, of which there are six rows in the upper jaw and four in the lower; the teeth are triangular, sometimes two inches in breadth, sharp-edged, and serrated; when not in use they are laid back in the mouth, nearly flat, but when the S. bites they are brought up—or at least those of the outer rows—by means of muscles with which each tooth is independently provided. The tail, as in all the sharks, is heterocercal, but its lobes are more nearly equal than in most of them.

The S. is often captured by sailors, by means of a great hook baited with a piece of meat, and attached to a chain, as the S.'s teeth readily bite through any rope. When the S. is hooked and hauled on board, great care is requisite to avoid danger both from the mouth and from the tail, the powerful action of the latter being generally interrupted by a sailor springing forward and cutting it above the fin with a hatchet. A curious method of catching the S. is practised in the South Sea Islands; a log of wood is set afloat with a strong rope attached to it, at the end of which is a noose, and the sharks gathering about it as if from curiosity, one of them may be expected soon to get its head into the noose, and is at last wearied out by the log. Formidable as the S. is, men have sometimes successfully braved it in its own element, watching its turning—as from the position of its mouth it must do—to seize its prey, and stabbing it in the belly.

The BLUE S. (*Carcharias glaucus*) is much smaller than the White S., seldom exceeding eight feet in length. It is also of a more slender form. The upper parts are of a blue color, the belly white. This species is common in the Mediterranean, and in the warmer parts of the Atlantic. It is not unfrequent on the south-western coasts of England in summer, apparently coming in pursuit of pilchards, and often doing great mischief to the nets and lines of fishermen, its sharp teeth biting through a net or line with the utmost ease.

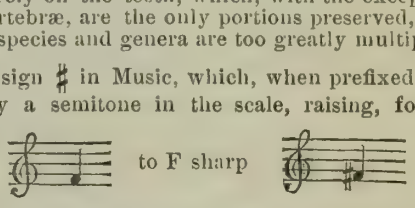
The BASKING S. (*Selache maxima*) belongs to the family *Lamnidæ*, having two dorsal fins, spout-holes, and no nictitating membrane. The snout of the Basking S. is short and blunt; the teeth are small, numerous, conical, and curved backwards. The skin is much rougher than in the White S. and Blue Shark. This species attains a great size, being sometimes 36 feet long, but it is not so thick in proportion as the White Shark. It is of a blackish-brown color, glossed with blue. It does not exhibit a ferocious character, and is supposed to feed on medusæ, crustaceans, and the like. It is often seen swimming slowly with its dorsal fin above the surface of the water, whence it has obtained the name of *Sail-fish*. It permits itself to be quite closely approached by a boat, but on being struck with a harpoon, it plunges suddenly down, and swims off with great rapidity, so that its capture is attended with danger. It is not uncommon on the northern and western coasts of Britain.

The GREENLAND S. (*Scymnus borealis*) is of the family *Scymnidæ*. It has large spout-holes, two dorsal fins, no anal fin, and no nictitating membrane. It inhabits the northern seas, and is rarely seen so far south as even the northern Scottish islands. It attains a length of 14 feet or more, is thick, and tapers suddenly at the tail; the fins very small; the teeth in both jaws so arranged as to diverge from a center. It bites and annoys whales, but feeds also on small fishes and crustaceans. When a whale has been killed, a S. will often come even whilst men are occupied in cutting off the blubber, and scoop out one great lump after another, and will return to its repast after having been severely wounded.

The rough skin of sharks is employed by joiners for polishing fine grained wood, and for covering the hilts of swords to make them firmer in the grasp—the flesh is coarse, but is sometimes eaten. The fins abound in gelatine, and are much used by the Chinese for making a rich gelatinous soup. Dried sharks' fins are a considerable article of import into China. The liver yields a large quantity of oil, which is now also, in some parts of the world, an article of commerce. For the sake of this oil a S. fishery is prosecuted on the coast of Ceylon.

Fossil Sharks make their first appearance in the Oolitic rocks from which eight species have been described. They become more numerous in the Cretaceous deposits, in which no less than 60 species have been found. In the Tertiary strata, their remains are still more abundant. But as the determination of fossil species depends entirely on the teeth, which, with the exception of the spines and vertebræ, are the only portions preserved, it is probable that the species and genera are too greatly multiplied.

SHARP, a sign ♯ in Music, which, when prefixed to a note, elevates it by a semitone in the scale, raising, for example,



When placed at the beginning of a piece of music, it denotes that all the notes on the line or space on which it is placed, and their octaves above and below, are to be played sharp. A double sharp × raises a note two semitones.

SHARP, JAMES, Archbishop of St. Andrews, was the son of William Sharp, sheriff-clerk of Banffshire, and was born in the castle of Banff, May 1618. Educated for the church at the University of Aberdeen, where he attained distinction as a student, and where he is said (on the authority of a tract, entitled *A True and Impartial Account of the Life of the Most Reverend Father in God, Dr. James Sharp, Archbishop of St. Andrews*, published in 1719) to have protested against the 'Solemn League and Covenant;' he afterwards visited England, and became acquainted with several eminent English divines, such as Hammond, Sanderson, and Taylor. Returning to Scotland, he was appointed a professor of philosophy at St. Andrews, through the influence of the Earl of Rothes, and soon after minister of the parish of Crail, an office which he held during the ascendency of Cromwell. In August 1651, when Monk was reducing Scotland to obedience, he was carried off, along with several other ministers, to England. S. quickly regained his liberty, and he possessed, for some years, the confidence of the more moderate party in the church. In 1656, he was chosen by them to plead their cause in London before the Protector, against the Rev. James Guthrie, a leader of the extreme section (the Protestors or Remonstrators), which he did with so much dexterity, that Cromwell is reported to have said: 'That gentleman, after the Scotch way, ought to be termed Sharp of that Ilk.' When the Restoration was on the eve of happening, S. was appointed by the moderate party to act as its

representative in the negotiations opened up with Monk and the king. This is the crucial period of his career, and on the view we take of his motives depends our whole estimate of his character. Was he sincere, or did he mean to betray the church to which he owed allegiance? Presbyterian writers are nearly unanimous in affirming his perfidy, although the evidence is doubtful.

Among the first things the Scottish parliament that met 1st January 1661 did, was to repeal or rescind every act passed since 1638, in consequence of which Episcopacy remained the Church of Scotland, as 'settled by law'—a dishonorable evasion of a promise made by Charles in a letter written to the Presbytery of Edinburgh in August 1660. Soon after, at a council held in Whitehall, S. was nominated Archbishop of St. Andrews, and having gone up to London, he was there formally consecrated by the Bishop of London and three other prelates. His government of the Scottish church was tyrannical and oppressive; and in consequence he became an object of hatred to most of his countrymen. When one Mitchell, a conventicle preacher, fired a pistol at him in the streets of Edinburgh, the populace allowed the intending assassin to walk quietly off, without making a single effort to arrest him. Finally, S. was assassinated on Magus Moor, near St. Andrews, 3d May 1679, by a band of fanatical Convenanters. In defence of S., the utmost that can be said is, that he was simply an ambitious ecclesiastic (of plausible and courtly manners), who had no belief in the 'divine right' of Presbytery, and who thought that if England were resolved to remain Episcopalian, it would be very much better if Scotland were to adopt the same form of church-government, and that if there must be an Archbishop of St. Andrews, there was no reason why he should not be the person. This theory is certainly a more sober one than the usual melodramatic Covenanting view, which makes him out to be 'a conscious villain,' who persecuted his old friends the more fiercely that he knew they were in the *right* and he in the *wrong*.

SHA'RPSHOOTERS, an old term applied in the army to riflemen. It is now appropriated to naval use, to the men stationed in the top to annoy those on the deck of an enemy's vessel.

SHASTRA or SHASTER, but more correctly written S'ASTRA (from the Sanscrit *s'âs*, to teach), means literally a book; but the term is especially applied to the *authoritative*, religious and legal, books of the Hindus. See SANSCRIT LITERATURE.

SHAT-EL-ARAB. See EUPHRATES.

SHAVE-GRASS. See EQUISETUM.

SHAWL MANUFACTURE. Perhaps no garment is of higher antiquity than the shawl; indeed, its simplicity of form would lead us to infer that it was the earliest in use. But of its manufacture we have no distinct account until the reign of the Emperor Jelal-ed-din-Mohammed Akbar, in 1556, when the celebrated Cashmere shawls were amongst the most important manufactures of the world, and were thought worthy to be minutely described in the *Ayin-i-Akbari*, or the 'Institutes of the Emperor.' In that work, four distinct classes of shawls, all of goat's wool, are described. The 1st were of remarkable lightness and softness, and were usually self-colored, and made of the wool undyed; the 2d were woven of wool in the natural colors—viz., white, black, and gray—these were probably arranged so as to form a plaid pattern similar to the shepherd's plaid of Scotland, which is of oriental origin; the 3d were called *gold-leaved*, probably from being embroidered with that material; and the 4th were long shawl-pieces large enough to enwrap the whole body. So carefully was this manufacture fostered, that it received the chief attention of the emperor, and every shawl manufactured was carefully described and registered, and the number of manufacturers was so great that in Lahore alone it is stated that there were upwards of 1000. The manufacture, in later times, passed through many vicissitudes, and during last century, it declined greatly; but in 1809, it had again risen, and there were then about 16,000 looms at work. From 2000 to 3000 of these beautiful fabrics are annually imported into Great Britain; but the admirable imitations now produced by our Paisley manufacturers, and by the French, are exerting great influence over the trade. The true Cashmere shawls are woven in many pieces, and joined together with great artistic skill; those of Britain and France are, however, woven in one piece, the loom being worked by hand, and of course furnished with a Jacquard machine for the production of the pattern. Besides the Cashmere shawls and their European imitations, there is an infinite variety of shawls made of various materials—as silk plain, embroidered, and in the form of crape; thread, cotton, and silk lace; and wool in a great variety of styles.

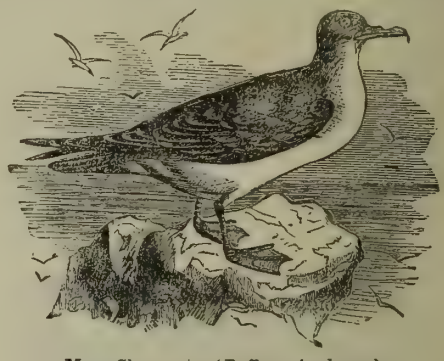
SHEA. See BASSIA.

SHEA'RING-MACHINE, a machine used in the preparation of woven woollen fabrics. See WOOLLEN MANUFACTURES.

SHEARS of various kinds are amongst the implements used in gardening. They are scissors on a large scale, variously modified to suit their various purposes, such as pruning trees, hedges, box-edgings, the verges of grass plots, &c. They are often furnished with long wooden handles, and a spring is sometimes fixed between the handles. A kind used for removing small branches of fruit-trees has one blade made to slide along the other whilst they are brought together, so that it makes a cut as clean and smooth as that of a knife.

SHEAR-STEEL. See IRON.

SHEA'RWATER (*Puffinus*), a genus of *Procellaridæ* (see PETREL), differing from petrels in having the tip of the lower mandible curved downwards, and the nostrils opening separately and not by a common tube. The bill is as long as the head, or longer, the upper mandible compressed and curved at the point. The legs are of moderate length, the tarsi compressed, the hind-toe rudimentary. The wings are long and pointed. The shearwaters spend their lives mostly on the ocean, rarely visiting the shore except for the purpose of incubation.—The GREATER, WANDERING, or CINEREOUS S. (*P. cinereus* or *major*) is about 18 inches long, the upper parts blackish-brown; the throat, breast, and belly gray. Young birds are entirely brown, the upper parts darkest. This species is frequently seen on the south-western coasts of Britain, It is very abundant on those of Newfoundland. —The MANX S. (*P. Anglorum*) is much more common on the



Manx Shearwater (*Puffinus Anglorum*).

British coasts, and is found also in more northern regions. It is about 14 inches long, grayish-black, the neck mottled with gray, the throat and all the under parts white. It breeds on islets, in rabbit-burrows, or in crevices of the rocks.—There are several other species in warmer climates.—The name S. is sometimes also given to the Skimmers.

SHEATH-BILL (*Chionis*), a genus of birds of the family *Chionidæ*, placed by many naturalists among the *Grallæ*, but by others regarded as belonging to the *Gallinaceous* order, and ranked by Mr. Swainson among *Columbidæ*. The legs are stout and moderately long, the toes much resemble those of the common fowl, but the fore-toes are united at the base. The bill is thick and conical, and the base is covered by a horny sheath, which the bird has the power of raising and depressing. The WHITE S. (*C. alba*) inhabits the shores of Australia, New Zealand, and neighboring islands, and feeds on molluscs, crustaceans, and whatever animal substance is thrown up by the waves. It is about the size of a partridge.

SHEATHING is a protection for the wooden planking of the immersed portion of a ship from the attacks of the teredo and other worms, molluscs, and marine animals, which especially in hot climates, adhere to the bottom and eat into the timber, while they retard the vessel's progress. As early as the time of Trajan, sheets of lead were used as sheathing. Thin deal boards, about half an inch thick, were in more modern times nailed on and frequently changed; but about the commencement of the present century, plates of copper were introduced, which have been found most effectual, though expensive. The gradual oxidation of the copper by the action of the sea-water produces a sort of poison, which prevents any marine animal from adhering, and keeps a clean bottom. The copper, however, slowly wears away in this oxidation, and requires renewing after a few years. To prevent this loss various methods have been devised. Sir H. Davy applied what he called protectors, consisting of pieces of iron and zinc on different parts of the *copper;* the action of the water on the two metals produced a small galvanic current, which prevented the copper from oxidizing; but it became forthwith encased in barnacles and weeds. For ships stationary in harbor, as hulks, ships-in-ordinary, &c., this system of protection answers well; but it fails for sea-going vesseis, together with many other protecting mixtures which have been tried, from the fact that in proportion as the copper is saved from oxidation, by so much does it cease to repel the incrustations which always threaten it.

SHEAVE. See PULLEY.

SHE'BA. See SABÆANS.

SHEBOY'GAN, a town and port of Wisconsin, U. S., on the west bank of Lake Michigan, at the mouth of the Sheboygan River, 52 miles north of Milwaukee. It was settled in 1836, has a good harbor, with mills at Sheboygan Falls, 6 miles above, and a large trade in wheat and timber. Pop. (1870) 5310; (1880) 7314.

SHECHI'NAH (from *shachan*, to reside, rest), a word used in post-biblical times by the Jews, and adopted by early Christian writers: expressive of the presence of the Divine Majesty, in Heaven, among the people of Israel, or in the Sanctuary. It is first found used in the Chaldee versions (Targums) as a kind of periphrasis for the person of God, wherever it is mentioned in the Bible as corporeal: thus being a kind of spiritual interpretation of anthropomorphism. The S. is not supposed to have dwelt in the second temple, but it is to return with the Messiah. The particular place where the S. was supposed to dwell was the 'mercy-seat between the cherubim.' The cherubim or other angels were always more or less connected with the S. itself, as in the phrases 'the heavenly hosts,' 'hosts of saints,' &c., accompanying the Divine presence. The first mention of the word is found in the Targum Jerushalmi, Gen. iii. 24—'And he expelled Adam, and caused to reside the splendor of his Shechinah from the beginning at the east of the garden of Eden, above the two cherubim.' (Second recension: 'between the two cherubim.') Another characteristic instance of its use is found in the version of Onkelos, Deut. iii. 24—'Thou art God, Thy divine Shechinah is in Heaven above, and rules on earth below.'

SHEEP (*Ovis*), a genus of ruminant quadrupeds of the family *Capridæ*, so nearly allied to goats that the propriety of generic distinction is very doubtful. They differ from goats in having the outline of the face more or less arched and convex; the horns spiral, sometimes very large in the males—in domestication, however, often wanting in the females, and also in the males of some breeds; the chin destitute of a beard; a sac or pit between the toes of each foot, lined with hair, and secreting a fatty matter. It is supposed by some that all the wild sheep existing in different parts of the world are mere varieties of one species, but of this there is no sufficient proof, nor is there anything more than unsupported conjecture in any of the opinions advanced concerning the origin of the domestic sheep, such, for example, as that which refers it to the Moufflon (q. v.), or that which ascribes different domesticated breeds to different wild originals, as the Moufflon and the Argali (q. v.).

All the wild sheep known are natives either of mountainous regions or of dry and elevated table-lands. They are gregarious, a character which the domesticated sheep fully retains. They are generally seen in small flocks, and are not easily approached, taking refuge in flight, a sharp whistling sound, emitted by one of the rams, serving as an alarm to the whole flock; although they are very capable of making a vigorous defence when driven to close combat. A ram of the domestic species is, indeed, able to sustain a conflict with a bull, taking advantage of his far greater agility, and butting against his foe with his strongly armed forehead. A ram has been known to throw a bull on the ground at the first onset, and is always ready to defend himself and his companions against a dog. Many rams exhibit great pugnacity. Sheep differ from goats in their mode of fighting. Goats rear themselves on their hind-legs and throw themselves sideways on their adversary, to bring the points of their horns to bear. Sheep rush straight at each other, a mode which better suits the different style of armature of the head. Rams of the blackfaced variety are especially powerful with their heads, and often at the rutting season kill each other. Their naturally strong skull is considerably protected in battle by heavy arched horns. A thorough ram fight is a terrifying sight. The two warriors go backwards each some fifteen or twenty yards, and then meet each other with great violence, their heads cracking loudly, and their beam-ends rising in response to the collision of heads. Ewes of this breed fight also. Sheep without horns are not so pugnacious as the mountain breeds.

All the wild sheep have short wool, with an outer clothing of long and nearly straight hair. But even the long hair—at least on the Moufflon—has the peculiar character of wool, in that roughness of surface which gives it the property of *felting* (see HAIR and FELT). One effect of domestication in the common sheep has been to cause the disappearance of the outer long hair, and to produce instead an increase of the length and abundance of the wool, an object of great importance to the sheep-farmer. In neglected breeds of the common sheep, the two kinds of hair or wool are very apparent. In some tropical climates, the sheep loses its abundant fleece, and is covered with hair little longer than that of the ox.

Although not equal to goats in their adaptation to rocky steeps, and not endowed with such power of leaping from crag to crag, most breeds of sheep exhibit a strong disposition to seek their food in places where no animal not very agile and sure-footed could venture; and those of the domesticated breeds which retain much of their original wildness are thus adapted to situations in which otherwise the pasture would be of little value to man. Every one who has seen the lambs frisking on a Highland hill, in a fine evening, must have admired their nimble movements in places where a herd-boy could with difficulty scramble. In fine weather, sheep ascend the heights; and in cold and stormy weather, they repair to the lower grounds. In modern times it has been customary to remove the large flocks from mountainous regions to lower grounds to pass the winter; and in the fall of the year, shepherds have difficulty in preventing the animals from leaving the summer pastures too early if the weather is unfavorable. On the other hand, if fine spring weather sets in before the period of removal from the winter quarters, the flocks keep pressing towards the summering regions. Mountain sheep have favored spots whither they go regularly over-night, and the ewes generally have choice localities to which they go to lamb. They get much attached to certain pastures, and many of them have been known to return stealthily, in the course of a few days, to their native or appreciated pastures, though removed some hundreds of miles.

A very interesting species of the wild sheep is the ROCKY MOUNTAIN SHEEP, or BIG-HORN (*O. montana*), of North America. It is equal in size to the argali, which it much resembles also in

Rocky Mountain Sheep.

its general appearance, and in the size and curvature of its horns. The horns of the old rams attain so great a size, and are so much curved downwards and forwards, that they often effectually prevent the animal from feeding on level ground. The abode of this species is in the most craggy and inaccessible parts of the Rocky Mountains. The flesh is of the very finest quality. The wool is very fine, and fully an inch and a half long; it is completely concealed by long hairs. The general color is brown, paler on the lower parts; the old rams are almost white in spring. The AOUDAD (*O. tragelaphus*) is a native of the north of Africa, inhabiting chiefly the lofty parts of the Atlas Mountains. It is sometimes called the Bearded Argali, although it has no beard on the chin; but the throat, the chest, and the front of the forelegs are remarkably adorned with long shaggy hair. On other parts the hair is comparatively short, with an underclothing of short wool. The color is a uniform reddish-yellow. The tail is longer than in the other wild species, and is terminated by a kind of tuft of long hairs. The horns are not so large as in the other wild species. In size, the Aoudad exceeds the Moufflon, but is not equal to the Argali. The French call it *Moufflon a mouchettes*, or Ruffled Moufflon, from the long hair of its forelegs.

The COMMON SHEEP (*O. aries*) was probably the first animal domesticated by man. We are told in the book of Genesis that Abel was 'a keeper of sheep,' and that he brought an offering unto the Lord 'of the firstlings of his flock and of the fat thereof.' And from that time until the death of Christ, lambs continued to be the most frequent sacrificial offerings, both amongst the patriarchs and the Jews. The felting and weaving of wool were unquestionably among the earliest of the arts. The wool was probably at first pulled from the skin, a rude and even cruel practice, which it is said still subsists in some countries, and was not very long ago relinquished in the Orkney Islands. We read in Genesis xxxviii. of Judah shearing his sheep, and there is abundance of other evidence that the better mode of obtaining the fleece has been in use from remote antiquity. The leather made of the skin of the sheep is much employed in bookbinding, and for making gloves. In patriarchal times, the milk was much used, as it still is in some countries; it is richer than cow's milk, and the cheese made of it has a sharp taste and strong flavor, which, however, are greatly relished by some. In Britain the milk is now very little used. In some mountainous parts of India the sheep is even used as a beast of burden, carrying loads of from 35 to 40 pounds,

over rough tracks, and up steep crags, where almost no other animal could be employed.

Those who watch sheep carefully, or keep them as pets, find them by no means devoid of intelligence. They have, however, a stupid habit of following, without scruple, the leader of the flock; so that, when sheep are being driven across a narrow bridge, or where a fence separates the road from a precipice, if anything occur to deter them from proceeding in the proper path, and one break over the fence or parapet, more of the flock may be expected to follow, as has sometimes happened, to their utter destruction. Sheep very soon come to know the voice of the shepherd, and also the appearance as well as the bark of the shepherd's dog. Though they stand more in awe of the shepherd's voice or commands than of any other human being's, the dogs regularly moving amongst them fail to keep them in such subjection as strange ones do.

The 'rutting' is from September till the middle of December, according to the variety of sheep, and the system of feeding. White-faced modern breeds have the tups early among them, and the hill flocks are later. The period of gestation is from 20 to 21 weeks. Ewes occupying sown or low-ground pastures lamb in March, while those not so well provided for—the mountain sheep—do not drop their lambs usually till April. The ancient breeds generally have only one lamb in a season, but modern highly-fed varieties frequently have twins, occasionally triplets, but rarely more. Lambs intended to come early into the market are as often as possible dropped in January. Generally lambs are weaned in July and August. Weaning of breeding or store lambs, however, is a feature of modern sheep-farming; at one time it was not uncommon to see several generations persistently following the parent stem. The shearing season ranges from the 1st of May till the middle of July, according to the description of sheep, the nature of the feeding, &c. Autumn is the most common time for the 'dipping,' 'juicing,' or 'smearing' of the flocks, to kill vermin, prevent skin disease, and preserve and cultivate the wool crop.

The great object for which the ancient Britons possessed sheep before the Roman invasion was the production of wool. The demand for butcher-meat has now raised the value of mutton and lamb so much, that the farmer finds it profitable to devote much of his attention to supply the market with these articles; and those breeds of sheep are reckoned most valuable which are most suitable for this purpose, even although the quality of the wool is inferior. When there was no food for sheep but the natural pasture, the animals could not be fattened for the market except during summer, and not until they had attained an age of three, four, or five years; whereas much of the mutton now consumed is the flesh of sheep not more than two years old, fattening being aided by turnips, mangold, oil-cake, &c.

The young branches of heath, and in lower situations, the shoots of furze, often serve as food for sheep, when the supply of grass fails. Sheep delight in the short grass and peculiar herbage of hill pastures and bare downs; and the mutton produced in such pastures, and by the breeds most suitable to them, is of superior quality to that of the large fat sheep fed on richer soils. The latter are also more liable to many diseases, particularly where the ground is at all moist. Aromatic and bitter herbs are particularly relished by sheep.

The breeds of sheep are very numerous, and very different.—The BLACK-FACED SHEEP of the Highlands of Scotland and of the north of England is perhaps as near the original type as any existing breed. Both male and female have horns; those of the

Black-faced Ewe and Ram.

ram large, with two or more spiral twists, those of the ewe much smaller, and little twisted. The face and legs are not always black. Many are speckled, and some principally white. The Black-faced sheep is robust, very active and hardy; enduring the rigors of a severe winter when sheep of most of the breeds common in Britain would perish. It survives on little food, and shifts admirably for itself in a snow-storm. The small quantity, and even inferior quality of food with which a Black-faced sheep will tide over a snow-storm, is most surprising.

As an instance of the tenacity of life in Black-faced sheep, under certain circumstances, they have been known to be buried five weeks under a snow-wreath and come out alive. It has a bright, quick eye, with an expression very different from that softness which is seen in many of the breeds, preferred for lower grounds and better pastures. The wool is long and coarse, and the weight of the fleece from three pounds to four pounds; but the mutton is of the finest quality; and on this account, and its hardiness, this breed is preferred to any other in many mountainous districts and on rough elevated moors.—The WELSH SHEEP is much smaller than the Black-faced; both sexes horned; the color various; the mutton highly esteemed; the fleece seldom weighs two pounds.—A very little larger breed with big bushy tail, hornless, or with short and little twisted horns, has long existed in the Shetland and Orkney Islands; its wool affording the material for the manufacture of Shetland hose. The Shetland and Orkney sheep are very hardy, and in winter feed much on seaweed.—Smaller than either of these, and, indeed, remarkably diminutive, is the hornless BRETON SHEEP.—The FOREST SHEEP of England, so called from being pastured in the royal forests, has now in most places been supplanted by other breeds. They are still to be seen on the barren grounds between the British and Bristol Channels; and the mutton is in much request in the London market. The original Forest Sheep was generally small, with face and legs russet brown or gray, wild, restless, and difficult to fatten, but producing wool of fine quality. The DORSET SHEEP is one of the best of the old English upland breeds. Both sexes have small horns. The wool and mutton are of medium quality; but the ewes are remarkable for their fecundity, and the abundance of their milk; and this breeding is valued as affording a supply of early lamb for the London market.

The RYELAND SHEEP has long existed in Herefordshire and some neighboring counties of England. It is small, short-limbed, white, hornless; produces excellent mutton; and before the introduction of Merino wool, its wool was preferred to every other kind for the manufacture of the finest broadcloths.—The CHEVIOT SHEEP has existed from time immemorial on the Cheviot Hills, and is now very widely diffused over a considerable part of England and almost all parts of Scotland, being hardy and well adapted for high grounds, although it is inferior in hardiness to the Black-faced. Cheviots, however, rather excel the Black-faced both in size and in the value of the fleece; but require a richer pasture. Ewes are hornless, and the rams almost so. The general figure is longer than that of the Black-faced sheep. They are narrow in shape, with slender forequarters and long pricked ears. The color is white, the face and legs occasionally mottled with gray, but generally quite white. The fleece weighs from three to five pounds. Great attention has for many years been devoted to the improvement of this breed.—The LEICESTER SHEEP is another of the most valuable breeds. This breed, as it now exists, is a result of the skill and care of Mr. Bakewell, who, soon after the middle of last century, began to make experiments for the improvement of the old Leicester sheep—a large, coarse-boned sheep, not easily fattened, and with coarse long wool, of which, however, the fleece weighed from eight to ten pounds. The new Leicester sheep has wool moderately long, of better quality, the average weight of the fleece being about seven or eight pounds; and is easily rendered very fat. It is naturally very broad on the back, with finely arched ribs. The color is white. Both sexes are hornless. The Leicester sheep is now common in all but the mountainous parts of Britain, and other breeds have been improved by crossing with it, particularly various breeds of long-woolled sheep, which have long existed in different parts of England, as those of Lincolnshire, Romney Marsh, &c.

A famous long-woolled breed is that called the COTSWOLD or GLOUCESTER, the wool of which was in great esteem in the 14th and 15th centuries, bearing a higher price than any other wool. In 1464, Edward IV. sent a present of Cotswold rams to Henry of Castile; and in 1468 a similar present was sent to John of Aragon. The Cotswold breed, however, as it at present exists, has been modified by crossing with the Leicester, and produces shorter wool and better mutton than in former times.—The SOUTH DOWN SHEEP has recently been improved with the utmost care. The color is generally white, and the face and legs are generally dun, black, or speckled. Both sexes are hornless. The wool is short, very close, and curled. The South Down derives its origin and name from the chalky *downs* of the south of England; but is now met with throughout England and the south of Scotland. The Shropshire sheep are large, with thick wool something like the South Down. They are hornless, and black or dun in the face and legs. They come early to maturity, but are suited only for finer climates and good keep. The Oxford Down is a heavy, somewhat soft sheep, without horns, and capable of rapid and

great development under good treatment. It is not suited to very cold and exposed situations.

The ICELAND SHEEP is remarkable for very frequently having three, four, or five horns. They are good butchers' animals, being deep and thick in the carcase, though rather short in the quarter. The same peculiarity, or monstrosity, as it may be deemed, is exhibited by the sheep of some of the most northern parts of Russia.—The north of Africa possesses a breed of sheep with legs of great length, pendulous ears, and much arched face; the wool short and curled, except on the neck and shoulders, which have a kind of mane.—India has also a hornless breed, with pendulous ears, short tail, and very fine much curled wool.—The BROAD-TAILED or FAT-TAILED SHEEP is found in many parts of Asia, as in Syria, India, and China, also in Barbary, and is now very abundant in the colony of the Cape of Good Hope. It is rather of small size, with soft and short wool. Its chief characteristic is the enormous development of the tail, by the accumulation of a mass of fat on each side, so great that the tail has been known to weigh 70 or 80 pounds. The tail is highly esteemed as a delicacy, and to protect it from being injured by dragging on the ground, the shepherd sometimes attaches a board to it, or even a small carriage with wheels. The fat of the tail is often used instead of butter. It is less solid than other fat.—The FAT-RUMPED SHEEP of Southern Tartary has a similar accumulation of fat on the rump, falling down in two great masses behind, and often entirely concealing the short tail.—The ASTRAKHAN or BUCHARIAN SHEEP has the wool twisted in spiral curls, and of very fine quality. The Circassian sheep has a remarkably long tail, covered with fine long wool, which trails on the ground.—The WALLACHIAN SHEEP, common in Hungary, as well as in the country from which it derives its name, is distinguished by the magnitude of its horns, and their direction. They make one great spiral turn, and then generally rise up from the head to a great height, twisting round as they rise. The wool is soft, and is concealed by long hair.

SHEEP-LOUSE, or SHEEP-TICK, or (in Scotland) KAID (*Melophagus ovinus*), an insect of the family *Hippoboscidæ*, to which also the Forest Fly belongs, ranks in the order *Diptera*, although in this genus the wings are completely wanting. It lives among the wool of sheep, and particularly of lambs, sucking the blood of the animal, and is most abundant in the early part of summer. Where it fixes its head in the skin, a large round tumor is formed. Its body is very compressed and smooth, of a rusty color, the head and thorax small, the abdomen large. The female does not lay eggs, but, like the other *Hippoboscidæ*, hatches the egg and nourishes the larva within her own body, till it passes into the pupa state, when it is deposited, oval-shaped and shining, fastened to the wool of the sheep. Sheep-farmers use various washes or *dips* for the destruction of these creatures, many of which are arsenical, while in others carbolic acid is a chief ingredient. The sheep tick is not a tick proper, not being one of the *Ixodidæ* (see TICK.)

Sheep-louse (*Melophagus ovinus*):

a, natural size; *b*, magnified; *c*, the pupa, magnified.

SHEEP'S-HEAD (*Sargus ovis*), a fish of the family *Sparidæ*, plentiful in the latter part of summer on some parts of the coast of North America, and highly esteemed for the table. It sometimes attains a weight of 14 or 15 pounds. A very large fish is sometimes sold in the New York market for a price equal to four or five pounds sterling. The fishery is therefore of some importance. Nets are used, and many fish are often taken at a single haul, which are immediately packed in ice for the market. It is difficult to take the S. with a line, as its cutting teeth snap the line asunder. The genus *Sargus* has cutting front teeth, and round teeth in the back of the mouth. *S. Rondeletii* inhabits the Mediterranean, and has been esteemed for the table from ancient times. The *Sargi* feed on shell-fish and the smaller crustaceans, which they easily crush with their round teeth; partly also on sea-weeds.

SHEEP-STEALING, in England, is felony, and is punishable with penal servitude from three to fourteen years, or imprisonment for two years. In Scotland, it is a capital offence, though, for some time, it has never been punished capitally.

SHEERNE'SS, a seaport and naval arsenal in the county of Kent, stands on the north-west extremity of the Isle of Sheppey, at the confluence of the Thames and Medway, 11 miles east-north-east of Chatham. It consists of four divisions, Blue-Town, Mile-Town, Marine-Town, and Westminster, and of these the first is within the limits of the garrison. The dockyard, much extended and improved within recent years, is now one of the finest in Europe. It covers 60 acres, comprising wet and dry docks, immense storehouses, and official residences. The harbor is usually crowded with vessels of all descriptions. An extensive oyster-fishery is carried on in the vicinity, from which as many as 50,000 bushels of 'natives' have been sent to London in one season. At Garrison Point is the residence of the port-admiral, the telegraph, coast-guard station, and barracks. The chief trade is in supplying the requirements of the employees in the various government establishments, and in the export of corn seeds and oysters. The neighborhood was once thought to be very unhealthy, but of late years important sanitary works have been carried out, and there are now few towns the population of which enjoy better health. Since the provision of direct railway communication with all parts of England, the town is much visited during the summer on account of the excellent sea-bathing there, which is under the management of a local joint-stock company. The beach and cliffs are a favorite resort for ramblers. Pop. (1881) 13,941. S. was captured by the Dutch under De Ruyter in 1667, and here the mutiny of the Nore burst forth in 1798.

SHEERS. The elemental form of a pair of sheers consists in two spars fastened together near the top, with a pulley at the point of junction, and held by a rope, fastened to any convenient object, in such a position that the weight lifted hangs nearly between the spars. This forms an easily improvised crane. An apparatus of this kind, of great height and strength, is used for masting vessels. In the principal dockyards, there are tall permanent sheers, mounted either on the side of a masting dock or on a floating sheer-hulk.

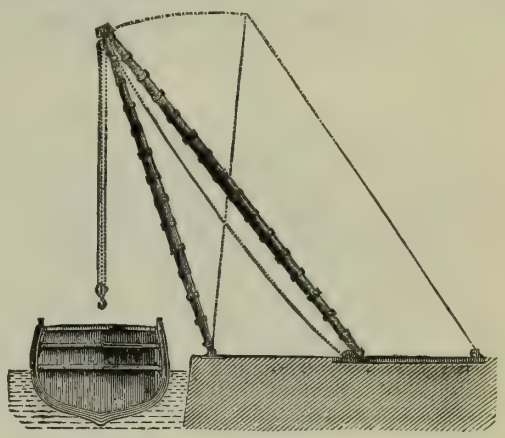


Diagram of 100-ton Sheers at Chatham Dockyard.

SHEET, on Shipboard, is the rope by which each of the lower corners of a square-sail, or the after-corner of a fore-and-aft sail, is held down, in order that the sail may be tightened to the wind.

SHEETING, a cloth made of flax or cotton, and used for bed-linen. It is chiefly made in Ireland in or near Belfast, and in Scotland. The term sheeting is also applied to the coarse hempen cloth used for making Tarpaulings (q. v.).

SHE'FFIELD, an important manufacturing town and parliamentary borough, in the West Riding of Yorkshire, and capital of an independent district, called Hallamshire (see SHIRE); it is picturesquely situated on several hills that slope towards the confluence of the rivers Sheaf and Don, 140 miles N.N.W. of London, with which it is connected by the Great Northern and Midland Railways, and 43 miles S.S.W. of York. The town, generally, is well built. It possesses many fine public buildings, such as the original parish church, supposed to have been erected in the reign of Henry I., 240 feet long by 130 feet broad; St. Mary's Catholic Church, surmounted by a tower 200 feet high; the town-hall, cutlers' hall, corn exchange; the new market-hall, or Norfolk Market, with a roof of glass and iron, erected by the Duke of Norfolk at a cost of about £40,000; music-hall, assembly rooms, theaters, &c.

There are extensive botanic gardens, and a fine cemetery about a mile from the town; many churches; numerous educational establishments, such as the Free Grammar School, the Collegiate School, the Wesley College, a Lancasterian and many national schools, free writing-schools, school of art, besides the Mark Firth College, opened in 1879. The Mechanics Institution dates from 1832. There are free and other public libraries, an Athenæum, and a Literary Society. The charitable institutions comprise an infirmary and several hospitals. As far back as the time of Chaucer, S. was noted for the manufacture of cutlery; and at the present day, an endless variety of articles in brass, iron, and steel is produced at the many manufactories with which the town abounds; such as knives of every description, silver and plated articles, Britannia-metal goods, coach-springs, spades, spindles, hammers, files, saws, boilers, stoves, grates, buttons, &c. In

March 1864, a new embankment, constructed for the Sheffield Water Company, at Bradfield, gave way, and let out a body of water 95 feet high from a reservoir 78 acres in extent. The destruction of life and property by this flood was unprecedented in England: 250 persons perished; mills, houses, and hamlets were swept away from their foundations, and, apart from the ruin of the Bradfield Dam, damage was done to private property to the extent of close upon £300,000. In 1866, trade outrages, in the form of 'rattening'—a local name for the stealing of tools and wheel-bands—and of unscrupulous treatment of the lives and limbs of non-union men, which had for more than twenty years been a disgrace to S., were brought to a prompt check by a Royal Commission, procured, among other influences, by the loyal outspokenness of the local press. Two fine churches have been recently erected—All Saints, a cruciform, early Second Pointed edifice, in 1867; and Sharrow Church, of the late First French Pointed period, in 1868. Since 1871, the introduction of the manufacture of armor-plates, railway-springs, tires, and rails has given a remarkable impetus to the growth of the town. The Albert Hall, erected in 1873, is a commodious building which seats 3000 people. S. has three public parks (one presented in 1878). Pop. (1871) 239,946; (1881) 284,403. The borough returns two members to parliament. Mary, Queen of Scots, was imprisoned in Sheffield Manor-house, about two miles from the town, for 12 or 14 years.

SHEIK (Arab, elder, aged person), a title of reverence, applied chiefly to a learned man, or a reputed saint, but also used sometimes as an ordinary title of respect, like the European Mr., Herr, &c. before the name. It is, however, only given to a Moslem. The Sheikh Al-Islam is the chief Mufti (q. v.) of Mohammedanism at Constantinople: a title supposed to have been first assumed by Mohammed II. at his conquest of Constantinople in 1453, when this place became the seat of his empire. The Sheikh of Mecca, by virtue of his supposed descent from the prophet, levies a kind of tribute on all the pilgrims to the Kaaba. The term is also applied to heads of Mohammedan monasteries (our abbot or prior), and to the higher order of religious preachers. Sheikh Al-Gebal (Ancient of the Mountain) is the name of the prince of the Assassins (q. v.), or those Ismaelites of Irak, who undertook to assassinate all those whom their chief would pronounce to be his enemies.

SHE'KEL (*siklos*, from *shakal*, to weigh), originally a certain standard weight in use among the ancient Hebrews, by which the value of metals, metal vessels, and other things was fixed. Gradually it became a normal piece of money, both in gold and silver, marked in some way or other as a coin, although not stamped. The gifts to the sanctuary, the fines, the taxes, the prices of merchandise, are all reckoned in the Old Testament by the shekel, not counted but weighed. Three different kinds of gold, silver, and copper shekels are mentioned: the common shekel, the shekel of the sanctuary (probably of double value), and the shekel of royal weight. Besides these, there was a half-shekel (*beka*), and a fourth-shekel. The sacred shekel was equal to 20 geras (beans), and 3000 sacred shekels made a talent. The gold shekel is reckoned approximatively to contain 161 Troy grains, the silver shekel 275. During the Babylonian exile, the Persian money (*dariks*) was used by the captives; nor do they seem to have afterwards used any but the coin of their foreign rulers. It was first under the Maccabæans that national money began to be struck, adorned with sacred emblems, and with inscriptions in the native language and characters. De Saulcy alone assumes, without much show of reason, Jewish coins to have existed from the time of Alexander the Great.

Simon, the 'prince and high-priest,' received, according to 1 Macc. xv. 16, the permission from Antiochus VII. to strike coin in 138 B.C. The emblems are sacred branches, sheaves, flowers, vases, &c., and the legend (in a peculiarly archaic ['Samaritan'] alphabet) contains the date, the name of the Jewish ruler, and the inscriptions 'Shekel of Israel,' 'Jerusalem the Holy,' 'Redemption of Israel.' The latest coins with Hebrew inscriptions date from the revolution of Bar Cochba under Hadrian. The value of the silver shekel is reckoned to be something over two shillings.

SHELBURNE, WILLIAM PETTY, Earl of, son of the first earl, and descendant of Sir W. Petty, founder of the science of political arithmetic, was born May 1737, and commenced his political career in 1761 by entering the House of Commons as member for Wycombe, but only sat for a few weeks, the death of his father having called him to the House of Lords. When Mr. G. Grenville succeeded Bute in 1763, S., whose talents had made him remarked, although only 26, was placed at the head of the Board of Trade. When Chatham formed his second administration in 1766, he made S. one of the Secretaries of State, although not yet thirty. Upon the fall of Lord North's Ministry in 1782, George III. sent for S., and proposed to him to form a government. He declined, not being the head of a party, and was sent by the king to the Marquis of Rockingham, with an offer of the Treasury, himself to be one of the Secretaries of State. According to Earl Russell, in his *Life of C. J. Fox*, it soon appeared that S. was not so much the colleague as the rival of Lord Rockingham, the chosen minister of the court, and the head of a separate party in the cabinet. Upon the death of Rockingham in 1782, the king sent at once for S., and offered him the Treasury, which he accepted without consulting his colleagues. Fox thereupon resigned, and S. introduced William Pitt, then only 23, into office as his Chancellor of the Exchequer.

S.'s ministry, on the occasion of the king's announcement of his determination to concede the independence of the American colonies, found itself outvoted by the coalition between Fox and Lord North. He resigned, and the coalition ministry took his place, but soon broke up. The nation expected that the king on this event would have sent for S., but William Pitt received the splendid prize, and S. was consoled by the coronet of a marquis (of Lansdowne). During the later years of his life, his health was delicate, and he withdrew from public life; but he came forward as a strong supporter of the union with Ireland. He indulged his tastes in the adornment of Lansdowne House. Here he collected a splendid gallery of ancient and modern pictures, together with a library of 10,000 volumes, comprising the largest collection of pamphlets and memoirs on English history and politics possessed by any man of his time, as well as a series of MSS., which were sold to the British Museum for £5000. He was a discerning patron of genius. It was while he resided in Lansdowne House as the librarian and friend of S. that Priestly made the discovery of oxygen. Jeremy Bentham was one of his most intimate friends. S. was the patron and friend of Sir S. Romilly, and twice offered him a seat in parliament. He was also on terms of intimacy with Mirabeau, Dumont, and other foreigners of literary and political distinction. He died in May 1805. See *Life of S.*, by Lord Edmond Fitzmaurice (London, 1875–6).

SHE'LIF, the chief river of Algeria (q. v.).

SHELL. This term is employed to designate the hard outer coverings of a large number of invertebrate animals. Shells are met with in the *Echinodermata*, in the great majority of the *Mollusca* (excluding the Molluscoids), in a few of the *Annelida* as Serpula, Spirorbis, &c., in the *Cirropoda*, and in the *Crustacea*. The forms of the different varieties of shells are sufficiently noticed in the articles on the classes of animals to which they respectively belong; and we shall confine our remarks to the intimate structure of shell, which, until the publications of Carpenter, Rainey, and others, during the last quarter of a century, was altogether misunderstood. The doctrine formerly held, and still maintained in many popular handbooks of conchology, was, that shell is not only extravascular (or devoid of vessels), but completely inorganic, being composed of an exudation of calcareous particles (chiefly carbonate of lime) cemented together by a kind of animal glue. It is now known that shell always possesses a more or less distinct organic structure, which in some cases resembles that of the *epidermis* of the higher animals, while in others it approximates to that of the *derma*, or true skin. The nature of the organic structure is so different in the Echinodermata, Mollusca, and Crustacea, that a separate description is required for each, and as Dr. Carpenter remarks: 'Even in the subordinate divisions of these groups, very characteristic diversities are frequently observable, so that, as in the case of the teeth, it is often possible to determine the family, sometimes the genus, and occasionally even the species, from the inspection of a minute fragment of a shell, as well fossil as recent.'

In the *Echinodermata*, the elementary structure of the skeleton exhibits the appearance of a net-work composed of calcareous and animal matter intimately united. The diameter of these

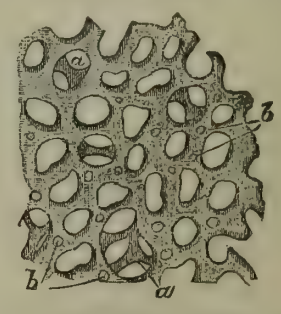


Fig. 1.—Thin Lamina of Shell of Echinus, showing its Areolar Structure:
a, *a*, portions of subjacent layer; *b*, *b*, fractured bases of columns connecting the superposed laminæ. Magnified 164 diameters.

apertures or meshes of network varies to a certain degree in different parts of the same shell, the openings being larger in the inner than the outer layers, the extremes being $\frac{1}{160}$th and $\frac{1}{1360}$th

of an inch. The entire shell is made up of an immense number of such plates, which lie parallel to one another, separated by minute vertical pillars.

In the *Mollusca*, the shell is formed upon the surface of the mantle, which corresponds to the true skin of other animals. Hence it must be regarded as epidermic. It consists of cells consolidated by a deposit of calcareous salts in their interior, but, as

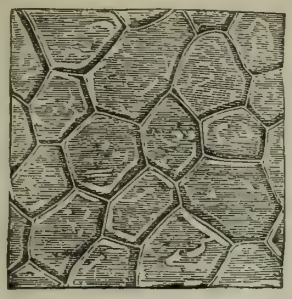


Fig. 2.—Section of the Shell of Pinna parallel to the surface, showing Prismatic Cellular Structure, cut transversely, magnified 185 diameters.

in the case of many other tissues, the original cellular organization often becomes so hidden by subsequent changes, as to cease to be recognizable. The typical condition of the shell in this subkingdom is best seen in certain bivalves—the genus *Pinna*, for example. On breaking off a small portion of the projecting margin of one of these shells, and examining it under the microscope, it is found to be made up of a vast number of prisms, hexagonal in form, and nearly uniform in size, which are arranged perpendicular to the surface of the lamina of the shell, so that the thickness of the lamina is formed by their length, and its surfaces by their extremities. On submitting such a lamina to the action of a dilute acid, the calcareous salts are dissolved, and a membrane is left which shows the prismatic structure as perfectly as it was seen in the original shell, the hexagonal divisions being evidently the walls of cells resembling those occurring in the pith or bark of a plant.

It sometimes happens in recent, but more commonly in fossil shells, that the animal matter decays and leaves the prisms ununited, and easily separable from one another. It is only in a few families of bivalves that the cellular structure is seen in this very distinct form, or that it makes up a large portion of the shell; and these families are closely allied to *Pinna*. In many shells, the

Fig. 3.—Calcareous Prisms of the Shell of Pinna, from Chalk.

external layer is formed on the above plan, while the internal layer is nacreous; in many, again, the nacre, or 'mother of pearl,' and in others sub-nacreous structure, constitutes nearly the whole thickness of the shell. The nacre, according to Sir D. Brewster, consists of a multitude of layers of carbonate of lime, alternating with animal membrane; and the grooved lines on which iridescent lustre depends, are due to the wearing away of the edges of the animal laminæ, while those composed of carbonate of lime stand out; it is, however, more probable, from Dr. Carpenter's researches, that the peculiar lineation of the surface of nacre is due to the disposition of a single membranous layer in folds or plaits, which lie more or less obliquely to the general surface.

In the *Crustacea*, the structure of the shell has only been ex-

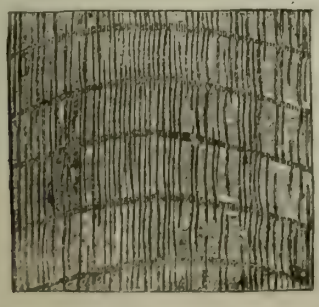
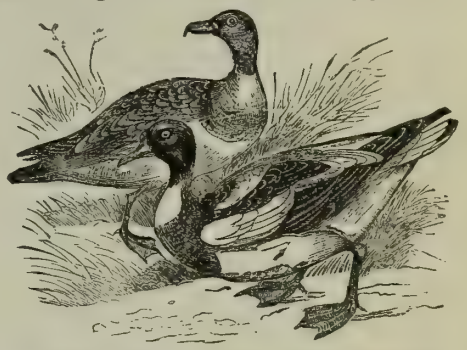


Fig. 4.—Portion of transverse section from Claw of Crab, magnified 400 diameters.

amined in the order of Decapods. In this order—in the common crab, for example—the shell consists of three layers, viz. (1) an external horny epidermic membrane covering the exterior; (2) a cellular or pigmentary structure; and (3) an internal calcareous or tubular substance. The horny layer is easily detached after the shell has been for some time immersed in dilute acid; it is thin and tenacious, and presents no trace of structure. The pigmentary layer is very thin in the crab and lobster, but is much thicker in some other Decapods. The internal layer is that which constitutes the chief part of the shell; it is in this layer that the calcareous matter is chiefly deposited; but even after this has been removed, a very distinct animal basis remains, which closely resembles that which is left after the dentine of the teeth has been deprived of its inorganic constituents, as may be seen in the accompanying figure, representing a transverse section from the claw of the crab; the dark lines representing minute tubules.

For further information on this subject, the reader is referred to Dr. Carpenter's various articles on the Microscopic structure of Shells, and especially to his article 'Shell' in the *Cyclopædia of Anatomy and Physiology* (from which the materials of the present article have been almost entirely drawn), and to his *Microscope and its Revelations*.

SHE'LLDRAKE or SHIELDRAKE (*Tadorna*), a genus of ducks of the section having the hind-toe without any pendent membrane.



Shelldrake, female and male (*Tadorna vulpanser*).

The shelldrakes are a connecting link between geese and ducks, having much resemblance to the former. The species are mostly natives of the southern hemisphere, but the COMMON S. (*T. vulpanser*, or *Bellonii*) is common on the sandy sea-shores of Britain; many coming from the north for the winter, and some remaining all the year, and breeding, making their nests in rabbit-burrows or other holes in soft soil, whence in some places the S receives the name of *Burrow Duck*. It is a beautiful bird, the sexes nearly alike in plumage; the head and upper part of the neck green, with a collar of white, and a lower collar of rich chestnut, extending over part of the back, the rest of the back white. The whole length is fully two feet. The S. is very capable of being tamed, and breeds in domestication. Its note is a shrill whistle. Its flesh is coarse and unpalatable—The RUDDY S. (*T. rutila*), the only other European species, is rare as a British bird, although common in many parts of Europe and Asia.

SHELLEY, PERCY BYSSHE, the eldest son of Sir Timothy Shelley, Bart., the representative of an old Sussex family, was born at Field Place, near Horsham, in that county on August 4, 1792. His earlier education he received at home with his sisters. About the age of ten he was sent to a school near Brentford, and thence, three years after, transferred to Eton. Shy and sensitive yet self-willed and unsubmissive, he suffered much from the harsh discipline of masters and the tyranny of his ruder associates. In his refusal to fag at Eton, he gave early indication of that passionate impatience of every form of constituted authority not approving itself to his reason which continued through life to distinguish him, and to find expression in his writings. In 1808, he left school, and after two years passed at home, he was sent to University College, Oxford. Even thus early, he had become a free-thinker of a somewhat advanced kind, and a pamphlet, entitled *A Defence of Atheism*, which he circulated during the second year of his college course, led to his expulsion from Oxford. This so irritated his father, that for some time he declined to receive him; and on his rash marriage, in August 1811, to a Miss Harriet Westbrook, the daughter of a retired innkeeper, the estrangement between them became final and complete, the old gentleman consenting to allow his son a liberal yearly income, but never after having any intercourse with him. S.'s marriage was in its issue tragical. In 1813, a separation took place between him and his wife, who, with two children, returned to the care of her father; and three years after, the unhappy woman drowned herself.

The refinements of intellectual sympathy which poets desiderate in their spouses, S. failed to find in his wife, but for a

time he seems to have lived with her not unhappily; nor to the last had he any fault to allege against her, except such negative ones as might be implied in his meeting a woman he liked better. This was Mary Godwin, a daughter of the celebrated William Godwin and Mary Wollstonecraft, with whom, in 1814, he travelled in France and Switzerland, and who afterwards became his second wife. Such excuse of his conduct in the matter as the theory of 'congenial souls' may afford in the eye of the moralist must to the full be allowed for S., whose later union was of almost ideal felicity and completeness. On the death of his first wife, he laid claim to his children; but this their grandfather, Mr. Westbrook, strange as it may now seem, successfully resisted at law on the ground of his atheism, as exhibited in the poem of *Queen Mab*, which a year or two before he had printed, though only for private circulation. In 1815, while living at Bishopsgate, near Windsor, he wrote his *Alastor*, one of the most finished and characteristic of his works; which was followed by *The Revolt of Islam*, composed in 1817 at Marlow.

During the interval, in the course of a tour in Switzerland, he had formed the acquaintance of Lord Byron, with whom afterwards in Italy he had much intimate intercourse. In March 1818, he left England finally—as it proved—to proceed to Italy; and during that and the following year, chiefly while a resident in Rome, he produced what may rank as his two finest poems—the grand lyrical drama of *Prometheus Unbound* and the tragedy of *The Cenci*. While at Venice with Lord Byron in 1820, he wrote *Julian and Maddalo*, a record in enduring verse of an interesting conversation of the discussional kind between the noble poet and himself. His other works of chief importance are: *Rosalind and Helen*, begun before he left England; *The Witch of the Atlas*, written in 1819; *Epipsychidion; Adonais* (a lament on the death of Keats); and *Hellas* (a lyrico-dramatic burst of exultation on the outbreak of the Greek war of liberty)—all three produced in 1821. The winter of 1822, S. passed at Pisa; and in the April following, he established himself near Lerici, in the Gulf of Spezia. His fondness for boating had through life amounted to a passion, and here he indulged it to the full. On July 8, 1823, in the company of an ex-naval friend, Mr. Williams, he sailed from Leghorn, whither he had gone to welcome his friend, Mr. Leigh Hunt, to Italy, and was lost in a sudden squall on his voyage homeward. The bodies were, after some time, washed ashore, and were burned, as the quarantine law of the country required, in presence of Lord Byron, Mr. Leigh Hunt, and another inimate friend, Mr. Trelawney. S.'s ashes were carefully preserved, and lie buried in the Protestant cemetery at Rome, near the grave of Keats.

In S.'s opinions, religious, social, and political, crude as they often were, and everywhere expressed with an unwise reckless vehemence, there was much that might reasonably offend; and they not only on their own account roused against him a storm of obloquy, but made him throughout life the accredited mark of the most foul and malicious slanders. To this chiefly it is to be attributed that, whilst he lived, his genius met with no wide appreciation; but since, it has been amply recognized, and perhaps no writer of his time at this day ranks higher on the whole than he. In sustained lyrical impetuosity, S. surpasses every other writer; his diction is not more remarkable for its opulence than for the expressive subtlety and precision with which it defines the nicest refinements of feeling and thought; and his page flashes with imagery like a royal robe rich with gems. But too often, whilst he dazzles, he also bewilders; he is fond of supersubtle abstractions, unsubstantial as clouds or dreams; and frequently in reading him we seem merely to be looking on wreaths of rainbow-colored mist. This want of clear and firm outlines is more or less felt throughout all his larger works, with the single exception of *The Cenci*, in which a terrible story of real life is dramatized with consummate vigor and directness of treatment. As to the matter of the rest of his poems, they concern themselves, for the most part, not with the world as it is or has been, but with a perfected world which is to be. S. is the *vates* of the future, as Scott is the poet of the past. Of the charge of atheism against S., it is enough to say that it rests mainly on his boyish poem of *Queen Mab;* that this he did not himself give to the world; and that when, in 1821, it was surreptitiously published, he issued an express protest against his being held answerable for any opinions set forth in it. In his later works, a vague Pantheism seems indicated; and one or two passages occur which fairly admit of a purely theistic interpretation. The most complete edition of S.'s works is that by J. Buxton Forman, published in 1880 (the poems in four volumes, the prose writings also in four volumes). See Medwin's *Life of Shelley* (1849); Trelawney's *Recollections of the Last Days of Shelley and Byorn* (Lond., 1858); the *Shelley Memorials*, by Lady Shelley (1859); *Shelley's Early Life*, by D. MacCarthy (1872); and lives by G. Barnet Smith (1877), and J. A. Symonds (1878).

By common testimony of all who knew him, S., who was held up to execration as a perfect monster of iniquity, was one of the purest, gentlest, most lovable of men; of the tenderest private affections, and, beyond the immediate circle of these, of the largest flowing charity. The passion of philanthropy expressed in his writings found as practical an expression in his daily life as if he had never made any very great profession of it. The episode of his first marriage seems more or less awkward for him; but the one passionate frailty of a boy can scarcely be held a serious blemish on a man whose whole subsequent life was exceptional in virtue and beneficenee.

Mary Wollstonecraft Godwin, wife of the poet, was born in London 1798, married Shelley, as above stated, in 1816; and in the same year produced a remarkable novel, entitled *Frankenstein*, the hero of which, a profound student of nature, discovers the secret of creating life, and produces a monster whose history, though wild and horrible in its incidents, is invested with a strong human interest. The work had a great success, and may be reckoned the best of Mrs. Shelley's literary efforts. Other novels of hers are *Valperga*, *The Last Man*, *Lodore*, and *The Fortunes of Perkin Warbeck*. She likewise wrote, *Rambles in Germany and Italy;* a series of biographies of foreign artists and poets for the *Cabinet Cyclopædia;* and edited her husband's poems. She died Feb. 1, 1851. See *Mary Wollstonecraft*, by Paul (1878).

SHELL-GUN belongs rather to the past than the present, as in modern rifled artillery all guns fire shells. Before their introduction, however, shells were fired from guns of large bore, and proportionately small thickness of metal, not differing materially from howitzers, except that they had greater length.

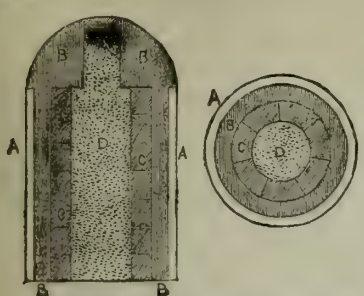
SHELL-LAC. See Lac.

SHELLS, called in earlier times bombs, consist of hollow vessels of metal, containing gunpowder or other explosive compound, so arranged that it shall explode at a certain point, and spread destruction around by the forcible dispersion of its fragments. The invention of this murderous missile cannot be accurately traced. Shells were employed in 1480 A.D., by the sultan of Gujerat, and by the Turks at the siege of Rhodes, in 1522. The Spaniards and Dutch both used them during the war of Dutch independence; and they appear to have been generally adopted by about 1634. As shells required Mortars (q. v.) for their projection, they were not used in naval warfare until the French constructed special bomb-vessels in 1681; but since that period, shell-guns, being cannon of large bore, have been introduced, and shells are now employed by all ships of war.

Until within a few years, every shell was a hollow sphere of cast-iron, varying in thickness from half an inch to two inches, and in diameter from five and a half inches to thirteen inches. The sphere had a fuse-hole (like a bung-hole) an inch across, through which the charge was inserted, consisting of pieces of metal and powder to burst the shell. The hole was plugged by a fuse, which was a tube of slow-burning powder, timed to communicate fire to the charge after the lapse of a certain number of seconds. This fuse might either be kindled by hand the moment before the mortar was fired, or its ignition might be effected by the act of firing itself. The Shrapnell shell, introduced by Colonel Sharpnell of the Royal Artillery about 1808, contained a number of bullets, and being fired at bodies of men, it was timed to explode about 100 yards before reaching them, when the shell burst, and the bullets with the fragments continued their course, diverging continually as they went, until they reached their object in a death-cloud. The *Concussion shell*, or *Percussion shell*, is one in which the charge is fired by the detonation of a cap on striking an object. If sufficiently delicate to explode on touching a soft object, and at the same time not to be exploded by the resistance of the air to its rapid flight, this form of shell is the most certain in execution.

Since the introduction of rifled ordnance, the shell has become the commonest form of projectile. It has ceased to be spherical, and is usually in the shape of an elongated bolt. Several rival shells at present divide public favor, and compete for adoption into war service. Without noticing the numerous varieties which are in course of trial on the continent and in America, the following are the principal British competitors. The *Armstrong* shell is a pointed bolt of iron (usually percussion), containing an inner 'segment shell,' made up of 49 segments of cast iron. Seven of these segments form a circle, or ring, and seven circles give the necessary length. A coating of lead affords a soft medium for fitting into the grooves of the gun. The shell thus made somewhat resembles a bottle without the neck. The necessary bursting charge having been inserted, the rear-end is plugged with lead, the fuse is screwed into the front, and the shell is ready for action. This projectile has a great and accurate range, and its segments cannot fail, on explosion, to do great damage. The principal drawback has been found in the lead-casing, which is often thrown off in parts soon after the shell leaves the gun, and which thus falls among the foremost ranks of the army using it, sometimes inflicting severe wounds. The *Whitworth* shell is an elongated hexagonal bolt of iron or steel, cast in one piece, and with a bursting charge at the rear-end. It explodes on percussion;

but the space allowed for the burster is deemed insufficient to produce the full effect which the length and correctness of the weapon's range give cause to expect. The *Lancaster* shell is oval, to fit the bore of the *Lancaster* gun (q. v.). *Martin's* shell is charged with molten iron, which sets on fire all combustible matter on



Armstrong Shell:—A, lead casing; B, outer shell; C, segments; D, charge.

Whitworth Shell.

which it can be thrown. The *Diaphragm* shell, invented by Colonel Boxer, R.A., has an iron division or diaphragm to separate the powder in the shell from any balls or slugs, in order that the friction of the latter may not prematurely cause the powder to explode. A six-pounder diaphragm shell contains 30 carbine-balls; an eight-inch shell, 322 musket-balls. The Palliser shell, which is now employed in the British service, is chiefly remarkable for the hardness imparted to its fire-point by a process of 'chilling' during casting. This gives it a great power of penetration into iron plates, &c.

SHELL-SAND. Sand consisting in great part of fragments of shells, and often containing a small proportion of organic matter, is a very useful manure, particularly for clay soils, heavy loams, and newly-reclaimed bogs. It is also advantageously applied to any soil deficient in lime. It neutralizes the organic acids which abound in peat, and forms with them compounds which serve as food for plants. Great deposits of shell-sand are found on the coasts of Devonshire and Cornwall, and are of great value in the agriculture of that district. Shell-sand is also found on many other parts of the British coast, and nowhere more abundantly than in the Outer Hebrides. The sand of many parts of the coast, however, being mostly silicious, is incapable of the same use. Shell-sand is much used as a manure in some of the maritime districts of France, as Bretagne and Normandy.

SHEMA'KHA, the former name for what is now known as the government of Baku, occupying the south-east portion of Transcaucasia. Area, 14,915 sq. m.; pop. (1880) 540,800. North of the Kur, and around its mouth, the surface is level, low, and fruitful, though little of the surface is under cultivation. Only in the towns and seaports, and the villages in their vicinity, are agriculture and industry pursued. The mountainous regions are inhabited by a rude predatory population.

SHEMAKHA, the capital of one of the six circles in the gov. of Baku, about 70 m. W.-N.-W. of the town of Baku. Formerly a thriving town, with silk and other manufactures, it was destroyed by an earthquake in 1859. After having been rebuilt, it was again destroyed, all but entirely, by another earthquake in 1872. It has a pop. of 26,000.

SHEMI'TIC (Semitic*) LANGUAGES the general name of a certain number of dialects, supposed at one time to have been spoken by the descendants of Shem. The term is of recent origin (Schlözer, Eichhorn), and a misnomer; for, in the first place, not all the nations derived in Genesis from Shem spoke an idiom akin to those understood by the term Shemitic (e. g., the Elamites, Lud, &c.), and, on the other hand, Canaan and Cush, whose Shemitic speech is undoubted, are there traced to Ham. Shemitic Languages, however, as a 'conventional appellation,' is still the best of all the general terms hitherto proposed (Arabic; Syro-Arabic, analogous to Indo-Germanic).

The family of Shemitic languages, which spread originally over Canaan (Phœnicia and Palestine), Assyria, Aram (Syria, Mesopotamia, Babylonia), and Arabia; and, at a later period, over part of Asia Minor and the Punic northern coast—i. e., from the countries on the Mediterranean to the Tigris, and from the Armenian Mountains to the south coast of Arabia—may broadly be divided into three principal classes: 1. The Aramaic or Northern (north-eastern) dialect, comprising, chiefly, the so-called Chaldee and Syriac; 2. The Southern, the chief representative of which is the Arabic, closely allied to whose older (Himyaritic) form is the Ethiopic; 3. The Middle, or principally Hebraic, to which also belong the languages of the other Palestinian inhabitants, those of the Canaanites and Phœnicians above all. The difference between the Middle and Northern branches, is less sharply marked, than between the Middle and the Southern or Arabic.

Before proceeding to treat of them individually, we shall try to point out their general position among other languages, and principally, the salient points of difference between the Shemitic and that other most important family of the Indo-Germanic or Aryan languages. First of all, then, we notice the preponderance given in Shemitic to the consonants in contradistinction to the vowels. The former are indeed the basis and the body of the words. The vowels are more or less accessories, modifying, fixing, precising the meaning, but never themselves containing it, while in the Indo-Germanic languages the root itself consists generally of a combination of vowels and consonants. A further peculiarity is the prevailing 'triliteralness' of Shemitic roots in the advanced stage in which we now know them. The Indo-Germanic languages derive their wealth from the logical law of their composition of roots, of verbs, and particles; the Shemitic add to their store in phonetically multiplying their sounds: either by splitting, as it were, their single consonants into two or more, through the reduplication of radicals, or by the addition of new consonants to the primary root, which is thus developed often from a monosyllabic (for by far the greatest number of Shemitic roots consisted primarily of two consonants only to which a third was generally added at a later period) into a root of five letters. Compound words are of the utmost rarity both in the noun (except proper names) and the verb, and they never consist of combined roots of verbs and particles, but of verbal and nominal roots. Regarding the formation of cases, tenses, and all those other grammatical changes of noun and verb which, in the Indo-Germanic family, are wrought—as far as the verb or noun itself is concerned—almost exclusively by suffixes, while the radical vowel changes merely according to euphonic rules within its own limited sphere, the Shemitic languages, principally and chiefly work their flexions by a change of vowels within the radical consonants, leaving the latter themselves intact. Only when these changes suffice no longer for the more elaborate modes of speech and thought, supplementary letters and syllables are sought in aid, and a certain small number of prefixes or affixes represents the vast and varied groups of little words (amounting at times to whole phrases) of the Indo-Germanic.

The Shemitic languages are also, if poorer, less complicated in forms than the former family. There are only two genders—which, however, are also distinguished in the second and third persons of the verb—and two principal tenses. These are strongly marked by the position of the personal pronoun, represented by a suffix in the so-called perfect and by a prefix in the so-called aorist or imperfect (future). The former expresses the finite, the completed action, the fact; the latter, the incompleted action, the thought, that which is becoming, growing, as it were, into a fact. One of the most curious features is the sudden change that may be produced in the two by a certain prefixed conjunctive-consonant. Perfect then becomes future, and *vice versâ*. Declension, in the Indo-Germanic sense, exists, if at all, in an extremely limited sense in Shemitic. The juxtaposition of two words (with slight vowel-changes) forms the genitive, while the other cases (in the Hebraic at least) are formed by prepositions. The oblique cases of pronouns are indicated by suffixes. The syntax is of the crudest and simplest description: a mere stringing together of sentences without any particular attempt at a logical and methodical arrangement of periods, according to their temporary superior or inferior relation to the subject-matter.

Another most important point of distinction between the two families is formed by what has been called their lexical difference, i. e., the want—except in a few isolated cases—of any correspondence or identity in their individual words. Most of those words which exhibit a similarity, can be shown to have been either adopted at a late period, or they simply fall under the category of onomatopoeic words (words imitating the sound of the object expressed, and therefore showing in all cases greater or smaller affinity to the original sound); or, again, words in which the common type of human language would involuntarily, and under all circumstances, connect a special meaning with a special sound, and would, therefore, be more or less identical in all idioms.

Of words introduced into European languages by Shemitic (Phœnician) traders may be instanced, *kanua* = cane, *gamal* = camel, *mor* = myrrh, *kezish* = cassia, *ahelim* = aloe, *nerd* = nard, *carkon* = crocus, *sappir* = sapphire, *sak* = sack, &c. Of onomatopoeic terms, *lakak* = (Sansc. *lih*) to lick, *charat* (Sansc. *charidan*) = to grate, scratch, *galal* = to roll, *parak* = to break, &c. On the other hand, words have crept into Shemitic from foreign languages; e. g., the Egyptian, *ior*, *iero*, *iaro*, river, Nile, is found as *yeor* in Hebrew, *pardes* (Heb.) paradise, is Persian, *kop* (Sansc. *kapi*) is the Heb. for ape, *karpas* (Sansc. *karpása*) = wool, cotton, &c.

As regards the age of the family of Shemitic languages, it is

* In Hebrew, the name from which the adjective is derived, is spelt *Shem;* but, as in many other cases, the *sh* of the original was transformed by the Septuagint into *s* (see SHIBBOLETH); and hence, through the influence of the modern versions that have in this respect followed the Septuagint, the form *Semitic* is more current among continental writers than *Shemitic.*

matter of great doubt whether or not they were developed earlier than any other, e. g., the Indo-Germanic. The monuments that have survived are not sufficient for us to form a final judgment as yet. It stands to reason, however, that a development may have taken place simultaneously and independently in the idioms of other nations. The notion long cherished (and still upheld by a few isolated speculators) that Hebrew was the original language of all mankind up to the episode of the tower of Babel, may here be passed over without remark. See PHILOLOGY.

We shall now endeavor to draw an outline of the relation of the Shemitic languages among themselves, and to cast a rapid glance at their individual characteristics and history, referring for fuller details to the articles devoted to the special branches indicated. Although the Shemitic languages are clearly sister dialects, their relationship is far from being so close as, for instance, that of the different Greek dialects. Thus, Abraham, belonging by his descent to a people of Shemitic tongue, and coming from a country where Shemitic was the general language, at his arrival in his new place of abode, inhabited by Shemites, was considered, and considered himself a foreigner to a much greater extent than it would have been the case had a Greek emigrated from one part of Greece into another.

It would be more fit perhaps to institute a comparison between the different Shemitic dialects and the Germanic languages among themselves: German, Dutch, Danish, Swedish, Norwegian, &c.; or the Slavonic idioms: Lithuanian, Lettish, Russian, Polish, Bohemian. But even these are not so far removed from each other as the Shemitic idioms. What the latter have in common are those grammatical and other characteristics indicated above, and the *root-words* themselves, which nearly everywhere have the same original signification; only that in this respect the Arabic shows by far the largest development of meanings out of the single roots, and consequently an unparalleled wealth of derivatives. Yet it must not be forgotten that our relics of ancient Hebrew are of a scanty nature, and that the Arabic has remained a living language until our day, and has, through Islam, spread further than any ancient and perhaps even modern language.

Regarding the much-vexed question as to which of the Shemitic languages is the oldest, it must be confessed that no positive result has yet been attained. For although the oldest palpable monuments of Shemitic have survived in Hebrew, while our earliest documents in Aramaic date from Cyrus, and those in Arabic, even centuries after Christ (Himyaritic, Ethiopic, 4th c.; northern Arabic, 6th c. A.D.), yet we cannot now decide which of these has preserved the type of the original mother-tongue most intact. It sometimes happens that vast internal movements, or a series of events in the history of a people—wanderings, wars, and the like—change, quicken, and develop its language even to decay, before it has had time to beget a literature. When this time does arrive, we meet already with all the traces of this decay in perfections, corruptions, and archaisms of form.

Thus, the Hebrew of the Bible, that is the most ancient form in which it has survived, offers more grammatical analogies (in incomplete structure, inflexion, &c.) to the modern than to the ancient Arabic, which lasted in its primitive purity and fulness of form as long as the simple life of the dwellers in the desert was not broken by those events which upheaved, from the time of Mohammed, their whole existence, and brought them in closest and most violent contact with other nations of other tongues. Then that process of decomposition, or phase of negligence and corruption, set in, which resulted in the looseness exhibited by modern Arabic. It thus reached the downward stage of the Hebrew of the Old Testament at ever so much later a period. Arabic classical literature thus exhibits, compared with the Hebrew, and even more with the Aramaic—which we meet in a worse state of aged and crippled organism and stunted form—about the same vigor freshness, and fulness of form and structure, which the Sanscrit exhibits among the Indo-Germanic or the Gothic in the narrower circle of the Germanic dialects. With all this, however, we cannot absolutely decide in favor of the Arabic as the nearest approach to the original type. The phase in which it enters into our historical horizon may be as far if not further removed from it even as the Aramaic. Its hasty individual development may have quickened more radical changes than even the decaying or decayed other branches present. So that, as we said, for the present at least, the question of priority must remain open. We shall, however, allot the first place to the second or Southern Shemitic (Arabic) class, simply because of its copiousness of words and development of forms. A faint trace of its peculiarity of article (*al*) is supposed to be found in Gen. x. 26 (*Almodad*); but this seems fallacious enough, considering that the Hebrew article must have been originally the same, and the word may simply exhibit the ancient Hebrew form.

In the golden epoch of Hebrew literature, Arab culture does indeed seem to have stood in high renown—Solomon's wisdom is likened unto that of the Arab's, Queen Sheba is an Arab queen, and Job's friends are Arabs. On its peculiar history and development, however, we cannot here dwell. (See ARABIAN LANGUAGE and LITERATURE). Suffice it to observe generally, that Arabic is not only the richest of Shemetic, but one of the richest of all languages, with its more than 6000 word-roots, and about 60,000 words; while the Hebrew has about 2000 of the former and 6000 of the latter. The 22 consonants of the Aramæans, and the 23 of the Hebrews, have been augmented into 28 with the Arabs. They further have twice the number of the Hebrew regular conjugations, in which, again, the latter exceed the Aramaic by one. The same abundance is noticeable in the Arabic tenses, declensions, &c. The general wealth of this language, however, will be best appreciated by its possessing some thousand different terms for a sword, and a proportionate number of words for lion, serpent, and the like; while on the other hand, its adaptibility and versatility is shown by one word often possessing a vast number of meanings. Anciently, it had two principal branches: the Himyaritic spoken in the south, which has perished almost completely (a few partly mutilated inscriptions, recently brought to the British Museum, have been published some time ago, and their interpretation has been attempted by Osiander and Levy in the *Germ. Or. Society's Transactions*), and the Koreishite, which, being the idiom of Mohammed's tribe, became *the* paramount Arabic for all times. The Ethiopic (see ETHIOPIA) is by some investigators held to have flowed from the Himyaritic; but from the 14th c., the Amharic dialect (also Shemitic, but with little capacity for writing purposes) has superseded the Ethiopic almost completely.

The North Shemitic or Aramaic, to which we now turn, is the language of the whole district between the Mediterranean and the Tigris, south of the Taurus, north of Phœnicia, the Israelitish territory, and Arabia. Here we have again to distinguish between Syria Proper, Mesopotamia (between Euphrates and Tigris), and Babylonia (south of Mesopotamia), whither the Israelites were carried by Nebuchadnezzar. Yet, with respect to this latter country, it can hardly be doubted that another dialect besides the Aramaic was spoken in it. But whether this was 'Medo-Persian,' ('like the Assyrian'), or some other 'Turanic' idiom, largely mixed with Shemitic ingredients, must remain doubtful until our knowledge of 'Turanian' and our reading of cuneiforms shall have advanced somewhat further. There is, however, but one voice among competent investigators, that whatever strange elements the Babylonian and Assyrian languages may contain, they have a full claim to be reckoned among the Shemitic. The Aramaic in general is, as has been observed before, poorer than the Hebrew in grammatical forms, vowels, &c., besides having a peculiar tendency to blunting its consonants, changing its soft *s* into *d*, *ts* into *t*, *sh* into *th*, and the like. It further does not express its article by a prefix, but by an *Alef*, and it forms its passives, not by a change of vowels, but by a special syllable prefixed to the root. The first distinct trace of a difference between Hebrew and Aramaic is found in Gen. xxxi, 47, where it is found necessary to translate Laban's designation of the stone-heap erected in memory of his peace with Jacob. Although the ancient Babylonians had, in all probability, a rich and important literature; yet nothing of it has survived. The so-called Babylonian fragments supposed to have comè down in Arabic translations are a mere fiction.

All the Aramaic literature which we now possess is derived from the Jews, and of a very late date. The Babylonian exiles, both those who returned to Palestine and those who stayed in the land of their captivity, made Aramaic their habitual language. It was the common tongue of Palestine at the time of Christ, the Hebrew being then chiefly the 'holy language'—i. e., the language of temple and synagogue. Thus, the Shemitic words used in the New Testament are one and all Aramaic (Mammon; Raka; Eli, Eli, &c.; Talitha Kumi; Abba; &c.), and the same may be said of the Shemitic terms found in Josephus. The oldest remains in this idiom (variously called Hebraisti, Arami, Sursi, Chaldee) are certain portions of the Old Testament (Daniel, Ezra, &c.), the Targums (q. v.), the Mishna (to a certain extent, at least), the Talmuds, and the Midrashim. Idiomatic shades are again observable in these different documents; but while, as a living language, it was spoken and pronounced differently in the different districts of Palestine and Babylon, yet the special subdivisions into special provincial dialects which have been attempted can hardly be said to be correct. From the 2d. c. A.D., Christian writers, chiefly in Mesopotamia, Edessa, Carrhæ, Nisibis, began to use this language in their writings, which are principally theological (Translation of the Bible) and dogmatical, but which also treat of medicine, history, philosophy, mathematics, &c. Yet their Aramaic assumed a character so essentially different, that, in some respects at least, it became an entirely distinct dialect, viz., Syriac, which, at a later period, assumed also—to make the breach complete—an alphabet of its own (Estrangelo). Many have been the attempts to account for this strange difference (the very existence of which was, on the other hand, almost totally denied at one time), but with no satisfactory result. Certain it is that the mere geographi-

cal reasons (East and West Aramaic, &c.) do not hold good, and are arbitrary and fallacious.

The Syriac, as a living language, ceased to be spoken since the 10th c., and only a few Syrian Christians in Kurdistan and Mesopotamia are supposed to use a kind of vulgar Aramaic. Syriac literature ceased about three centuries later. As the language of the church, however, it is still in use with the Jakobite, Nestorian, and Maronite branches of the Syrian church. Minor sister dialects of Aramaic are the Samaritan, a corrupt Judæo-Aramaic mixed with Arabic words; the Zabian or Nazaræan (Mandaic), the language of a theosophical sect ('disciples of John the Baptist') standing between the Syriac and Chaldee, and mixed with Persian, but bearing altogether the stamp of an uncouth, ungrammatical, sadly-neglected idiom; further, the Palmyrene (Palmyra), which, with a written character closely akin to the square Hebrew, offers but little variations from the Syriac; and finally, the Ægypto-Aramaic, which is found on a few monuments (Stone of Carpentras, Papyri), and probably belongs to Jews, who, at a late period, had immigrated into Egypt, and had adopted the Egyptian religion. Its words are principally Judæo-Aramaic, but with a large infusion of foreign elements.

The third principal branch, the Middle Shemitic, which comprises Hebrew and Phœnician (Punic)—and all the questions connected with these—have been discussed at some length under JEWS and PHŒNICIA; to which we refer. See also the special articles ARABIC, CHALDEE, ARAMAIC, &c.

SHEMITIC NATIONS, or SHEMITES. The different nations generally comprised under this name, viz., the Assyrians, the Chaldæans or Babylonians, the Syrians, Phœnicians, Hebrews, Arabs, and Ethiopians, are all treated specially in the course of this work; it only remains here to add a few observations on the characteristics ascribed to them all in common, and on the influence they have exercised upon the history and development of humanity.

As regards the language, the poverty of the inflections, the well-nigh absolute impossibility of expressing abstract ideas, the general absence of compound verbs and substantives, and the primitive state of the syntax in the Shemitic as contrasted with the wealth and vigor of the Aryan, have been noticed in the previous article. From this arises, as an almost natural consequence, the general inferiority of Shemitic literature—to what we emphatically call 'classical literature.' Certain most important forms of Indo-Germanic poetry, for instance, are completely wanting in the Shemitic, such as the epopee and the drama; although, on the other hand, the peculiar ancient form of Arabic poetry—the Kasida—and the grand bursts of pathos found in the religious books of the Hebrews, are vainly sought in Indo-European literature. Again, a primitive state of Law seems to have developed among the Aryan nations, the chief characteristic of which was a recognition, albeit a dim enough one, of individual rights, in as far as they did not war against the complex unity of the 'State.' With the Shemites, in the absence of that talent for organization and conciliation which is so essential a mark of the Indo-Europeans, we find either a patriarchal, an anarchical or a despotical kind of government. Science and philosophy, in the larger sense of the word, are the almost exclusive property of the Aryans. The inferiority of the Shemites in these respects, however, is amply counterbalanced by the sublime place they take as the ethical teachers of all humanity. How the hard and narrow egotism which, not quite unjustly, is ascribed to them, ever came to bear and ripen those grand moral maxims with which we meet in the earliest Jewish records, and which, wrought up to their purest idealism, form the shining glory of the New Testament, is a problem of which some seek the solution in a peculiar *intensity* of character inherent in the Shemitic races; while others account for it by direct 'Inspiration.' The same may be said of that Monotheism which belonged, in the first instance, to the Hebrews out of all the nations of the earth. It is a grave mistake, however, to describe, as Renan does, the Shemites indiscriminately as monotheists.

Babylon and Assyria, and Syria or Phœnicia, and the ante-islamic Arabs, were neither more nor less polytheistic than the early or present inhabitants of India. And, we may well add, not before the return from the Babylonian exile are the Jews themselves, as a body, to be considered as real monotheists. But ever since, both they, and, from the time of Mohammed, the Arabs, have been the representatives of a more austere and exclusive dogma of the unity of the godhead, than a great part of the civilized world has found good to accept up to this day. Both Christianity and Islam, the most powerful religious agents, the one for nearly two thousand years, the other for about twelve hundred, are in their origin Shemitic, and their influence need not here be enlarged upon. For what we owe to the Shemites in the field of industry and inventions, and the civilization these carried with them wherever they were imported, we need only refer to PHŒNICIA. Nor ought we to forget that the very Alphabet itself is of Shemitic origin.

SHEMITIC PLURAL. The Shemitic languages, particularly the Hebrew, often use the plural where other languages only make use of the singular. This is particularly the case in terms of space and time—their vastness being conceived, so to say, as a multiplicity. Thus, certain regions, like Heaven—which, through the influence of the Bible language, is also with us sometimes used *pluraliter*—the expanse of water; further, the place at a person's head or feet, or even certain limbs of the body (conceived as space), like neck, face, &c.; or, again, periods of times, like youth, age, life, and special *lasting* qualities or states, like barrenness, blindness, mercifulness, and the like, are put in plural number, where we have the singular only. It is further applied to might and strength, as consisting originally of a multiplicity of elements of power. This is particularly shown in the word ELOHIM (q. v.), = a Unity of many 'Mights'—i. e., the Supreme Being. The false conclusions as to the plurality of the Divine Persons being proved by this word are best refuted by the occurrence of the plural in the word Master (Adon), Lord (Baal), when these stand unmistakably for a single human individual, and are meant to express merely his proprietorship of some object or other.

SHENANDO'AH, a river of Virginia, U. S., the largest trbutary to the Potomac, drains the beautiful and fertile valley between the Blue Ridge and the principal range of the Alleghanies. It rises in two branches near the center of the state, and runs north-east to the Potomac, 170 miles, being navigable for small boats 100 miles. In the war of 1861—1865, this valley was the scene of numerous conflicts, was successively occupied by the opposing armies, and finally laid waste by General Sheridan in the autumn of 1864.

SHE'NDY, a town of Africa, in Lower Nubia, on the right bank of the Nile, 100 miles in direct line below Khartoum. At its markets, two of which take place every week, a large variety of articles, as wheat, straw, salt, and cotton goods are sold. Near the town, which gives name to a large district, the finest senna is obtained. Pop. about 10,000.

SHENSTONE, WILLIAM, the son of Thomas Shenstone of the Leasowes, Hales Owen, Shropshire, and his wife Anne Penn, was born there in the year 1714. In 1732, he was sent to Pembroke College, Oxford. Whilst there, he devoted himself much to the study of English poetry, and in 1737 he published without his name, a small volume of miscellaneous verse. Subsequently, for some years, he lived in a somewhat vagrant way, yet without ceasing to cultivate his talent. In 1741, appeared his *Judgment of Hercules;* and next year, *The Schoolmistress*, the work by which chiefly he continues to be remembered. In 1745, his parents being dead, he established himself on his property of the Leasowes, where he thenceforth continued to reside. He busied himself with landscape gardening, and such was his success in beautifying his little estate, that it attracted visitors from all quarters, and brought him more fame than his poetry. He was thus, however, led into serious pecuniary embarrassments, from which, on February 11, 1763, a putrid fever relieved him.

The Schoolmistress, which has secured for its author a permanent if humble place among English poets, is written in the stanza and antique manner of Spenser's *Faery Queen;* and in the contrast between the stateliness of the vehicle, and the familiar and homely quality of the subject, with the graphic truth of its treatment, there is a singular source of charm. The other works of S. are for the most part quite insignificant; but his *Pastoral Ballad* has touches of exquisite tenderness and truth of sentiment expressed in a simple and appropriate melody.

SHEOL (LXX. *Hades, Thanatos*, Vulg. *Inferi*), a Hebrew term of very frequent occurrence (65 times) in the Old Testament, and rendered by the Authorized Version: grave, hell, or pit. Its derivation is doubtful: while some connect it with a root, denoting to seek, others derive it from a root, 'to dig out,' 'to hollow' (compare Germ. *Hölle*). The use of the word in the original would seem to prove a great fluctuation of the dogma respecting the world to come, during the various periods represented in the special parts of the Bible. Sometimes it does stand unmistakably for 'tomb,' although our notions of an artificially prepared grave do not originally belong to it; at other times, it is the abode of disembodied spirits, whether good or evil. It is the place where the dead go to be united with their 'people,' their 'ancestors,' friends, and all the departed. It was placed in the center of the earth, or below the ocean, and was a dismal, dark place, like the Orcus, or Tartarus. It has gates and bars, it has chambers, valleys, and rivers, and its inhabitants—the shadows—(*Rephaim* = feeble ones), who ordinarily enjoy deep repose in this 'reign of silence,' are troubled by being called up to the surface, or tremble at the arrival of some great tyrant. As the receptacle of all things, it contains the shadows even of trees and kingdoms. It is described as all-devouring, remorseless, and insatiable. There can be no doubt of the existence of an idea—however vague—if not of immortality, in the modern sense, yet

of some state after life among the Hebrews, even in the earliest times. For the Gehenna (Ge-Hinom) of the New Testament—the contemporaneous Sheol—see HELL.

SHEPHERD'S DOG, or SHEEP-DOG, the most useful and valuable of all kinds of dog, and universally employed by shepherds throughout Europe, and in the countries colonized from Europe, and also in some parts of Asia, to assist them in the tending of their flocks. Without it, the shepherd would be utterly incapable of taking care of the great number of sheep often under his charge; and the expense of keeping the requisite number of shepherds would far more than take away the profits of sheep-farming. That the dog was employed in the tending of sheep in very ancient times, we learn from the allusion to the *dogs of the flock* in Job xxx. 1. Buffon imagined the shepherd's dog to be the original of all the domesticated dogs; but was unable to assign any good reason for such an opinion. The shepherd's dog exhibits nearly the same characters in all parts of Europe, although there are slight diversities in different countries, as between that of England and that of Scotland, there known as the *Collie*. It is of middling size—differences of size, however, being amongst the characteristics of different races; of rather slender form, with a pretty sharp muzzle; the ears erect, or, in some races, drooping at the tip; the hair soft, long, shaggy, and somewhat waved; the tail slightly pendulous, more or less recurved, and very bushy; the feet well protected by hair, so as to be adapted for rough ground. The eye is very bright and intelligent, although the ordinary demeanor of the animal is remarkably calm and quiet. No kind of dog is more intelligent, and perhaps none so docile. Its ready comprehension of the meaning of its master, its prompt obedience to his word or gesture, its evident knowledge of what is requisite to be done, and the services which it performs, can never be observed without admiration.

A shepherd's dog exhibits the utmost care to prevent sheep from straying off the road along which they are being driven, and sets itself, often of its own accord, to watch any gate or gap in the fence, or goes immediately to bring back stragglers. It is equally

Shepherd's Dog, or Collie.

useful on the bleak moor or wild mountain, readily going for sheep, and bringing them from a distance. The sheep become perfectly acquainted with it, and evidently regard it as a friend, and not as an enemy, although the appearance of any other dog would alarm them at once. It knows the sheep of the flock it is required to attend, and even in a crowded market adroitly separates them from others with which they have become mingled. Its remembrance of places is obviously very accurate; and a dog which has found great difficulty in conducting sheep through crowded thoroughfares, does the same work much better on subsequent occasions. The intelligence of the shepherd's dog has sometimes been proved in a very remarkable way by dishonest masters employing them to steal sheep; the master merely indicating by some sign the sheep which he wished to add to his own flock, and leaving the dog to do it in his absence. For stealing sheep in this way, a farmer in the south of Scotland was hanged about the end of last century. More frequent instances are on record of the shepherd's dog conducting a flock of sheep safely home for many miles, unaccompanied by the shepherd. The shepherd's dog is affectionate, and becomes strongly attached to its master, but is generally shy to strangers. It is generally treated with great gentleness by the shepherd; no severity is used in its training, nor could be used with advantage. It is very muscular and active, and capable, perhaps beyond any other kind of dog, of continuing its exertions during a long time.

The shepherd's dog is often crossed with other kinds of dog, and particularly with the pointer and setter. Dogs are thus obtained, which, while capable of all the services required by the shepherd, are equally capable of being employed in the pursuit of game, and are most successful in night-poaching.

The *Drover's Dog* is very often a cross between the shepherd's dog and the mastiff, the foxhound, the pointer, or the grayhound. It displays many of the best qualities of the shepherd's dog, and if too frequently very different from it in its cruel treatment of sheep, the fault is originally that of the brutal master.

SHEPHERD'S PURSE (*Capsella*—formerly *Thlaspi—Bursa Pastoris*), an annual plant of the natural order *Cruciferæ*, a most abundant weed in gardens and cornfields in Britain, and remarkable as one of the few plants that are found over almost the whole world, adapting themselves to almost all soils and climates. It is a very variable plant, from 3 inches to 2 feet in height, with root-leaves more or less pinnatifid, all the leaves more or less toothed, and rough with hairs. The root-leaves spread closely along the ground. The flowers are white and diminutive. The pouch, from which the English name seems to be derived, is laterally compressed, and somewhat heart shaped. This is a troublesome weed where it abounds, but being an annual, it is extirpated by continual and careful cultivation.

SHE'PPEY, ISLE OF, a portion of the county of Kent, insulated from the mainland by the Swale, an arm of the estuary of the Medway, is nine miles long, and four miles broad. In early times, its dimensions were much greater, but the sea has encroached upon, and is gradually eating away, the northern shore, which is lined by cliffs of London clay, from 60 to 80 feet in height. The church of Minster, formerly in the middle of the island, is now on the north coast. Great numbers of interesting fossils are found embedded in the London clay, of which the whole island is composed. In the north of the island, corn is grown, but the south districts, which are low, are laid out in grass. Almost the whole of the inhabitants are massed in the seaport of Sheerness (q. v.).

SHE'PTON MA'LLET, a market-town of Somersetshire, five miles east-south-east of Wells. It is a town of considerable antiquity, and is mentioned in *Domesday Book* as Sepeton. Its grammar-school, free to twelve boys, was founded in 1627. Worsted stockings, crape, serge, and velvets are manufactured. It contains several large breweries. Pop. (1871) 5149; (1881) 5322.

SHE'RBET, an oriental beverage, much used in Mohammedan countries, where stimulating drinks are forbidden. It consists of the juices of various fruits diluted with water, and sweetened exactly in the way in which lemonade is made in Europe.

SHE'RBORNE, a market-town of Dorsetshire, on the river Yeo, 18 miles north-north-west of Dorchester. The King's School, founded in 1550, has an endowment of nearly £1000 a year, and several exhibitions of £40, tennable for four years at either of the great English universities. There are several silk-throwing mills. Pop. (1881) 5053.

S. was the Saxon Scireburn (*scir burna*, clear brook.) It was erected into a bishopric in 705, and remained so till 1075, when the see was removed to Old Sarum. It was a prosperous place.

SHERBROOKE, VISCOUNT. See LOWE.

SHERIDAN, RICHARD BRINSLEY, was the son of Thomas Sheridan, a lecturer on oratory and elocution, in his day of some notoriety. He was born at Dublin in September 1751, in due course was sent to school there, and afterwards removed to Harrow. He gave no promise as a boy of the brilliancy he afterwards displayed as a man, being pronounced a hopeless dunce by all his teachers. He does not seem to have been brought up to any regular employment; and after his elopement and marriage in 1773 with a Miss Linley, a public singer of great beauty and accomplishment, his prospects did not seem bright, more especially as he insisted, on a point of pride, that his wife should give up her profession. As the readiest resource he betook himself to literature. The lighter drama was the sphere which attracted him, and in January 1775, his first comedy, *The Rivals*, was produced.

Damned on its first appearance, through certain deficiences in the acting, this piece on its repetition found gradually the favor with the public which its wit and vivacity deserved, and made the reputation of the writer. In the course of the year following, S. followed up his success by a farce of no very great merit, entitled *St. Patrick's Day, or the Scheming Lieutenant*, and a second comedy, *The Duenna*, amid the sparkling dialogue of which are interspersed some songs of exquisite merit. He now became in some unexplained manner—for though his pieces were most successful, they could scarcely have brought him the necessary funds—part proprietor of the Drury Lane Theater; and in 1777, his *School for Scandal* was produced there. This, which is by much his greatest effort, instantly leaped into the popularity it has ever since continued to retain. His other works for the stage were the inimitably clever farce, *The Critic* (1779), and, after a long interval, *The Stranger and Pizarro* (1798), both adapted from the German of Kotzebue. During this interval, he was deeply engaged in politics. S.'s wit and sprightliness coruscated in society as brightly as they did in his comedies; he was an admirable table-companion—over a bottle, the best of then living good-fellows. With Fox and his wild set, these gifts made him a prime favorite; and through the influence of Fox it was that in 1780 he was returned to parliament for the borough of Stafford. In his politics, he faithfully followed Fox, and the Whig party from time to time had good service from their brilliant recruit. He never failed to

amuse the House, and when stirred by the trumpet-call of a great occasion, he was capable of rising to heights of noble eloquence. In particular, his famous speech, urging the impeachment of Warren Hastings (q. v.), is still traditionally remembered as perhaps the very grandest triumph of oratory in a time prolific of such triumphs.

In 1792, S. lost his wife; and three years after, he was married again to a Miss Ogle, who brought him five thousand pounds, to S. no doubt welcome, though trifling as a relief to the difficulties in which he had become involved, and which more and more continued to accumulate upon him. Always the most reckless and improvident of mortals, he did not improve with time. His later years were years of wretched struggle, of which debt, duns, and dissipation may furnish a convenient alliterative summary. His health failed him with his fortunes; and his friends, not finding him in his sickness and adversity quite so amusing as formerly, naturally failed him also—notably and shamefully, the Prince Regent, whose dull brains over the wine-cup he had many a time been made use of to brighten. Some honorable exceptions there were, among whom the poets, Rogers and Moore may be mentioned as steadily kind to him to the last. He died in London on the 7th July 1816, in his sixty-fifth year.

See his biography by Moore, and (for a just and delicate appreciation of his genius) Hazlitt's *Lectures on the Comic Writers*. A good edition of his works, edited by F. Stainforth, was published in 1874.

SHERI'F (Arab. noble), designates, among Moslems, a descendant of Mohammed, through his daughter Fatima and Ali. The title is inherited both from the paternal and maternal side; and thus the number of members of this aristocracy is very large among the Moslems. The men have the privilege of wearing green turbans, the women green veils, and they mostly avail themselves of this outward badge of nobility—the prophet's color—while that of the other Moslems' turbans is white. Many of these sherifs founded dynasties in Africa; and the line which, now-a-days, rules in Fez and Morocco, still boasts of that proud designation.

SHE'RIFF (A.-S. *scir-gerefa*, the reeve or fiscal-officer of a shire; compare Ger. *graf*), in English Law, is an officer whose duties are chiefly ministerial (for he has only a few trifling judicial duties). The office is of great antiquity. The sheriff was formerly chosen by the inhabitants, though probably requiring confirmation by the crown. But popular elections for that purpose were put an end to by a statute of 9 Ed. II., which enacted that in future the sheriffs should be assigned by the chancellor, treasurer, and judges. Ever since that statute, the custom has been, and now is, for all the judges of the common law-courts, with the Lord Chancellor, and Chancellor of the Exchequer, to meet in the Court of Exchequer at Westminster on the morrow of All Souls, and then and there propose three persons for each county to the crown. This is called the pricking of the sheriffs, and the crown afterwards selects one of the three nominated, and appoints him to the office. A sheriff continues in office for one year only, and cannot be compelled to serve a second time. The office is not only gratuitous, but compulsory, for if the person appointed refuses, he is liable to indictment. In practice, country gentlemen of wealth are appointed. In the city of London, the sheriffs are appointed not by the crown, but by the citizens. The sheriff has important official duties in elections of members of parliament. He is, by his office, the first man in the county, and superior to any nobleman while he holds office. He has the duty of summoning the *posse comitatus*—i. e., all the people of the county—to assist him in the keeping of the Queen's peace; and if any person above the age of fifteen, and under the degree of a peer, refuse to attend the sheriff after due warning, he incurs a fine or imprisonment. The chief legal duty which the sheriff discharges is that of executing, i. e., carrying out all the judgments and orders of the courts of law. It is he who seizes the goods of debtors or their persons, and puts them in prison. For this purpose, he has a number of persons called bound-bailiffs (or, in popular dialect, bumbailiffs), who in practice do this invidious work, and give a bond to the sheriff to protect him against any mistake or irregularity on their part.

The necessity of this bond is obvious, for the doctrine of law is, that the sheriff is personally responsible for every mistake or excess made or committed by the bailiffs in executing the writs or process of the court, and frequent actions are brought against him by indignant prisoners, or debtors whose persons or goods have been arrested; and the courts watch jealously the least infringement of personal rights caused by these bailiffs. Every sheriff has also an under-sheriff and deputy-sheriff, the latter being generally an attorney, who takes charge of the legal business.

SHERIFF, in Scotland, is a title given to three county officials, all appointed by the crown. The lord lieutenant is 'sheriff-principal,' and as such, though he performs no duties, takes precedence in the county. The 'sheriff-depute' discharged the duties of the office until recently, when the greater part of them devolved on the 'sheriff-substitute.' In Scotland, the office of sheriff is still that of a local Judge, and not merely ministerial, as in England. The institution of the office is very ancient, and the jurisdiction, both civil and criminal, was, and still is, very extensive. By the statute 20 George II. c. 43, the office was put on a better footing. The principal, or high sheriff, was debarred from performing any judicial duty, and it was enacted that none should be appointed to be a sheriff-depute but an advocate of at least three years' standing. The sheriff-depute is disqualified from acting as advocate in any cause originating in his county, though in other respects he is at full liberty to practice. He holds his office for life or good behavior. The same statute gave each sheriff-depute power to appoint a sheriff-substitute. The sheriff-substitute was at first appointed during the pleasure of the sheriff-depute, but he is now appointed by the crown, requires to be an advocate or solicitor of five years' standing, and holds office *ad vitam aut culpam*. Being bound to reside within his county or district, and prohibited from taking other employment, while the sheriff-depute usually attends the sittings of the Court of Session in Edinburgh, he, in practice, exercises the original jurisdiction attaching to the office.

The civil jurisdiction of the sheriff extends to all personal actions on contract or obligations without limit, actions for rent, and other questions between landlord and tenant. In questions affecting real or heritable property, his jurisdiction is unlimited in amount when the object is to regulate possession; but when the validity of a title is in issue, he is limited to cases where the value is less than £1000, and where the parties consent. In these cases there is an appeal from the decision of the sheriff-substitute to that of the sheriff-depute. He has also a summary jurisdiction in small-debt cases where the amount in question is not above £12; and these cases are determined without written pleadings. The sheriff does not try civil causes with a jury. In criminal cases, the sheriff has jurisdiction in all the minor offences which do not infer death or banishment, and power to award any punishment not exceeding two years' imprisonment. He has also jurisdiction in cases of bankruptcy and insolvency to any amount. In small-debt actions, criminal and bankruptcy matters, there is no appeal from the sheriff-substitute to the sheriff-depute. The sheriff's jurisdiction excludes that of the justices of peace in riots. He has charge also of taking the precognitions in criminal cases. He revises the lists of electors, and returns the writs for the election of members of parliament; and this last is almost the only duty which he performs in common with the English sheriff. An idea of the multifarious duties performed by the Scotch sheriff, may be gathered from the statement that he exercises, within a comparatively small district, the functions which in England are exercised by the commissioners in bankruptcy, county-court judges, the stipendiary magistrates, recorders, revising barristers, and coroners. The office of Commissary (q. v.) has been amalgamated with that of sheriff. Recently, large additions have been made to the sheriff's jurisdiction, and other changes are in contemplation.

The office of sheriff is one of the few which may be traced back to the Saxon times, and it appears originally to have been the same both in England and Scotland. The sheriff was (under the earl and next to the bishop) the chief man of the shire, and seems to have possessed unlimited jurisdiction to keep the peace; to have presided in all the courts; to have punished all crimes, and have redressed all civil wrongs. This extensive jurisdiction, gradually acquired at the cost of lesser local courts, has been gradually infringed upon, partly by the exercise of the royal prerogative, and partly by parliament. But in England it suffered more from the appointment to the office of men unfit to exercise judicial powers, and from the consequent usurpation of their functions by the supreme courts. The same causes operated in Scotland, though to a less extent. In England, they resulted in the almost entire abolition of the judicial functions of the sheriff. In Scotland, they resulted in his being deprived of the more important parts of the criminal jurisdiction, particularly of the power to punish by death; and in his civil jurisdiction being limited mainly to questions affecting movables. In both countries, the office was usually hereditary, which tended to a separation of the duties of the office into the honorary and the laborious—the former being performed by the principal sheriff, and the latter by the deputy. In Scotland, this separation was completed by the act of Geo. II., which entirely separated the offices, by the transference of the power of appointing the depute from the principal sheriff to the crown. In England, this complete separation has never become necessary, from the fact of the sheriff's power having been much more crippled than in Scotland. Indeed, in England, so purely honorary and ministerial has the office become, that it has been held by a female, and in Westmoreland, the office was hereditary down to 1849. The duty of enforcing the orders of the supreme courts, which now in England are a principal part of the duties of the sheriff, appears to have been engrafted on the office—probably on the theory that these orders were those of the

king himself. In Scotland, the sheriff has never been called on to enforce any writs except those actually and not merely in name proceeding at the instance of the crown.

SHERIFF-CLERK, in Scotland, is the registrar of the sheriff's court, and as such has charge of the records of the court. He registers, and, when required by the proper party, issues the sheriff's judgments. He also conducts what correspondence may be required. He has important duties to perform in regulating the summary execution which is issued in Scotland against the debtors in bills of exchange, promissory notes, and bonds, without the necessity of any judicial suit.

SHERIFF-MUIR, a name given to several moors in Scotland on account of the 'wapinschaws' which used to be there held, under the superintendence of the sheriff. The only moor of this name which appears prominently in Scottish history is situated in Perthshire, on the northern slope of the Ochils, two miles north-east of Dunblane, and was the site of the great battle between the adherents of the Houses of Stewart and Hanover, 13th November 1715. The former, who consisted of the northern clans under the Earl of Seaforth, and the western clans under General Gordon, numbering about 9000 in all, were on their march southwards, under the leadership of the Earl of Mar, to join the Jacobites who had risen in the north-west of England, when they were met by the Duke of Argyle at the head of 3500 disciplined troops. After lying under arms all night, the Macdonalds, who formed the center and right of the Highland army, attacked the left of their opponents, and routed it so completely that the fugitives fled with all speed to Stirling, carrying the news that Argyle had been totally defeated. Argyle, however, with his dragoons had meantime driven the left of the Highlanders back for two miles, when the right and center returned from the pursuit, and took him in rear; he then skilfully withdrew his men to a place of shelter, and remained facing his opponents till the evening, when he retired to Dunblane, and next day to Stirling. About 500 were slain on each side. As a mere battle, the victory lay with the Highlanders; but it was so little decisive, that it paralyzed the action of the Jacobites almost as effectually as a defeat would have done.

SHERLOCK, Thomas, D.D., an English prelate, was the son of Dr. William Sherlock, Dean of St. Paul's, and was born in London in 1678. He was educated at Eton and Catharine Hall, Cambridge, where he took the degree of M.A. in 1701. In 1704, he obtained the Mastership of the Temple; in 1714, he became vice-chancellor of his college, taking the degree of D.D. in the same year; and in 1716, Dean of Chichester. Eleven years later, he was raised to the see of Bangor, was transferred to that of Salisbury in 1734, and in 1748 to that of London. He died in 1761. S. was a strenuous Tory, and supported the Church-and-State politics of his day with a sort of dull dignity. He displayed a good deal of diplomatic skill in his different official positions, whence Bentley nicknamed him 'Cardinal Alberoni;' his eloquence and learning were likewise of a very superior order, as may still be ascertained from his 4 vols. of *Sermons* (1755—1776), which were highly praised in their day. Besides these sermons, he wrote a variety of controversial treatises and pamphlets, all of which are now wholly forgotten.

SHERMAN, William Tecumseh, an American general, born in Ohio in 1818, was educated for the army at the military academy of West Point, and received a commission as 1st lieutenant in 1841. During the war with Mexico, he served in California, and was promoted to the rank of captain. In 1860, at the secession of the Southern States, he was residing at New Orleans in a civil capacity, but went north, and at the commencement of the war offered his services to the Federal government, was appointed colonel of infantry, and was in the battle of Bull Run. Raised to the rank of brigadier-general, he succeeded General Anderson in the department of Ohio, from which he was removed for declaring that it would require 200,000 men to hold Kentucky. He distinguished himself at the battle of Shiloh, and as major-general in the siege of Vicksburg.

Raised to an independent command, he marched across the state of Mississippi, and after the defeat of General Rosencranz, took command of the army in Geogia, forced General Hood to evacuate Atlanta, and then marched across the entire state, capturing Savannah and Charleston; from which point he moved north, capturing the most important Confederate positions, and by cutting off the resources of Gen. Lee, compelled the evacuation of Richmond, and the surrender of General Lee to General Grant, April 9, 1865. The surrender of the army of General Johnstone to General S. in North Carolina a few days later, and that of General Kirby Smith, west of the Mississippi, closed the war. No northern general has acquired greater popularlty than Sherman. He divides with Lee and Stonewall Jackson the admiration of impartial foreigners. S. was appointed lieutenant-general in 1866; and, in 1869, became commander-in-chief. He has had ample justice done to the daring originality of design, the fertility of resource, brilliant strategy, and untiring energy, that made Grant pronounce him 'the best field-officer the war had produced.' See *Memoirs of Gen. William T. Sherman*, by Himself; published in 1875.

SHERRY. See Wine.

SHE'RWOOD FOREST, a stretch of hilly country in the west of Nottinghamshire, lying between Nottingham and Worksop, and extending about 25 miles from north to south, and 6 to 8 miles from east to west. It was formerly a royal forest, and the traditional scene of many of the exploits of the famous Robin Hood and his followers; but it is now almost wholly disafforested, and is occupied by gentlemen's seats and fine parks. The town of Mansfield, and a number of villages are situated within the ancient bounds. Numerous remains of the old forest are still to be seen. The soil, which is principally a species of quartzose gravel, is in some places fertile, in others almost barren, and on the whole but of moderate quality.

SHE'TLAND, ZETLAND, or anciently HIALTLAND, and likely the Ultima Thule of the Romans, a group of about 100 islands, islets, and rocks, 23 of which are inhabited. They lie between the Atlantic and the North Sea, between lats. 59° 51′ and 60° 50′ N., and between longs. 0° 53′ and 1° 15′ W.; but Fair Isle, which belongs to S., lies to the south, and is about midway between Orkney and Shetland. The group is about 25 leagues north-east of Orkney, and 44 west of Norway. Area, 325 square miles. There are three chief islands, the largest or mainland, 60 miles long by 3 to 10 broad; Yell, 20 by 6 miles; and Unst, 11 by 6 miles. Pop. in 1811, 22,379; and in 1871, 31,608; 1881, 29,709, and 5444 inhabited houses. In 1871, 67 per cent. of the children between the ages of five and thirteen were receiving education. In 1869, only 4·7 per cent. of the births were illegitimate. Lerwick, 272 miles north of Edinburgh, and 95 north of Wick, is the only town in S., and has a custom-house, law courts, and other public offices, and about seventy shops. Its pop. in 1881 was 3854. It has a fine natural harbor, and has steam communication with Granton bi-weekly in summer, and weekly in winter, for passengers, mails, and a large part of the exports from and imports into Shetland. Fort Charlotte, now used as a prison, court-house, &c., is at the north end of the town, and adds to its picturesqueness. Lerwick has two hotels, two licensed public-houses, and several lodging-houses. The chief imports are oatmeal, flour, tea, tobacco, spirits, sugar, cottons, woollens, timber (chiefly from Norway), tar, salt, &c. From £15,000 to £20,000 worth of breadstuff is imported annually to supply the deficiency of native grain. All classes consume much tea. No wood grows in the country. In 1880, 268 vessels, of 44,582 tons, entered, and 220, of 39,327 tons, cleared the port of Lerwick. Scalloway and Hillswick are the largest villages. The chief exports are dried salted fish, about 3000 tons annually, about a half to Spain; herrings, 4000 to 10,000 barrels in the year; about 2100 cattle and 600 ponies yearly; about 12,000 sheep in 1878; eggs, of which 54,000 have left in one steamer; hand-knitted woollens of great beauty and fineness of workmanship; fish oil; chromate of iron from Unst; copper ore from Sandlodge; iron pyrites formerly from Fitful when sulphur was dear. The exports exceed in value £100,000 annually.

Fishing for cod, ling, herring, is the chief industry, but each fisherman has usually a small farm, at £4 or £5 yearly rent, and mostly worked by the females of his family. In 1876 S. had 614 fishing-boats, with 2772 fishermen and boys. Almost all the small tenants practice spade cultivation. Seals and bottle-nosed whales are often caught. Nearly every house has a quern or hand-mill, and every township has one or more of the old Norse water-mills. The spinning-wheel is common, but the spindle is still in use in some parts. Carts are rare, and in many districts unknown. The sheep and ponies run at large on the Scatfield or Common, and have registered marks; but many large tracts have been enclosed and drained, and now rear first-class Cheviot and black-faced sheep. The *rivlin*, a sandal of untanned leather, is still worn. Some lands are still held runrig, and some islanders on the west still hold their stock as steel-bow. In certain districts, till a very late period, the poor, by the Norse law, went from house to house, and stayed a longer or shorter period in each, according to the size of the farm. The S. dialect is a soft and pleasant English, but contains many peculiar Norse words. Many of the people still eat their fish wind-dried and slightly tainted. Young men from S. are employed as sailors in the Peterhead and Dundee whalers, or at some of the large shipping ports of the kingdom. They are intelligent, sober, and sedate, and are much liked as seamen. S. is still subjected to the *truck* or barter system in local commercial transactions.

S. had a parliamentary constituency of 393 in 1881—1882, and with Orkney forms a county, which sends one member to parliament. In 1881, S. had 5244 horses, 19,117 cattle, 72,156 sheep, and 3789 pigs; 10,774 acres in oats and barley, the only grain crops; and 763 acres in turnips. The native cattle, sheep, and horses (shelties or ponies) are small. The valued rent in 1881—1882 was £40,560. Free landed property is termed udal, and the pro-

prietor an udaller. S. has 14 civil parishes, with 23 Established churches, and 9 Free.

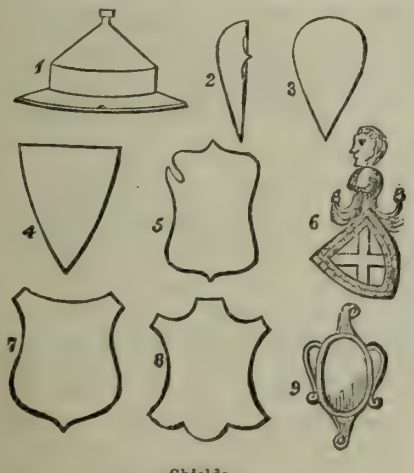
The surface is rugged and wild, and often sterile. The coasts are abrupt, and cut with deep bays or voes, and caves. The rocks are mainly gneiss, clayslate, sandstone, granite, sienite, micaslate, serpentine, and diallage. The highest hills are Ronas, 1500 feet, and one of five in Foula, 1400. The coast-cliff scenery is very fine, and none in Scotland surpasses that about Papa Stour. The climate is moist and variable. South-west, south, and north winds prevail. The mean temperature for the year is 45°, for January 39°, and for July 53°, winter being warmer, and summer cooler than in the south of Scotland. The mean annual rainfall at Bressay is 38 inches, and at East Yell, 50. The tide flows an hour earlier on the west than on the east side of Shetland. The prevailing diseases are dyspepsia, rheumatism, and catarrh. Infant mortality is not high. Idiotcy and imbecility are frequent. Fair hair and blue eyes are very common.

Though we know little or nothing of the original inhabitants of S., the physiognomy, character, and language of the present point to a Norse or Scandinavian descent. In Unst, &c., have been found cairns over long and short stone coffins, with skeletons, clay urns, weapons, and stone vessels. Tumuli and burned stones and earth are frequent, and contain remains of rude buildings and stone implements. Circular strongholds of unhewn stone, called burghs or 'broughs,' are very numerous, generally on a cliff or headland, but also on artificial islands in fresh-water lochs. Mousa Isle has the most perfect 'brough' known. In Sandsting occur very rude underground houses, with the rudest stone implements. In Bressay was found a stone of the Christian period, with an Ogham inscription. Monoliths are rather frequent. Stone circles are rare, and never large.

SHI'BBOLETH (Heb. ear of corn, or stream), the test-word used by the Gileadites, under Jephthah, after their victory over the Ephraimites, recorded in Judges xii. 6. It appears that the latter could not pronounce the *sh*, and, by saying sibboleth, betrayed themselves, and were slaughtered mercilessly. It may be noticed that all those Hebrew names in the Old Testament, which commence with the *sh*, have now, through the inability of the Septuagint to render this sound in Greek, become familiar to us through the versions that flowed from it, as beginning with the simple *s*, e. g., Sem, Simon, Samaria, Solomon, Saul, &c. The word Shibboleth is used in modern languages in the sense indicated: viz. a test of speech and manners of a certain party or class of society.

SHIEL, Loch, in the west of Scotland, forms part of the boundary between the counties of Argyle and Inverness, separating the district of Moidart on the north from those of Sunart and Ardgower on the south. The head of the loch is about 16 miles west of Fort-William. It is 15 miles long, and about one mile broad, and communicates with the sea by Shiel Water and Loch Moidart.

SHIELD, a piece of defensive armor, borne on the left arm, to ward off the strokes of the sword and of missiles. It has been constantly used from ancient times through the middle ages, till the invention of firearms rendered it useless. The large shield worn by the Greeks and Romans (Gr. *aspis*, Lat. *clipeus*) was cir-



Shields.

cular, and often ornamented with devices. Another form of shield (Lat. *scutum*) was used by the Roman heavy-armed infantry, square, but bent to encircle the body. The early shield or knightly escutcheon of the middle ages was circular in outline, and convex, with a boss in the center; the body generally of wood, and the rim of metal (No. 1).

In the 11th c., a form came into use which has been compared to a boy's kite (No. 2), and is said, with some probability, to have been brought by the Normans from Sicily. It was on shields of this shape that armorial designs were first represented. These shields were in reality curved like the Roman *scutum;* but after heraldry began to be systematized, we generally find them represented on seals, monuments, &c., as flattened, in order to let the whole armorial design be seen. In the 13th c., this long and tapering form began to give place to a pear-shape (No. 3), and a triangular or heater-shape (No. 4). During the 14th c., these new forms became more generally prevalent, and the heater-shape, which was perhaps most frequently represented on armorial seals, began to approach more to an inverted equilateral arch. The same variety of forms, with some modifications, continued during the 15th c., a tendency appearing in all representations of the heater-shaped shield to give it more breadth below. A notch was often taken out in the dexter chief for the reception of the lance, in which case the shield was said to be *à bouche* (No. 5). Subsequent to the middle of the 14th c., when the shield came to be depicted as surmounted by the helmet and crest, the shield is often represented *couché*, that is, pendent from the corner (No. 6), an arrangement said to have originated in the practice of competitors hanging up their shields prior to a tournament, where, according to De la Colombière, if they were to fight on horseback, they suspended it by the sinister chief, and if on foot, by the dexter chief. A square shield denoted a knight-banneret. Shields of arms were often represented as suspended from the *guige*, or shield-belt, which was worn by the knights to sustain the shield, and to secure it to their persons.

After the introduction of firearms made shields no longer a part of the warrior's actual equipment, the form of the shields on which armorial bearings were depicted, on seals, monuments, brasses, &c., varied greatly in form, and generally speaking, became gradually more tasteless, fanciful, and unmeaning (Nos. 7, 8, 9). A tendency has, however, been shown in recent heraldry to recur to the artistic forms prevalent in the 14th and 15th centuries.

In early times, shields of the form which generally prevailed at the period, were exhibited on the seals and monuments of ladies; but about the 15th c., the practice began, which afterwards became usual, of unmarried ladies and widows (the sovereign excepted) bearing their arms on a lozenge instead of a shield.

The heraldic insignia of towns, corporations, &c., as well as individuals, are placed on shields. The bearing of Merchants' Marks (q. v.) in a shield was prohibited by the heralds of the 16th c. under severe penalties, and yet not a few instances are to be found on monumental brasses of these devices being placed on shields.

SHIELDS, North, a seaport and market-town of Northumberland, in the parish of Tynemouth, on the north bank of the Tyne, and at the mouth of that river, opposite South Shields, and eight miles east-north-east of Newcastle. It stretches more than a mile along the river-bank, and is rapidly extending westward, owing to its rising trade and manufactures. There are numerous collieries in the vicinity, and the Northumberland Docks, which are within the borough, export more than a million tons a year. The harbor is bordered with quays; and the quays of North and South Shields (which are, however, separate ports) are spacious enough to accommodate 2000 vessels of 500 tons each. North and South Shields possess together upwards of 200,000 tons of shipping. The building of wood and iron vessels, and tug-steamers, the manufacture of anchors, chain-cables, ropes, blocks, masts, and other articles of ship-furniture, are the principal branches of industry. North S. has a free library, sailor's home, and theater. In conjunction with Tynemouth (q. v.), and three smaller townships, it forms a municipal and parliamentary borough, named after Tynemouth, and sends one member to parliament. Pop. of parl. and mun. borough of Tynemouth (1871), 38,941, of which total, however, only 8619 belonged to North Shields; (1881) 43,863.

SHIELDS, South, a custom-house port, municipal and parliamentary borough and market-town of Durham, on the south bank of the Tyne, and at the mouth of that river, 9 miles east-north-east of Newcastle by river and railway. The town stretches for two miles along the side of Shields harbor, which is lined with numerous dockyards and manufactories. The Tyne Dock, containing 50 acres of water space, in which upwards of a million tons of coals are annually shipped, and a large import trade is carried on, is within the borough. The market-place is a spacious square in the center of the town, near which is the large church of St. Hilda. The town, with North Shields, is one of the chief ports in the kingdom for the building of iron ships, iron screw-steamers, and tug-steamers. There are large alkali, bottle, and glass works, and every kind of manufacture connected with shipping. A steam-ferry for passengers and carriages plies day and night between the two towns, one on the north, and the other on the south side of the entrance to the Tyne. Shields bar has been

removed by dredging, in order, with the piers, to form a harbor of refuge. The sea-coast, in the neighborhood, is interesting from the rocks and caves. The life-boat is a South S. invention. South S. sends one member to parliament. South S. possesses a large public library, with news-room, and large hall for public meetings. There is an extensive colliery, that of St. Hilda's; a school board; and Tyne Pilotage Board. The Nautical College, founded on a bequest of £30,000, was opened in 1869; it includes a museum and observatory. Pop. (1861) 35,239; (1871) 45,336; (1881) 56,922.

SHI'ITES ('sectaries,' from the Arab. *Shiah, Shiat*, a party, a faction), the name given to a Mohammedan sect by the 'Sunnites' (q. v.), or orthodox Moslems. The S. called themselves 'followers of Ali,' and have special observances, ceremonies, and rites, as well as particular dogmas of their own. The principal difference between the two consists in the belief of the S. that the Imamat, or supreme rule, both spiritual and secular, over all Mohammedans, was originally vested in Ali Ibn Abi Taleb, and has been inherited by his descendants, to whom it legitimately now belongs. The Persians are S.; the Turks, on the other hand, are Sunnites; and this division between the two nations dates chiefly from the califate of Mothi Lilla, the Abasside, in 363 H., when political dissensions, which ended in the destruction of Bagdad and the loss of the califate of the Moslems, assumed the character of a religious war. The S. themselves never assume that (derogatory) name, but call themselves *Al-Adeliat*, 'Sect of the Just Ones.' They are subdivided again into five sects, to one of which, that of Haidar, the Persians belong: the present dynasty of Persia deriving its descent from Haidar, a descendant of Ali. Ali himself is, by some of them, endowed with more than human attributes.—The S. believe in metempsychosis and the descent of God upon His creatures, inasmuch as He, omnipresent, sometimes appears in some individual person, such as their Imams. Their five subdivisions they liken unto five trees, with seventy branches; for their minor divisions of opinions, on matters of comparatively unimportant points of dogma, are endless. Yet, in this they all agree, that they consider the califs Abu Bekr, Omar, and Othman, who are regarded with the highest reverence by the orthodox Sunnites, as unrighteous pretenders, and usurpers of the sovereign power, which properly ought to have gone to Ali direct from the Prophet. For the same reason, they abominate the memory of the Ommayad califs, who executed Husain, a son of Ali, and they still mourn his death at its anniversary. They likewise reject the Abasside califs, notwithstanding their descent from Mohammed, because they did not belong to Ali's line.

SHIKARPU'R, the most important trading-town, and probably the most populous town, in Sinde, stands about 20 miles west of the Indus, half way between Multan and Kûrrachi. The district in which it stands is so low and level, that, by means of canals, which are supplied from the Indus, it is flooded every season. Its climate, notwithstanding, is said to be not unhealthy. The inundated quarters are extremely fertile and produce great crops. Groves, orchards, and fruit-gardens surround the town; sugar-cane is largely grown. S. is situated on one of the great routes by the Bolan Pass from Sinde to Afghanistan, and the transit-trade to that country and to Khorassan is important. The bankers and financiers of S. are known and trusted from Astrakhan to Calcutta. S. is the chief town of the district of the same name, which has an area of 8813 sq. m., and 776,227 inhabitants. Pop. of the town (1872) 38,107, about 20,000 of whom are Hindus, and the rest chiefly Mohammedans.

SHI'LKA. See AMOOR.

SHILLING, the name of a money in use throughout many European states, partly as a coin, and partly as a money of account. In all probability, the name, as well as the thing itself, is derived from the Roman *solidus*, which, with other remains of Roman institutions, was adopted by the Franks and other Germanic nations. See PENNY, SOLIDUS. Others give more fanciful derivations, as from *schellen*, to ring, on account of the particularly clear ring of the coin, and from St. Kilian, whose effigy was stamped on the shillings of Würzburg. The *Solidus-shilling* of the middle ages has suffered various degrees of diminution in the different countries. Thus, the English silver shilling is $\frac{1}{20}$th of a pound sterling; the Danish copper one is $\frac{1}{96}$th of a ryksdaler, and = $\frac{1}{4}d.$ sterling; and the Swedish shilling is $\frac{1}{48}$th of a ryks-daler, = $\frac{1}{8}d.$ sterling. In Mecklenburg, Slesvig-Holstein, Hamburg, and Lübeck, the shilling is used as a fractional money of account (the $\frac{1}{10}$th of a mark, $\frac{1}{48}$th of a thaler), and as small silver change (each coin being a shade less in value than 1*d.* sterling). The French *sou* is another representative of the solidus. See POUND MINT.

SHIN, LOCH, in the south of Sutherlandshire, measures 18 m. by 1 m. The Shin Water, a famous trout-stream, carries the waters of the loch into Oikell Water. Loch S. abounds in trout and salmon.

SHINGLES, flat pieces of wood used in roofing like slates or tiles. Such roofs are much used in newly-settled countries where timber is plentiful. The wood is chosen from among the kinds which split readily and straightly, and is usually some kind of fir. It is cut into blocks, the longitudinal faces of which are of the size intended for the shingles, which are then regularly split off in thicknesses of about a quarter of an inch.

SHINGLES (probably derived from Lat. *cingulum*, a belt) is the popular name for the variety of *Herpes* (q. v.) which is known as *H. zoster*.

SHINTOISM. See JAPAN.

SHIP (from the root *skap-*, to scoop, dig) is a term applied with great vagueness to all large vessels; while under *shipping* would be included vessels of all sizes, excepting boats without decks. Among seamen, the expression is said to be limited to vessels carrying three masts, with a royal-mast surmounting each; but the development of steam-navigation, in which the largest vessels have sometimes only a schooner rig, must have gone far towards obliterating this distinction.

SHIP-BROKER, INSURANCE BROKER. A ship-broker is a person employed in the buying and selling and freighting of ships. His duties include adjusting the terms of charter-parties and bills of lading, settling with the master for his salary, collecting freights on goods brought into port, arranging with passengers for the terms of their passage, and generally managing all business transactions occurring between shipowners and the shippers or consignees of goods. The charges made by ship-brokers are generally about two per cent. on their gross receipts. Ship-brokers have been ruled not to be within the acts for the regulation and admission of brokers.

The business of an *insurance broker* is usually combined with that of a ship-broker. Marine insurance is in Great Britain to a large extent transacted by brokers. Those who insure are in most cases capitalists, who are known to the broker as persons prepared to undergo any risks which he recommends to them. The broker, who has a list of persons ready at a moment's notice to underwrite a policy, is the mutual agent for both parties. He procures the subscriptions of the underwriters, arranging with them the rate of premium and conditions of the risk, receiving from them the amount of their respective subscriptions, in the event of loss; and, when such loss is partial, arranging the proportion to be recovered from the different underwriters. An insurance broker charges as profit five per cent. on the premium, and one-half per cent. deducted from all claims recovered from the underwriters. An insurance broker is personally liable to the underwriters for the amount of the premium, but incurs no liability to make good the amount insured to the owner of the ship and goods, who, in case of loss, must look to the underwriter alone for indemnification.

SHIP-BUILDING. See NAVIGATION; NAVIES, ANCIENT AND MODERN; and NAVY, BRITISH. From crossing a river or lake on a floating log, or on two or more logs fastened together raft-wise, the first steps towards ship-building were probably Canoes (q. v.), and Coracles (q. v.). The earliest Egyptian drawings show boats constructed of sawn planks, and having sails as well as numerous oars. So far as can be learned from ancient sculptures, the galleys of the Mediterranean at the dawn of civilization appear to have been open, at least in the middle portion; to have been built with keel, ribs, and planking, and to have been strengthened cross-wise by the numerous benches on which the rowers sat. Ships continued, however, to be generally of small draught, for they were beached every winter; and Cæsar mentions, as a noteworthy circumstance, that some of the long ships with which he invaded Britain could only approach the shore to such a point that the soldiers in disembarking were breast-high in the water. The Romans built their vessels of pine, cedar, and other light woods; but their ships of war were of oak at the bows, clamped strongly with iron or brass, for use as rams—a custom now curiously revived after 2000 years of disuse. According to Cæsar, the Veneti first built entirely of oak. The speedy oxidation of iron bolts and fastenings led to their supersession by copper and brass about the time of Nero. Before this time, the planks had been calked with flax, and the seams had been pitched. There is evidence to show that in Trajan's reign sheathing of lead fastened on with copper nails had been used as a protection for the timbers from the devastating insects of the Mediterranean. With the decline of Roman greatness came a new era for ship-building. The hardy Norsemen had chopping seas and Atlantic swells to fight with; their ships differed much from the stately galleys and quinqueremes of the empire. Far smaller, they were built more stoutly, with bluff bows, and a lug-sail which could be braced well up to the wind. The Norse ships must have been of considerable power, for there is good evidence that they had visited the coasts of the New World at an early period.

We have, however, very little knowledge of the construction of these vessels, except that they had high prows and sterns to resist the waves, and that they were calculated for sailing in opposition to the galleys, which were for rowing. The introduction of galleys by Alfred, pulled by 40 and 60 oars, and twice as long, deep, nimble, and steady as the Danish ships, kept the latter in check; but it also checked the development of ocean-navigation, for the galleys were only fit for shore-service. The ships gradually increased in size. Hardicanute had a galley pulled by 80 oars; and contemporaneously, the Venetians are said to have built ships of 1200 to 2000 tons. William invaded England in miserably small sailing vessels; but large—indeed very large—vessels appear to have existed in the time of Richard I. John systematized ship-building by establishing a royal dockyard at Portsmouth. Large ships constructed for sailing only seem to have come into general use, together with the mariner's compass, in the beginning of the 14th century. One hundred and fifty years later, the addition of the bowsprit added much to the sailing-powers of vessels.

In Ellis's Collection of Letters there is one, dated 1419, from John Alcêtre to King Henry V., concerning a ship building at Bayonne for that monarch. This letter is curious, as showing how many of the present terms then existed, and also that the 'Kynges schyppes' were of considerable dimensions (e. g., 'the stemme is in hithe 96 fete; and the post 48 fete; and the kele ys yn leynthe 112 fete.') Before this period, ships had been built strong enough to encounter ice in the whale-fishery. From this period the history of ship-building is resolved into the history of individual parts, for the main principles of wooden ships were already established. In Henry VII.'s reign, the cumbrous fourth mast began to be dispensed with; in that of his successors, shifting top-masts came into fashion, the lofty stems and sterns (which must have precluded sailing on a wind) fell gradually into disuse. Port-holes were invented at least as early as 1500. In 1567, there were cutter-rigged vessels in the British seas. In the century ensuing, naval architecture was much improved by Mr. Phineas Pett, his son Peter, and by Sir Anthony Deane; but the best naval architects were not in England. Within the present century, the introduction of steam has led to the building of ships with finer lines, both for bow and stern. About 1836, iron was introduced as a material for ship-building, and has now (1878) so far superseded wood, that, taking steamers and sailing ships together, 10 iron vessels are built for 1 wooden one.

Adverting now to the actual art and practice of ship-building, the subject is divisible into two distinct portions—the theoretical, known as *Naval Architecture;* and the practical, called *Ship-building.* The naval architect designs the form of a ship with reference to the objects intended in her construction, to the speed required, powers of stowage, &c.; while the ship-builder works from his drawings, and gives practical effect to the theoretical design.

Naval architecture on a theoretic basis is of recent date, for, as in all cases, practical efforts, more or less in the dark, have preceded by many ages the theorems of the man of science; nor is it at present by any means an exact science: some most successful ships have been but happy experiments. Our present knowledge of naval architecture we owe mostly to the researches of such men as the late Professor Rankine, Mr. Scott Russell, Mr. Froude, and others. All ships have to possess certain qualities, the principal of which are buoyancy, stability, handiness, and speed; but it is not possible for any ship to possess at the same time the maximum of all these, as to some extent they neutralize each other. The skill of the naval architect is shown in duly proportioning them to one another, ascertaining which are the more important in each particular case, and providing these without unduly impairing the others. In some vessels, it is essential that the greatest possible speed should be attained; while, as they are to work only in smooth water, their degree of stability (or freedom from excessive rolling, and tendency to right themselves when heeled over by a wave) is only secondary. In others, which have to weather long-continued storms in mid-ocean, speed may have to be sacrificed to attain greater steadiness. In sailing-vessels, where the means of propulsion is not under control of the crew as in steamers, handiness—the property of answering quickly to their helms, and of readily performing various manœuvres (such as tacking) under all conditions of weather—is often the quality to which most attention has to be paid. Along with all these things, the ship has to be made so as to have the largest possible amount of cargo or passenger space consistent with the proper degree of buoyancy. The degree in which a ship possesses the various qualities named depends chiefly upon her external form and dimensions, about which the following general statements may be given:

An increase of length gives an increase of displacement of water, and therefore of carrying-power; if this be not desired, it allows of finer lines forward and aft, and consequently greater speed. It also increases the resistance to lee-way. The greater friction of the water on the longer sides does not appear to be material. Against the increase is to be set a diminished power of turning, tacking, and wearing. It also involves a more careful balancing of weights in the fore and after portions of the ship, for the moment of inertia of a small weight may become large in a long vessel, from being such weight multiplied into the square of its distance from the ship's center of gravity.

The increase of breadth gives greater stability to the ship, and, by allowing of more sail, indirectly greater speed; but directly, it increases the resistance to the water. Of course, greater breadth enables greater bulk to be carried. Depth is a question dependent on the seas to be navigated, the object for which the ship is intended, and many other reasons. It is to be borne always in mind that the consumption of stores on a long voyage will change the draught of a ship considerably. Practice has proved unequivocally that ships sail better for drawing more water aft than forward.

Passing now to the actual designing of vessels: the architect works on paper only; he has therefore to show on a flat surface, for the builder's guidance, the exact position, curvature, and relief of every line and point in his proposed structure. He accordingly draws three plans, on each of which every point of the ship is traceable: the *sheer-plan*, showing all lines of length and height; the *half-breadth plan*, lines of length and breadth; and the *body-plan*, which shows breadth and height. From these combinations, the exact position of every point is determinable.

Figures 1 to 3 show those plans, called *construction drawings*, on the same scale for the *Great Eastern* steamship. The sheer-plan represents, in its outside line, a vertical plane through the keel. The dotted lines, 1, 2, 3, are the edges of supposed horizontal planes drawn at various heights. The curved lines, I, II, III, are the edges, as they would appear on the outer covering of the ship, of vertical planes drawn parallel to the central plane through the keel. The uprights, A, B, &c., A_1, B_1, &c., are the edges of supposed planes drawn at given distances from the line of greatest breadth X, at right angles to the plane through the keel.

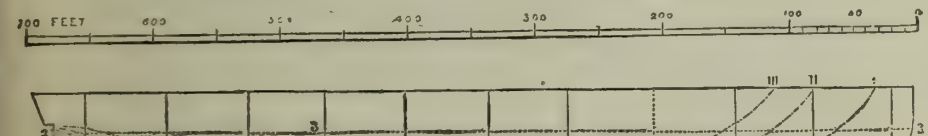


Fig. 1.—*Great Eastern*—Sheer Plan.

The half-breadth plan represents one half of the ship's upper deck, as regards the black outer line; the horizontal, vertical, and cross sections of the sheer-plan appearing again under different conditions. The vertical longitudinal sections become straight lines parallel to the keel; the horizontal sections appear as curves taken at different heights on the vessel's sides. The body-plan is the ship looked at end-on; the outer line being her cross section at the line of greatest breadth, and the horizontal and vertical sectional lines appearing at right angles to each other. The lines on the left side correspond to the cross sections of the after-body (that is, the portion of the ship nearer the stern than the line of greatest width), and show the curvature of the ship's sides towards the stern; while in a similar manner those on the right side show the curvature up to the bow. Of course, in working-drawings from which ships are to be actually built, the scale employed would be very large; and instead of three or four sectional lines in each direction, a great number would be inserted for the guidance of the builder. With these three plans in hand, the workman has the exact position of every point in the ship's exterior coating exactly defined. Even the un-

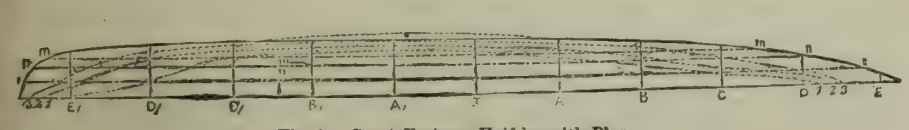


Fig. 2.—*Great Eastern*—Half-breadth Plan.

professional observer need not strain his imagination greatly to clothe these flat plans with their dimensions of length, breadth, and depth, and to conjure up before his eyes the precise form of the goodly ship represented.

Further, to illustrate the lines of different classes of ships, figs. 4 and 5 show the half-body plans of well-known vessels, the clipper *Lord of the Isles*, and the yacht *America*.

With the completion of the construction drawings the work of the naval architect ceases, but in most cases the two professions of naval architect and shipbuilder are combined in one firm, if not in one man. It is then to be decided of what material the ship shall be constructed. The choice lies between iron, steel, wood, and a combination of wood and iron. Of the many woods employed, oak, teak, and fir are those most commonly used. The building of a wooden and of an iron ship are quite distinct operations, the requisite strength being obtained in a different manner in each case. It is necessary, therefore to consider separately the principles of wooden ship-building and iron ship-building; and as the older and most time-honored process, we will first deal with the art of the shipwright who forms the vessel of timber.

Fig 3.—*Great Eastern*—Body Plan.

In addition to the construction drawings which we have described, it is usual also to construct a small wooden model of the ship—upon a scale very often of ¼ inch to the foot—which shows the designer what his ship is going to look like better than the flat paper can do. This model is made of a number of horizontal layers of wood, and upon it the whole arrangement of the plating of the ship is marked, with the position of all the joints, &c.

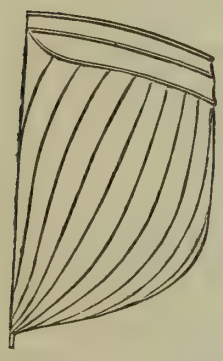


Fig. 4.—Clipper—*Lord of the Isles.*

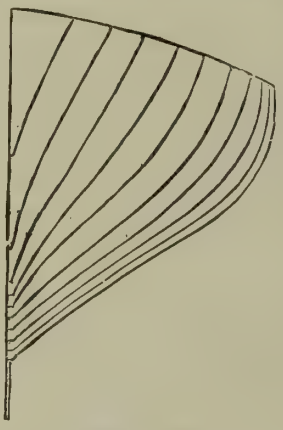


Fig. 5.—Yacht—*America.*

Wooden Ship-building.—The first process is to develop, or 'lay off,' on the *mould-loft floor*, certain full-size working sections of the required ship. These are taken from the construction drawings and the model, and are built up of planks. The combinations of these pieces of plank show the shape in which the several timbers will have to be cut, to impart the necessary curvature and strength.

The next step in actual construction is to prepare the slipway, by raising a number of strong blocks of timber a short distance apart, on which the keel shall rest, and which shall sustain the entire ship when built. These blocks are composed of several pieces, and it is of the utmost importance that their upper surfaces be in an exact line. That line is made at an inclination of ⅝ths of an inch to a foot; and the keel of the ship, and the ship itself, have consequently that slope to the horizon while building. This inclination is for the facility it affords in launching the completed vessel. On the blocks is laid the keel, which may be called the back-bone, and is certainly by far the most important timber in the ship. From it start the ribs, the stem, and the stern-post; so that any serious accident happening to the keel, involves the breaking up of the whole structure. It is therefore made of great strength, being, in a first-rate, no less than 20 inches square. The material is usually elm, on account of its toughness, its non-liability to split, and the fact that immersion in sea-water preserves it. The pieces of which it is composed are united by the strongest kind of scarph joint (see CARPENTRY).

What the keel is to the bottom, the stem and stern-post are to the bow and stern of the ship, forming the keys from which the ends of the planking (technically called the 'butts') and all longitudinal supports start. Each is, of necessity, of great strength, and they rise from the respective extremities of the keel. The *stern-post* has to bear the rudder, and is usually made, when possible, of one piece of timber; it is united to the keel by a mortise and tenon joint. In screw-steamers, there is a second stern-post, forming the forward support for the screw.

The extreme outlines of the ship being now established, the builder proceeds with the timbers to form the bottom and sides, which together constitute the *frame*, corresponding to the ribs in an animal. The ribs form the sides of the ship, and are placed at from 2 feet 6 inches to 3 feet 9 inches from center to center. Up to the water-line, the spaces between them are filled in solid with timbers of equal thickness. For this purpose, in the midship-body the keel is crossed at right angles or nearly so, by certain timbers which form the *floor*. The keel is let about three-fourths of an inch into a groove running along the bottom of the floor, while above the floor, the *keelson* is a massive timber, parallel to the keel. The keel and keelson are bolted firmly together by long copper bolts, which pass through the timbers of the floor, and completely fix the latter. As an additional strengthening to the frame in large vessels, *side* or *sister keelsons* are bolted on to the floor or futtocks, a short distance on each side of the principal keelson. Fig. 6 is a cross section of a three-decked wooden vessel, showing a complete rib, with the principal parts as they are commonly arranged amidships. Near the ends of the ship, the frames no longer stand at right angles to the keel, but are necessarily bent or canted round.

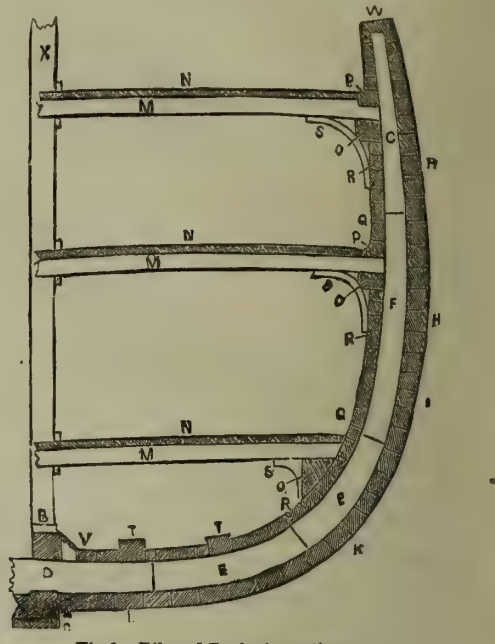


Fig 6.—Rib and Decks in section:
A, keel; B, keelson; C, false keel; D, floor; EE, futtocks; F, top-timber; G, lengthening piece; HH, wales; I, diminishing planks; K, bottom planks; L, garboard strakes; M, beam; N, deck; O, shelf; P, waterway; Q, spirketting; R, clamps; S, knees; T, side-keelsons; V, limber strakes; W, rough-tree rail; X, mast.

After the main skeleton, as it were, of the ship is built, the skin is the only thing remaining to complete its exterior. This is represented by thick wooden planking, fastened on to the ribs, the lowest layer pressing into the rabbet of the keel, and the highest reaching to the uppermost bulwark. The thickest planking is at the bends or wales, marked H in fig. 6, where it varies from 4½-inch in small vessels to 10-inch in ships of the first class. Every complete line of planking from stem to stern is styled a *strake*. Oak and fir are the woods mostly used for the skin, and elm for the planks nearest the keel. The planks are generally fastened to the ribs by copper bolts, but wooden treenails are frequently employed, as less in weight than copper, and less liable to split the wood. The comparative utility of wood and copper fastenings for the strakes is still a disputed point.

In a well-constructed ship the filling in of the timbers to a level above the water-line should be so accurately formed that she would float without her planking; but when the latter has been well calked, it is certain that it adds greatly to the dryness of the ship, while it aids materially in binding her several parts together.

At frequent intervals across the ship, and at the heights of the several decks, are inserted the *beams*, which are solid masses of timber, either in one piece or scarphed. These prevent the ship from collapsing, and at the same time support the decks. The beams and decks are shown at M and N respectively in fig. 6. The beams are always made convex upwards, principally for the sake of preventing water lodging on the decks. When the beams are

well established, the hatchways and mast-holes are traced out. This done, the deck is laid down of straight-grained hard wood, and the planks are calked and pitched between, until the deck or platform becomes perfectly water-tight.

Along the inside of the bottom are laid the *sister keelsons* or *side keelsons*, if the ship be large, and all spaces are filled up with planking, except the width of one plank next the keelson on each side, which is left for a drain to carry all refuse-water to the foot of the pumps.

Iron Ship-building.—Iron affords in many respects a better material for ships than wood. In the first place the same strength may be obtained with less weight; secondly, iron plates can be bent to any curve, so that the combinations necessary for strength in wooden vessels can be avoided. The laying off the lines of the

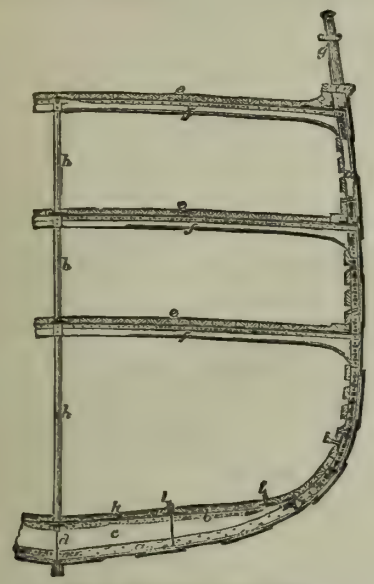


Fig. 7.—Section of Iron Ship:
a, frames; *b*, reverse angle-irons; *c*, floors; *d*, keelson plate; *e*, *e*, decks; *f*, *f*, deck beams; *g*, bulwarks; *h*, *h*, stanchions; *i*, *i*, bilge keelsons; *k*, ceiling.

vessel full size upon the mould-loft floor is the first process in iron as in wooden ship-building. Rough wooden templates are here made of the cross-sections of the ship, one template to every cross section.

The slip-way is prepared in much the same way as in the case of a wooden ship. The keel is generally of flat bar-iron—sometimes in several thicknesses—the different lengths being scarphed at the ends and riveted together, or sometimes welded. In the cross-section of a 2000-ton iron vessel given in fig. 7, the keel is in five thicknesses; in the middle a center-plate which is carried upwards through the floors, and forms a keelson; on either side of this a thick bar, and outside these again the two lowermost plates of the skin bent downwards. The whole five thicknesses are riveted together.

The ribs in an iron ship are called 'frames.' They are always made of angle-iron (*a*, fig. 8), and are placed from 18 inches to 2 feet apart. They are bent, while red-hot upon a large flat cast-iron plate into the proper curve, fixed by the templates already mentioned. The frames, when thus bent to the right shape, are

Fig. 8.

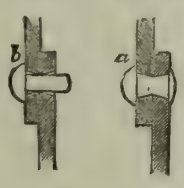


Fig. 9.

set up in place upon the keel. To them are fastened at the bottom the *floors*, which are narrow plates running across the ship; and frequently additional stiffness is gained by running 'reverse' angle-irons along the top of the floors, throughout at least a considerable portion of the ship's length. The beams which support the deck, and which are convex upwards as in wooden ships, are made of such a section as is shown in *b* or *c*, fig. 8.

After the frames, floors, and beams are in place, the plating commences, each particular plate being of a size and shape exactly as determined by the model. The lowest plates of all are called the 'garboard strake,' and are usually bent downwards and riveted to the sides of the keel, as in fig. 7. The thickness of the plates gradually diminishes upwards, till the 'sheer strake'—the strake at the level of the main-deck—is reached, and this is always made very strong. The deck beams are further secured and stiffened by longitudinal and diagonal plates called 'stringers.' All the iron-work of a ship is fastened together by rivets. Holes are first punched or drilled in the plates and angle-irons—in most cases before they are put together. The holes having been made exactly to overlap, a red-hot rivet is inserted through them, as in *b*, fig. 9. A man, called a 'holder-up,' holds the head of the rivet forcibly in its place with an iron tool, while two riveters on the other side of the plate strike its end rapidly with their hammers, until it is all hammered down as at *a*. The contraction of the rivet when it cools causes it to hold the two plates still more tightly together. Iron ships are always divided into a number of compartments by transverse partitions called 'bulk-heads.' These partitions can easily be made water-tight, and then afford great additional security to the vessel, as, in the event of a leak occurring, it will often be possible to confine the water to the space between two bulkheads, and there will be sufficient buoyancy in the other compartments to keep the vessel afloat. The bulkheads are fitted with water-tight doors, and besides being a source of safety, they are also the cause of great additional transverse strength.

By the time that the external plating of the ship is finished, and the beams and bulkheads all in their places, she is ready for launching; much, however, still remains to be done to her. Most frequently, the greater part of the decks has to be laid, and the whole of the cabin fittings to be put up; the rudder and steering gear have to be fitted; the wooden 'ceiling' (which lines the hold) to be put in; the masts have to be set, and all the spars, sails, and rigging put up; and lastly, in a steam-vessel, the engines and boilers have to be placed and properly secured on the seatings provided for them.

Steel has till lately been little used in the construction of ships. As it possesses much greater strength than iron, all the various parts of a steel ship may be made much lighter for the same strains than in an iron one; but there has been a very widespread distrust of it, based on the difficulty of getting really reliable steel plates and bars. But since 1880 the use of steel has been steadily growing in favor. On the Clyde, for example, the tonnage of steel-built vessels in 1879 was only 18,000 tons; in 1880, it was 42,000 tons; in 1881, 66,600 tons; while in 1882, 60 vessels were built of steel, with a tonnage of 108,254 tons.

Ships of Iron and Wood conjointly, or 'composite' vessels. It was at one time thought that various advantages would be obtained by the use both of iron and of wood in the same ship, the frames and beams being made of the former material, and the skin of the latter. Composite vessels were always more used by the French than among ourselves, but although Lloyd's committee have thought this class of vessels of sufficient importance to publish special rules in reference to it, very few composite ships are now constructed. Of above 1000 ships built in a year, not more than a dozen or so are composite; and of the total new tonnage added in a year to the register of British shipping, an extremely small proportion belongs to composite vessels.

In some recent ships of war (e. g., the *Triumph* and *Swiftsure*), the vessels, after being built of iron in the usual way, and heavily armored, have been covered all over with planking, and copper-sheathed. The object of this has been to insure that the ship's bottom shall not be fouled with weeds and barnacles, which so easily happens with iron vessels, as these frigates are intended for very high speeds.

Internal Arrangements of a Ship.—Whether the vessel be of iron or wood, her internal design must follow the purposes for which she may be required. As a general principle, the ship is divided into a greater or less number of platforms, floors, or decks (q. v.), devoted to various purposes. In a ship-of-war a large portion is required for the men, the remainder being occupied by warlike stores, provisions, and coal. In a merchant-vessel, far less space is allotted to the crew, and far more to the cargo. In every ship, a space must be provided for the carriage of provisions and water proportionate to the number of the crew and the intended duration of voyages. A steamer differs from a sailing-vessel in requiring a large compartment amidships to be kept clear for her engines and boilers. In screw-steamers, to the height of the boss of the screw above the keelson, a tunnel, known as the *screw-alley*, has to be kept open for the shaft of the screw from the engine-room to the stern. The heavier portion of a cargo, as coal and water, is carried immediately above the keel, so that the center of gravity may be as low as possible, and for the same reason the engines and boilers are placed as low down as practicable. For various details concerning the formation and arrangement of ships, the reader is referred to detached articles descriptive of the respective portions, as DECKS, MASTS, CAPSTAN, CHAINS, CHANNELS, HOLD, KEEL, SAIL, SHEATHING, &c.

Lloyd's.—In order that a ship may be insured by the underwriters, it has to be inspected and surveyed by one of the survey-

ors of 'Lloyd's.' According to the reports of their surveyors, the committee of Lloyd's Registry classify the vessel, affixing to its name a letter which is intended to be an indication of its qualities. For wooden vessels, these letters (in order of excellence) are A (in black or red), Æ, E, and I; for iron ships or steamers they are $\frac{A}{A}$, $\frac{A}{B}$, and $\frac{A}{C}$. Numbers put before these letters indicate the number of years for which they are to hold that grade; and numbers (1 or 2) put after the letters refer to the completeness of their equipment.

Of late years there has been a decrease in the *number* of sailing-vessels and steamers built, but an increase in the joint *tonnage* (as also in the number of steamers. There was a depression in the ship-building trade between 1874 and 1880; but the tonnage of ships built in 1881 for the foreign trade exceeded that of any previous year by 25,000 tons.

NUMBER AND TONNAGE OF VESSELS, THE BUILDING OF WHICH WAS COMPLETED IN THE YEAR 1875, IN THE UNITED KINGDOM.

Ports.	Sailing.								Steam.							
	Iron.		Wood.		Composite.		Total.		Iron.		Wood.		Composite.		Total.	
	Ves.	Tons.	Ves.	Tons.	Ves.	Tons.	Ves.	Tons.	Ves.	Tons.	Ves.	Tons.	Ves.	Tons.	Ves.	Tons.
England:																
Hull	..	..	11	789	..	..	11	789	5	4,261	..	..	..	..	5	4,261
Liverpool	14	15,713	1	237	..	..	15	15,950	11	5,307	..	..	..	..	11	5,307
London	1	1,964	7	700	..	..	8	2,664	18	7,513	1	13	1	140	20	7,666
Newcastle & Shields	9	7,634	..	..	..	..	9	7,634	47	30,068	14	375	..	..	61	30,443
Sunderland	34	34,036	21	8,716	1	1,335	56	44,087	26	21,880	..	..	1	510	27	22,390
Other Ports	23	24,021	278	23,028	..	..	301	47,049	53	31,023	38	753	2	20	93	31,796
Total England	81	83,368	318	33,470	1	1,335	400	118,173	160	100,052	53	1,141	4	670	217	101,863
Scotland:																
Glasgow	63	64,064	1	32	..	..	64	64,096	72	51,118	..	..	5	678	77	51,796
Greenock	32	30,943	7	257	..	..	39	31,200	39	13,879	..	..	..	..	39	13,879
Other Ports	10	10,567	37	6,955	..	..	47	17,522	15	7,097	3	568	1	89	19	7,754
Total Scotland	105	105,574	45	7,244	..	..	150	112,818	126	72,094	3	568	6	767	135	73,429
Ireland:																
Total	7	9,814	9	841	..	..	16	10,655	5	3,613	..	..	..	..	5	3,613
Total, United Kingdom	193	198,756	372	41,555	1	1,335	566	241,646	291	175,759	56	1,709	10	1,437	357	178,905

SHIP-MONEY, a tax had recourse to in England at various times, but especially in the reign of Charles I., for the equipment of a fleet. In 1007, when the country was threatened by the Danes, a law was made obliging all proprietors of 310 hides of land to equip a vessel for the protection of the coast. Elizabeth, at the time of the threatened Spanish invasion, required the various ports to fit out a certain number of ships at their own charge; and so great anxiety was shown by the public for the national defence, that London and some other ports furnished twice as many vessels as had been demanded. It was in 1626 that Charles first had recourse to an impost of this description, requiring each of the maritime towns, with the assistance of the neighboring counties, to arm a given number of vessels, 20 being required from London. In 1634 the tax was extended over the whole kingdom. A general spirit of resistance was immediately aroused, not so much in consideration of the amount of the tax, as of the objectionable feature that it was imposed by the arbitrary authority of the king alone, which had come to be regarded as an unwarrantable stretch of the royal prerogative. In 1637, the celebrated John Hampden, a gentleman of property in Buckinghamshire, resolved to confront the power of the government by disputing the legality of this exercise of the prerogative, and resolutely refused payment of the impost, an example in which he was followed by nearly the whole county to which he belonged. He was prosecuted in the Exchequer Chamber for non-payment, and his trial was watched with great interest and anxiety by the nation on account of the constitutional point involved in it. The judges, four excepted, pronounced in favor of the crown; but the trial had the effect of thoroughly arousing the public mind to the danger of the imposition of taxes by the royal authority alone. The Long Parliament, shortly after its meeting in 1640, voted ship-money illegal, and the sheriffs and others who had been employed in assessing it or collecting it to be delinquents; and cancelled the sentence against Hampden.

SHIPPING. See Merchant Ship. Act.

SHIP-WORM. See Teredo.

SHIPWRECKS, in ancient times, were deemed the property of the crown, but by a statute of Henry I., the harsh consequences of this law were avoided whenever any person escaped alive out of the ship; and in Henry II.'s charter it was declared that if either man or beast escaped alive, the goods should remain to the owners if claimed within three months; and the courts of law still further refined away all these harsh rules. Many nice distinctions have been made as to what goods constitute wreck, which is distinct from goods floating. See Flotsam. By the Merchant Shipping Act, 1854, which extends to the United Kingdom, the Board of Trade has the superintendence of all matters relating to wreck, and to jetsam, flotsam, and ligan. Receivers of wreck are appointed for various districts, and have power to summon assistance. When wreck is found by any person, he must give notice to the receiver of wrecks, and if nobody claim the property within a year, it is sold, and the proceeds, after paying salvage and other such expenses, are paid into the Exchequer. Persons plundering wreck are guilty of felony, and may be punished with three to fourteen years' penal servitude; and any person exposing false signals to cause wreck, may be sentenced to penal servitude for life.

The number of wrecks, casualties, and collisions from all causes on or near the coasts of the United Kingdom, reported in 1874–5, was 3590; a large increase on previous years, accounted for in great measure by the inclusion of small casualties not previously counted, &c. In the year 1879–80, a much larger number—5204—was reported. Of the casualties of 1874–5, about 1 in 23 resulted in loss of life. It having been found in numerous instances that the direction and force of the wind as given by the masters in their reports differed more or less from the particulars of weather reported to the Meteorological Office during 1872, steps were taken towards making strict inquiry at the moment into all such variations.

The life lost in 1874–5 was distributed as follows: In fishing smacks, 110; in vessels carrying heavy cargoes in bulk, 207; and in other vessels, 609. Three hundred and thirty-eight wrecks and casualties happened in 1874–5 to nearly new ships, 646 to ships from 3 to 7 years of age; 921 to ships from 7 to 14 years old; 1262 to ships from 15 to 30 years old; 567 to ships from 30 to 50 years old; 74 to ships between 50 and 60; 31 to ships between 60 and 70; 18 to ships between 70 and 80; 11 to ships between 80 and 90; 3 to ships between 90 and 100; and 3 to ships over 100 years old. The ages of 385 vessels were unknown. The sum paid by the Board of Trade out of the Mercantile Marine Fund for providing apparatus for saving lives on the coasts of the United Kingdom in 1874–5 was £11,010; the expenditure on this account in the 20 years 1855—1875, was £163,445, besides £1337 paid by the Admiralty on account of life-belts. At the end of June 1875, there were on the coasts of the United Kingdom 277 sets of rockets or mortar apparatus provided by the Board of Trade. The number of life-boats in 1875 was 273, of which 244 belonged to the National Life-boat Institution; and 29 (of which six were subsidized by the Board of Trade) were under other management. 548 stations were supplied with Captain Ward's life-jackets for the use of the coast-guard. The number of Volunteer Life Brigades in 1875 was 5, and the number of Volunteer Life Com-

panies, 1160. The number of lives saved on or near the coasts of the United Kingdom in 1878–9 was 3302—449 being saved by lifeboats; 269 by rocket and mortar apparatus lines, &c.; 228 by luggers, coast-guard, and other boats; 623 by ships and steamboats; 1535 by ships' own boats, &c.; and 198 by other means. The number of lives saved on or near the coasts of the United Kingdom in the 23 years 1856—1879 was 91,746. The number of inquiries held, 1878–9, before Wreck Commissioners at home, was 55; before magistrates, 76; in British possessions abroad, 165; and in naval courts abroad, 57.

SHIRA'Z, a celebrated city of Persia, and the capital of the province of Fars, in lat. 29° 41′ N., long. 52° 38′ E., was formerly a very flourishing city, and the ordinary residence of the Persian monarchs, but is now singularly divested of its ancient splendor. It is situated in a wide plain, on one of the limestone ledges which shoot out from the great West-Persian mountain system, 112 miles from the Persian Gulf, and 35 south-west of the ancient Persepolis (q. v.). It is inclosed by walls nearly four miles in circumference, and, previous to the great earthquakes which have repeatedly laid it in ruins, contained many splendid mosques, bazaars, caravansarais, and other public buildings. The houses, which are mostly built of stone, are superior in appearance to those of most other Persian towns; and the adjoining portion of the plain is of exuberant fertility, and is laid out in vineyards and in rose-gardens of great extent. The principal manufactures are silk, cotton, and woollen goods, cutlery, firearms, glass, and earthenware. The wine of S., which is very strong and resembles Tokay, is still famous throughout the East. Rose-water is also still prepared in large quantities. The trade of the town is transacted in the *Bazar-i-Wukell*, which is about a quarter of a mile long by 40 feet wide, and affords accommodation to several hundred shop-keepers. S. carries on trade with Yezd, Ispahan, and Bushire, from the last of which towns it receives Indian and European goods. The city was founded in 697 A.D., and from its beautiful situation and charming climate, became a favorite resort of the Persian princes; but a destructive earthquake in 1812 laid a large portion of it in ruins, and another in 1824, which cost the lives of 4000 of the inhabitants, completed the wreck of its prosperity. It was, however, rebuilt, and had obtained a pop. of 40,000 (its pop. previous to 1812 having been almost 60,000), when a third and more terrible visitation of this destructive agent, in April 1853, laid almost the whole town again in ruins, and caused the death of 12,000 people. It has since been partially rebuilt in a somewhat inferior style, and its pop. is now estimated at 25,000. It is celebrated for the number and eminence of the scholars and poets to whom it has given birth; chief of these is Sibuyah, the first of Arab grammarians; Hafiz (q. v.), the 'Anacreon' of Persia, whose tomb is half a mile north-east of the Ispahan gate; and Saadi (q. v.), whose mausoleum is 22 miles to the north-east.—See *History of Persia*, by Clements Markham, 1874.

SHIRE (Sax. *sciran*, to divide), a term which seems to have originated in the 8th c., and is applied to the districts, otherwise called counties, into which Great Britain is divided. A considerable number of the counties of England, as Kent, Essex, Surrey, Norfolk, Suffolk, were formed out of the petty kingdoms of the Anglo-Saxons, which, with the advancing tide of centralization, were gradually becoming consolidated into one great kingdom. As early as 800, an entry in the Saxon Chronicle relates that kings had ceased to reign among the *Hwiccas* (the inhabitants of the district afterwards known as Worcestershire), and that they were governed by an ealdorman acting under Cynwulf, king of Mercia. This substitution of ealdorman (or earls) for kings marks the gradual organization of the counties. It was sometimes found convenient to split up a kingdom into several shires. The civil, military, and judicial head of the shire was the ealdorman, whose office was not necessarily hereditary, though it had sometimes a tendency to become so. Twice a year he held the shire-mote, in which he and the bishop presided with equal jurisdiction. Among other questions which would come before the shire-motes were those that related to the boundaries of the respective shires. As a border thane pushed his occupation towards the frontiers of the shire to which he belonged, and came into collision with the occupants of the neighboring shire, questions necessarily arose which could only be settled by a compromise arranged by the two shire-motes, and these compromises may account for the irregular jagged boundaries which separate shire from shire, and occasional isolation of particular portions. Yorkshire, Durham, Cheshire, and Worcestershire derived their name from their ancient bishoprics. Various shires which had once an existence in the north, as Norhamshire, Islandshire, Hexhamshire, Hallamshire, Bamboroughshire, have merged into others. The term shire is nearly synonymous with county, yet not quite so, as there are certain counties with whose names the affix 'shire' is never used.

One explanation which has been given of this usage is, that the object of the addition of the syllable 'shire' is to distinguish the county from the town of the same name, and that it is therefore only applicable to counties bearing the same name with their county town. Another explanation is, that shire being a word of Anglo-Saxon origin, is not properly applied to any of the English counties except those which formed part of the larger Anglo-Saxon kingdoms. Neither of these reasons are exactly correspondent with the actual usage, by which shire terminates the names of all the English counties except the following: Northumberland, Cumberland, Westmoreland, Durham, Norfolk, Suffolk, Essex, Sussex, Middlesex, Kent, Surrey, and Cornwall. In Cheshire, we drop the final syllable of the town of Chester. Berkshire, Shropshire, and Hampshire are never used in their simple form, though sometimes abbreviated into Berks, Salop, and Hants. Shire is applied to all the Welsh counties except Anglesea.

In Scotland, the English tendencies of the sovereigns from the time of Malcolm Canmore to the war of succession, and the tide of immigration from the south, brought in, among other innovations, the division into shires. Its introduction seems to have begun early in the 12th century. Twenty-five shires or counties are enumerated in a public ordinance of date 1305. Nearly all the counties of Scotland may receive the terminal addition of shire. It is not applied to the island county of Orkney, and seldom to the counties of Bute and Caithness. Kirkcudbright is neither a shire nor a county, but a Stewartry. See STEWARTRY. The Irish counties are not generally called shires.

In England, south of the Tees, there was a sub-division of the shires into *hundreds*, which originally, in theory at least, seem to have been districts inhabited by 100 or 120 families; and were in some localities called *wapentakes*, these hundreds or wapentakes being further subdivided into *tythings*, inhabited by ten free families; and it became incumbent on every one to be enrolled in a tything and hundred for the purposes of civil government. In some of the larger counties there was an intermediate division to which that into hundreds was subordinate. Yorkshire had and still has its *Ridings*, (q. v.), Kent had its *Lathes*, and Sussex its *Rapes*. The division into hundreds and tythings never penetrated into the four northern counties of England, or into Scotland, where the *ward* and *quarter* were the immediate subdivisions of the county.

England possessed three *counties palatine*—Cheshire, Lancashire, and Durham—of which the earls formerly possessed all the judicial and fiscal powers of the crown, all now annexed to the crown (see PALATINE). Similar privileges belonged to the earldom of Stratherne in Scotland.

SHIRÉ, a river of South-eastern Africa, has its source in Lake Nyassa, from which it issues in lat. 14° 28′ S., and after a southerly course of 250 miles, joins the Zambesi. It flows through a cotton and sugar producing country of vast extent, is 80 to 150 yards broad, 12 feet deep, and never varies more than 2 or 3 feet from the wet to the dry season. Its current travels at the rate of 2½ knots an hour. The navigation is obstructed by cataracts over a space of 35 miles, in which it falls 1200 feet.

SHIRWA, or TAMANDUA, a lake of South-east Africa, north end 30 miles south-east of Lake Nyassa, lat. of center 15° 10′ S., long. 35° 40′ E. It is of an oval shape, tapering to the south; length, 60; breadth, 10 to 23 miles; and 1800 feet above the sea-level. It is surrounded by elevated land. On the west, between the lake and the River Shiré, Mount Zomba rises to 7000 feet. Several small rivers enter the lake on the south and west.

SHI'SDRA, or JISDRA, a town of European Russia, in the government of Kaluga, and 80 miles south-west from Kaluga, on the Shisdra, a branch of the Oka. It has manufactures of woollen cloth, glass-works, iron-works, tanneries, oil-factories. Pop. (1880) 11,703.

SHI'SHAK (in hieroglyphs, Shashank, the Susak, or Susakim of the Septuagint, and the Shishak of the Hebrew version, the Sessonchosis or Sesonchis of Manetho), the name of several monarchs of the 22d, or Bubastite Egyptian dynasty, supposed to have descended from foreign settlers in Bubastis, and to have been of Shemitic origin. The kings of this name were S. I., the first monarch of the dynasty, whose name is found in the portico built by the Bubastite dynasty at the great temple of Karnak, and on several statues of the goddess Pasht, which probably came from Luxor. Jeroboam fled to S. from the pursuit of Solomon, who wished to kill him, and lived there during the lifetime of Solomon. On the death of this monarch, Jeroboam quitted Egypt, and contended with Rehoboam for the possession of the crown. This struggle caused the division of the kingdom of David into two states, that of Israel and Judah. In the fifth year of Rehoboam, S. marched to Jerusalem with an army of 12,000 chariots, 60,000 cavalry, and an innumerable number of infantry, composed of Troglodytes, Libyans, and Ethiopians. He took the city, the treasures of the temple, and all the gold bucklers which Solomon had made. The conquest of Jerusalem is found recorded on the monuments of Karnak, on which S. I. is represented dragging before the God Ammon three files of prisoners, inscribed with various names of places, amongst which are Judæa, Mageddo,

Ajalon, Mahanaim, and other towns taken by S. in his line of march.

SHI'TTIM-WOOD. It is not certain what kind of wood is meant by this name in the Old Testament. The Ark of the Covenant was made of it, and probably it was a kind of wood distinguished both for beauty and durability. It has generally been supposed to be the wood of the *Acacia Nilotica*, which, however, is deficient in both these qualities. Another supposition is, that the wood of a species of olive is meant, *Olea similis*, which possesses them both, and is particularly remarkable for its durability.

SHIVES, a name used by cork-cutters to designate the small bungs used to close wide-mouthed bottles, in contradistinction to the phial-corks used for narrow-necked bottles.

SHO'A, a kingdom of Africa, the most southern division of Abyssinia, in lat. 8° 30′—10° or 11° N., long. 38°—40° 30′ E. Its boundaries, however, are by no means fixed, that on the W., where S. is bordered by the Galla tribes, being specially variable. An extensive tract in the east of the kingdom, between the capital, Ankobar, and the river Hawash is called Efat. The character of the country, and the condition of the people, are described under ABYSSINIA (q. v.).

SHOCK, COLLAPSE, AND REACTION. It is well known that some forms of injury, as, for example, a blow on the pit of the stomach, may occasion death without leaving any visible trace of their operation in the body, and, indeed, life may occasionally be destroyed even by sudden and powerful mental emotions. In such cases as these, death is said to result from shock, the actual cause of death being the sudden arrest of the heart's action, consequent on the violent disturbance given to the nervous system. Instead of actual death, the condition known as *collapse* is more frequently induced, in which the patient lies in a state of utter prostration, and apparently on the verge of dissolution. The face, and even the lips, are pale and bloodless; the skin is cold and clammy, and drops of sweat are often seen on the forehead. The features are contracted, and there is great languor in the general expression. There is extreme muscular debility, and the sphincter muscles sometimes relax, so that there is involuntary discharge of the contents of the bowels and the bladder. The pulse is quick, and so feeble as often to be almost imperceptible, and the respiratory movements are short and weak, or panting and gasping. The patient is in some cases bewildered and incoherent, in others drowsy, and sometimes almost insensible. Nausea and vomiting, with hiccup, are not unfrequent symptoms; and in the case of children, convulsions are often present.

When a person recovers from a state of collapse, he passes into a condition termed *reaction*, which often lasts for several hours. The first symptoms of this favorable change are improvements in the state of the pulse and the respiratory actions, recovery of the power of swallowing, an increased temperature, and an inclination to move from the supine position to one side. A slight degree of feverishness then often ensues, after which the skin becomes moist, the patient falls asleep, and awakes convalescent. As a general rule, the longer the symptoms of reaction are delayed, the greater is the danger, and if several hours pass without any sign of the commencement of reaction, there is little hope of recovery. If the reaction is imperfectly developed, a condition may supervene which is known as 'prostration with excitement,' which may terminate either fatally or favorably, and into the symptoms of which our limited space will not allow us to enter further than to remark that a peculiar delirium, closely resembling *delirium tremens*, is most commonly present.

The principal causes of collapse (as given by Mr. Savory in his article 'Collapse, and the General Effects of Shock upon the System,' in Holmes's *System of Surgery*) are :

'Injuries sudden and severe, or extensive, as contused and lacerated wounds, involving a considerable amount of texture—the crushing of a limb, for instance. Burns present familiar and striking examples of extreme collapse, produced by this cause. Under this head, too, come capital operations. Injuries of very important organs, as the liver or other of the viscera, or of the joints, or other organs abundantly supplied with nerves. Pain alone, when intense and protracted has proved fatal in this way; and it appears in a case related by Sir A. Cooper, that sudden relief from great agony was attended by the same untoward result. Certain poisons operate in this manner, depressing the system so suddenly and severely as to produce a state of collapse; tobacco, for example, and drastic purgatives have in some cases induced a similar condition.'

The effects of shock are aggravated by loss of blood; and hæmorrhage alone, if sudden and profuse, will produce collapse. General debility and old age favor the influence of the shock, and much depends upon the idiosyncrasy of the patient; an injury which will produce no apparent effect on one man, often producing a serious and persistent impression on another.

The following are the most important points in regard to treatment: The patient should be kept in a horizontal position, with the head on the same level as the body, and he should not be raised till decided symptoms of reaction appear. The best stimulus is brandy, given in the form of hot brandy and water. 'Its effects,' says Mr. Savory, 'are most certain and decided,' and it suits the stomach best. It will remain when all other stimulants are rejected. The state of the circulation and the temperature are the guide to its use. If no effects are apparent after an ounce or two have been swallowed, it is very questionable if any advantage will be gained from a larger quantity.' At the same time, heat should be applied to the pit of the stomach and the extremities, by means of hot flannel, hot-water-tins, or, in their absence, bottles containing hot water, and other appliances. Nourishment, in the form of beef-tea, should closely follow the stimulants; the two may be combined with the greatest advantage, and as the system rallies, the latter may be entirely replaced by the former.

In those cases in which a patient is in a state of extreme collapse from an injury requiring a capital operation, such as the amputation of a limb, the operation should be performed as soon as his condition will admit of it; and although it should not be undertaken while the prostration is extreme, it is not necessary, or even advisable, in Mr. Savory's opinion, to wait for complete reaction; and this is the opinion of most of our best surgeons. Moreover, in these cases, the use of chloroform is not expedient; for, in the first place, it cannot be safely administered to a patient so depressed; and, secondly, the chief reason for its employment is wanting, for a person in a state of collapse is comparatively insensible to pain. For further information on this subject, the reader is referred to Travers *On Constitutional Irritation*, and to the excellent article of Mr. Savory, from which we have freely borrowed.

SHODDY formerly meant only the waste arising from the manufacture of wool; it now has a wider and much more important signification, and is almost wholly understood to mean the wool of woven fabrics reduced to the state in which it was before being spun and woven, and thus rendered available for remanufacture. Woollen rags, no matter how old and worn, are now a valuable commodity to the manufacturer; they are sorted into two special kinds, the rags of worsted goods and the rags of woollen goods, the former being made of *combing* or long staple-wools, and the latter of *carding* or short-staple wools. The former are those properly known as *shoddy*-rags, and the latter are called *mungo*. Both are treated in the same way; they are put into a machine called a *willey*, in which a cylinder covered with sharp hooks is revolving, and the rags are so torn by the hooks, that in a short time all traces of spinning and weaving are removed, and the material is again reduced to wool capable of being reworked. It was formerly used as a means of adulteration and cheapening woollen cloths, but it is now found of greater advantage in making a class of light cloths adapted for mild climates and other purposes. The name is derived from *shed*. See WOOLLEN MANUFACTURES.

SHOEBURYNESS, on the coast of Essex and at the mouth of the Thames, faces the Nore. Since 1842 a school of gunnery has been established here, with artillery barracks, batteries, targets, and other appliances for experimenting on cannon.

SHOEING OF HORSES. In olden times, horses generally went unshod, as they now do in many eastern countries; but our Macadamized roads and paved streets, our fast paces and heavy loads, would speedily wear away the stoutest hoofs, and a rim of iron has accordingly been long in use as a protection. In style and pattern, the horse's shoe varies almost as much as his master's boot, and like it, when badly made, or unskilfully fitted, produces serious inconvenience, and even leads to accidents and diseases. When the feet are strong and properly managed, nothing is better than a plain shoe of tolerably uniform breadth and thickness, carefully fashioned to the shape of the foot. But many good authorities prefer what is called a seated shoe, which has a level part for the crust to rest upon, and within that the inner half of the shoe towards the sole surface is bevelled off. This seated shoe is thus wider than the plain shoe, and hence affords greater protection for a weak or flat sole. For faulty or diseased feet, special forms of shoes are suitable. In all healthy feet, the shoe should be fitted to the foot, and not, as is commonly done, the foot cut to fit the shoe. Another frequent error of keeping the shoe short and spare at the heels must be avoided. For roadsters, the toe of the fore-shoes should be slightly turned up, which greatly obviates tripping. The hind-shoes are generally thickened, and sometimes turned down at the heels. The number of nails required must vary somewhat with the weight of the shoe and soundness of the horn; five is the minimum, nine the maximum. It is important, however, that the shoes be firmly held on by as few nails as possible.

In a saddle-horse with sound feet, three on the outside, and two on the inside, should suffice to hold a well-fitted shoe. Horses for heavy draught are generally shod in Scotland with tips and heels, which afford increased firmness of tread, and greater power, especially when dragging heavy loads. To preserve the foot in a

sound state, the shoes should be removed every month. When the shoe is carefully taken off, the sole-surface on which it has rested should be rasped, to remove any ragged edges and any portions of adhering nails. Having for a month been protected from the wear to which the exposed portions of the foot are subjected, it will probably have grown considerably, and, in a stout hoof, will require to be cut down with the drawing-knife, especially towards the toe. Except in very strong feet, and in farm-horses working on soft land, the surface of the sole uncovered by the shoe seldom requires to be cut. It is the natural protection of the internal delicate parts, and must be preferable to the leather and pads often artificially substituted for it. The bars must likewise remain untouched, for they are of great service in supporting weight; whilst the tough, elastic frog must be scrupulously preserved from the destructive attacks of the knife, and allowed uninjured to fulfil its functions as an insensible pad, obviating concussion, and supporting weight. When the shoe is put on, and the nails well driven home, they should be broken off about an eighth or even sixteenth of an inch from the crust, and hammered well down into it. This obviously gives the shoe a much firmer hold than the usual practice of twisting off the projecting nail close to the crust, and afterwards rasping down any asperities that still remain. When the shoe is firmly clinched, the rasp may be very lightly run round the lower margin of the crust just where it meets the shoe, to smooth down any irregularities, but all further use of the rasp must be interdicted. The clinched nails, if touched, will only have their firm hold weakened; nor must the upper portions of the crust, which blacksmiths are so fond of turning out rasped and whitened, be thus senselessly deprived of those external unctuous structures, which render the unrasped foot so tough and sound, and so free from sandcracks.

To prevent the hoof becoming too dry and hard, it is advisable, especially in roadsters, and in hot weather, to stop the feet several times a week with a mixture of equal weights of lard, tar, bees-wax, and honey, with about one-fourth part of glycerine, melted together, well stirred, and preserved in pots for use. Fuller details on this subject will be found in a little volume entitled *Notes on the Shoeing of Horses*, by Lieutenant-colonel Fitzwygram, 15th (the King's) Hussars; and in a paper on 'Horse-shoeing,' by Mr. Miles, published in the *Journal of the Royal Agricultural Society of England*, and reprinted in a separate form by Mr. Murray, Albemarle Street, London.

SHOES, SHOE-TRADE. Clothing for the feet, whether in the form of sandals or shoes, has been in use in every country aspiring to civilization in ancient and modern times. The rudimentary shoe is a sandal consisting of a sole, held to the foot by straps and thongs, as represented in fig. 1. Such were the common Egyptian and Greek shoes, to which the shoes of the peasantry of the Abruzzi, in the south of Italy, bear a close resemblance. In Egypt, however, the ordinary materials for shoes were strips of the papyrus interwoven like a mat; an example of a sole of this kind is given in fig. 2. As is seen from paint-

Fig. 1.

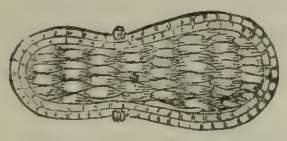


Fig. 2.

ings on the walls of Thebes, shoemaking formed a distinct trade in the reign of Thothmes III., 1495 B.C., or about the period of the flight of the Israelities. In the adjoining illustration, fig. 3, a sketch is presented from Thebes of two Egyptian shoemakers at work, with the tools of their profession beside them. The

Fig. 3.

streets of Rome were encumbered with the stalls of shoemakers in the reign of Domitian. The shoe of the ancient Hebrews was a species of sandal. For ladies, the sandal, translated 'shoe,' in the scriptures, was highly ornamental: 'How beautiful are thy feet with shoes, O prince's daughter' (Cant. vii. 1). Ornamented slippers are still a luxury in the East. The foot-coverings of the Romans were various in character, from the simple sandal and slipper to the boot, which extended up the leg. When the shoe covered the whole foot, it was termed *calceus;* the calceus of a particular form and of great strength worn by the Roman soldier was known as *caliga*.

Reference is made in Scripture to different symbolical usages in connection with sandals or shoes. The delivery of a shoe was used as a testimony in transferring a possession: 'A man plucked off his shoe, and gave it to his neighbor: and this was a testimony in Israel' (Ruth iv. 7). In cases of this kind, the throwing of a shoe on a property was a symbol of a new proprietorship or occupancy: 'Over Edom will I cast my shoe' (Psalm lx. 8). From these ancient practices, in which the shoe was symbolical of contract, perhaps comes the curious old custom in England and Scotland of throwing old shoes for good luck after a bride and bridegroom on departing for their new home.

St. Crispin and his brother Crispinian have long been regarded as the patron saints of shoemakers. According to medieval legend these personages were natives of Rome, and having become converts to Christianity, traveled into France and Britain to propagate the faith, everywhere supporting themselves by making shoes, which they sold to the poor at a very low price—one part of the legend being that an angel supplied them with leather. It is said that they suffered martyrdom in England towards the end of the 3d century. The memory of St. Crispin, of whom we chiefly hear has, from time immemorial, been kept up by processions and other festivities in his honor on October 25, which is known as 'St. Crispin's Day.' Under this saintly tutelage, shoemaking has attained to the distinctive appellation of the 'gentle craft;' and is noted for the number of individuals who have risen from it to eminence. See an amusing but scarce work, *Crispin Anecdotes;* and a trade newspaper called *St. Crispin*. The sedentary and solitary nature of the craft, as hitherto conducted, has possibly had some influence in producing a degree of thoughtfulness, while the act of hammering his leather is calculated, as some imagine, to stimulate the mental energy of the operative. If there be any real virtue in the sitting attitude of the shoemaker, a corresponding evil attends that method of carrying on his operations.

In every profession, sitting at work in a close atmosphere is particularly injurious to the health. Statistics assure us that out of 10,000 artisans who sit at their labor, 2577 fall sick, and 95 die annually; whilst as regards an equal number of those who alternately sit and stand, only 1713 sicken, and 61 die. To remedy this crying evil, a member of the profession, Mr. J. Sparkes Hall, London, has invented a simple and inexpensive work-bench, at which shoes may be made standing. Of this standing-bench, we offer a sketch in fig. 4. A few days' practice, we are told, renders

Fig. 4.

the workman as expert with the standing-bench as if he were seated according to the old plan, and he can execute closing with less fatigue and considerably more cleanliness. The only kinds of work in which sitting is more convenient are rounding the soles, lasting, and fitting. This standing-bench is, however, not much adopted by the men, who prefer old usages.

The fashion of shoes, as has occurred with other articles of dress, has undergone innumerable changes. At one time, shoes were pointed to an extravagant degree; and in last century, the high heels of ladies' shoes became a monstrosity. Shortly after the beginning of the present century, the most marked improvement was the making of shoes right and left; the substitution of latchets for buckles about the same period was also a step in advance. In our own day, the general disuse of the shoe proper, and the introduction of short ankle-boots, are the chief changes

of fashion. A proposal for a more perfect adaptation of shoes and boots to the shape of the foot, is noticed under FOOT.

The shoemaking trade, as at present conducted in Britain, is divided into two departments—the bespoke and the ready-made or sale business. The larger department hitherto has been that in which customers bespeak boots and shoes by having them made to measure; but it is generally giving way to the plan of buying articles ready-made. The cause of this is exceedingly obvious. The process of measuring is usually very imperfect, owing, among other reasons, to the want of lasts to suit every variety of feet as well as the too general indifference to meet individual peculiarities. On this account, and even at the risk of purchasing an inferior class of goods, the public are becoming daily more disposed to encourage the ready-made trade. Accordingly, large quantities of boots and shoes in innumerable varieties are now made and supplied wholesale by manufacturers for the retail dealers. Northampton, Stafford, and Leicester, are considerable seats of this manufacture in England; and from certain districts in France, there are increasing importations, chiefly of a cheap kind of ladies' shoes.

The plan of making boots and shoes by isolated workmen at their own homes, has been found quite incompatible with the modern necessities of trade. As in the case of the handloom weaver, the shoemaker of the old school has had to succumb to machinery. After an unsuccessful struggle to oppose the introduction of sewing-machines, these are now coming generally into use, and men are employed in large numbers together in what may be called shoe-factories. Northampton and Stafford, the two chief of the centers just named, have unquestionably benefited by the introduction of the sewing-machine, although it deranged the relations between the masters and men for a time. An instructive and valuable exhibition of the leather and shoe trades was held at Northampton in 1873, illustrating the high pitch of excellence which these trades have now attained.

This manufacture has long been a staple trade of Massachusetts, in which state the quantity of boots and shoes fabricated annually is numbered by millions of pairs. Recently, a machine has been introduced into the American shoe-trade for fixing the soles to the uppers by means of pegs, the inventor being a person in Salem, Massachusetts. A pair of boots or shoes can be pegged in two minutes. These pegged goods are disposed of wholesale in boxes, and may be seen in retail stores all over the United States. As evidence of the important character of the shoe-trade in Massachusetts, it may be mentioned that a few years ago there were as many as fifteen members of the 'gentle craft' in the legislature of that state. Ingenious machines have also been introduced for fastening the soles to the uppers by means of fine screws. They were shown at the International Exhibitions of 1862 and 1867, at work, uncoiling lengths of wire, making the end into a screw, cutting off a small piece, piercing a hole in the sole, and screwing the wire therein.

There are no means of determining the extent of this trade in England or the United Kingdom. All that can be done is to state the amount of imports and exports. The boots and shoes imported in 1876 were 109,906 doz. pairs, having a value of £328,540. These are entered among the customs tables as leather manufactures; but as very few boots and shoes are actually without leather, nearly all are probably included here. The exports in 1876 were 441,632 doz. pairs, value £1,403,466; in 1880, 420,189 doz. pairs, value £1,282,221 (of which nearly half were sent to Australia). The export trade varied as follows:

	Dozen pairs.	Value.
1865	439,283	£1,462,105
1867	274,036	952,804
1869	436,329	1,326,792
1871	510,648	1,513,665
1873	526,460	1,704,145
1875	462,104	1,509,639

SHO'LA, the white pith of the leguminous plant *Æschynomene aspera*, a native of the East Indies. With this substance, which is exceedingly light, the natives of India make a great variety of useful articles, especially hats, which being very light and cool, are in great request. Helmets made of Shola are much used by the British troops in India.

SHOOTING, with intent to wound, is felony in the law of England, and punishable with penal servitude for life. The offence consists in shooting at another, or drawing a trigger, or in any other manner attempting to discharge loaded arms. It is not, however, an offence unless there was a possibility of injuring some person; the intent must not only exist, but the relative situation of the parties must be such that serious injury might have ensued. The extent of the actual wound is immaterial.

SHORE. See SEA-SHORE.

SHORE, in Ship-building, is a strong prop or stanchion placed under the bottom or against the side of a ship, to keep her steady on the slip or in dock. Shores are also used to support or prop up a building during alterations.

SHOREDITCH. See TOWER HAMLETS.

SHO'REHAM, NEW, a seaport, and parliamentary borough of Sussex, on the left bank and at the mouth of the Adur, six miles west of Brighton. The town arose when the harbor of Old Shoreham, now a mile inland, became silted up. Pop. of the parish (1881) 3572. Ship-building is carried on here on an extensive scale, and the trade of the port is considerable, principally with France and the coast. In 1880, 802 vessels, of 90,721 tons, entered, and 817 vessels, of 91,683 tons, cleared the port. About 160 vessels belong to S., of which a large number are employed in the oyster-trade. The parliamentary borough, which includes the *Rape* (see SUSSEX) of Bramber, contains (1881) 42,442 inhabitants.

SHORTHAND. The problem which inventors of systems of shorthand have attempted to solve, is thus formulated by Peter Bales, a writing-master and stenographer who lived towards the end of the sixteenth century—'to write as fast as a man speaketh treatably.' 'This,' he says, 'may, in appearance, seem difficult; but it is, in effect, very easy, containing a many commodities under a few principles, the shortness whereof is attained by memory, and swiftness by practice, and sweetness by industry.' Although three hundred years have elapsed since this assertion was made, it has not yet been realized to the extent anticipated.

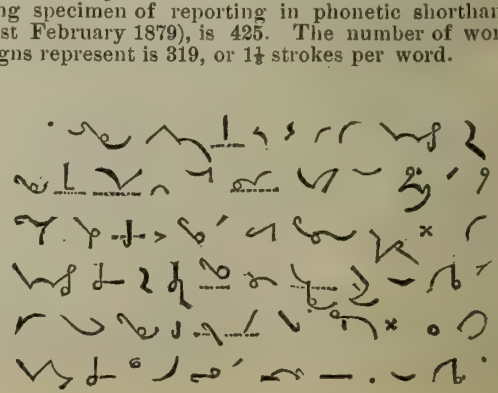
The publication, in 1837, of Mr. Isaac Pitman's system of shorthand, entitled 'Phonography,' in which the stenographic signs or letters represent the *sounds* of the English language, marks a new era in the art. The legibility which this principle secures has led to the very general use of shorthand in merchants' and lawyers' offices, and in railway and ordinary correspondence, it has also promoted the establishment, in England, of a dozen shorthand periodicals. A vigorous propagandism, and instruction books at low prices, have aided in giving to this system its well-merited distinction above all others in public estimation. At the end of the last century, the price of a treatise on shorthand was a guinea, and a course of lessons in the art was charged five or ten guineas. In contrast with this, Mr. Pitman's system is published in a compendious tabular form for a penny, and he has organized a Phonetic Society, extending throughout Great Britain and Ireland, whose members invite learners to send their lessons through the post for gratuitous correction.

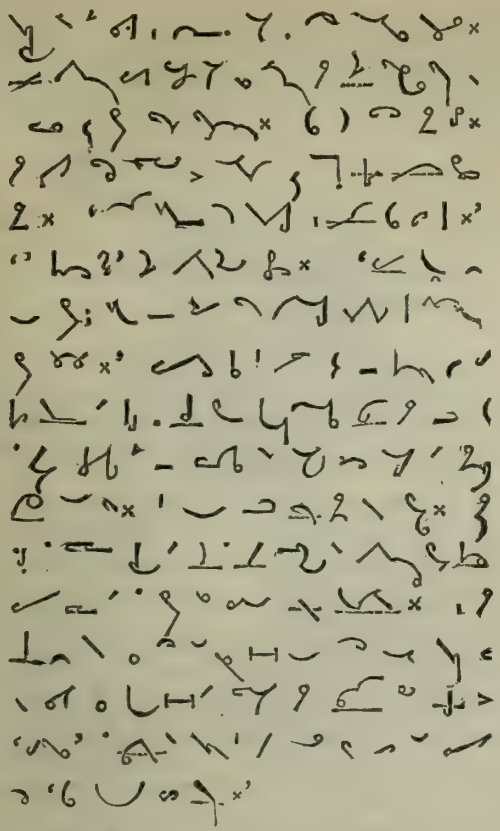
Before giving a brief description of this system of shorthand, we may note the conditions on which alone Peter Bales's reasonable anticipation of the future universal practice of shorthand can be realized, and then it may be seen if phonography fulfils these conditions.

Given a language, say the English, it is required to provide signs for its expression which may be written at the rate of speech in a public assembly, which ranges from a very slow utterance of 60 words in a minute, with frequent pauses, to a rapid flow of 180 words in a minute. The average of public speaking is a mean between these extremes—that is, 120 words a minute, or two words per second. A dexterous penman can make 180 separate simple strokes or dots in a minute. The required system of shorthand must, therefore, represent two words by three strokes (or dots), or by one and a half strokes per word. Let the reader try his hand upon such signs as

(the last two struck upward), and he will feel assured that there is no error in the conclusion to which he will be brought.

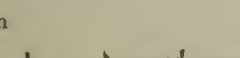
The number of pen strokes and dots or short vowel marks in the following specimen of reporting in phonetic shorthand (*Phon. Jour.*, 1st February 1879), is 425. The number of words which these signs represent is 319, or 1⅓ strokes per word.





Key.—An enterprising reporter had heard that the late Lord Palmerston was to be present at an archery meeting in a small country village in Hampshire, and he accordingly posted down to the place, and waited for something to turn up. Lord Palmerston's task was to distribute prizes to some half-dozen blushing young ladies, and the whole company present didn't number much above a score. His lordship performed the task with his usual grace and good humor, giving the young ladies a paternal pat on the head, but making only the most commonplace observations. Our reporter waited anxiously until, to his horror, he saw the proceedings brought to a close without a speech from the Premier. This was more than he could stand. He rushed from his corner to the noble lord, who was getting out of the room as fast as he could: 'My lord, I beg your pardon, but really this will not do.' 'What do you mean?' was the reply of the astonished statesman. 'Why, you've made no speech; I've come all the way from London to report it, and I must have a speech of some sort.' Whereupon it is on record that the good-tempered old gentleman turned back, and detained the audience for twenty minutes while he gave them a genial dissertation on the good qualities of English women in general, and Hampshire lasses in particular. On another occasion, however, he made up for this. He was attending an agricultural dinner, and saw a large gathering of reporters, for the times were critical, and a speech of his certain to be valuable. But he had made up his mind not to speak—no man knew better when to hold his tongue—and accordingly he slyly sent down to the 'gentleman of the press' a slip of paper, on which, in his bold round hand, were the words: 'This fish won't bite!'

We have seen that the pen can produce 1½ strokes per word uttered at the rate of 120 per minute. The pen is therefore ahead of the speaker, and in a burst of oratory could record 200 words in a minute. In this calculation the reporter has the further advantage, that this estimate is based on the number of *separate* strokes which the pen can make in a minute, whereas *joined* strokes can be written more rapidly than single ones; thus

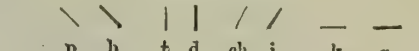


take less time than

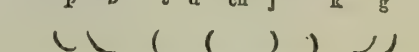
&c. In the above specimen only 130 words are written by single strokes, and the remaining 295 words or phrases (for several words are often linked together in one shorthand outline) are composed of from 2 to 4 strokes combined in one stenographic form.

Words can be recognized, either in longhand or shorthand, by their consonants alone; and the simple strokes employed in shorthand to represent the consonants may be placed in three positions, *above, on,* or *through* the real or imaginary line on which the writing is placed. The twelve simple or pure vowels and five diphthongs in the English language may be arranged in three classes, according to the nature of the sounds, as below. The vowel of any given word, or rather the class of vowels to which it belongs, may therefore be understood by the *position* which the consonant part of the word takes with respect to the line. The alphabet of phonography is:

CONSONANTS.

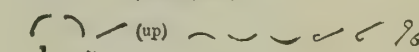


p b t d ch j k g



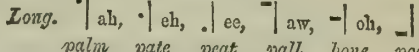
f v th th s z sh zh

(*thin*) (*then*)



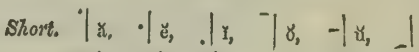
l r (up) m n ng w y h

VOWELS.



Long. ah, eh, ee, aw, oh, oō

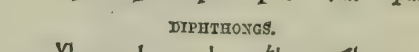
palm *pate* *peat* *pall* *bone* *pool*



Short. ă, ĕ, ĭ, ŏ, ŭ, o͝o

pat *pet* *pit* *poll* *bun* *pull*

DIPHTHONGS.



ei, eu, ou, ai, oi

pine *new* *now* *ay* (*yes*) *boy*

The vowel and diphthong signs are the dots, dashes, and small angular marks; the upright stroke to which they are placed (the shorthand letter *t*) is introduced to show the *position* in which the vowel sign is written with respect to *all* consonants. These 17 vowel-signs may be distributed into three classes, all the sounds in each class having a common characteristic; thus:

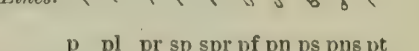
Class 1.—Ah, ă; au, ŏ; ei, ai, oi, = 7, in each of which, except *ei*, the broad sound of *ah* or *aw* is heard.

Class 2.—Eh, ĕ; oh, ŭ, = 4, intermediate sounds between *ah* and *ee*, and between *aw* and *oo*.

Class 3.—Ee, ĭ; ōō, o͝o; eu, ou, = 6, in each of which the close *ee*, or close *oo*, predominates.

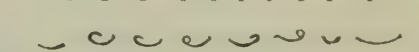
By adding a hook or small circle to the consonants, by halving, and by lengthening, double and treble letters are produced, on the following plan:

Straight Lines.



p pl pr sp spr pf pn ps pns pt

Curves.



n nl nr sn nn ns nt ntr

This principle is applicable to all the consonants, and conduces to the brevity of the system.

The shorthand letters, both vowels and consonants, are employed first as component parts of words, and secondly each letter is made the representative of some common word in which the letter is prominently heard; thus \ *p* represents *up*, | *t* stands for *it*, / *ch* for *which*, — *k* for *come*, ∖ o͝o for *to*, &c.

The most frequently occurring words, *the, and, of, in, to,* &c., are selected for this distinction, and are called grammalogues, or letter-words; and the shorthand letters, when thus employed, are logograms or word-letters. In the 'learners' style' of phonography only 50 grammalogues are used; in the ordinary or 'corresponding style' there are 150 (which amount to one-half of the language, on common subjects); and in the 'reporting style' the number is largely increased, for every short word becomes a grammalogue on the principle of omitting its vowel and writing the consonant form *in position* with respect to the line, *above, on,* or *below,* to denote a vowel of the first, second, or third class.

Phonography is a growth of the age, and is the lineal descendant of the 200 different systems that have been published since the

appearance of the first system of modern shorthand in 1588. It carries out fully the principle which all previous systems acknowledge, but do not faithfully apply—namely, that of enlarging the ordinary 26-letter alphabet. Those systems add to the alphabet three signs for *ch*, *th*, and *sh*; but these are not all the consonants in which our alphabet is deficient. Two signs are required for *th*, as pronounced in *thin* and *then*, one for *ng* in *sing*, and one for *zh* in *pleasure* (plezhure). But the principal defect in the ordinary systems of shorthand is in their vowel notation. They contain but five signs for the five vowels *a*, *e*, *i*, *o*, *u*, which, single and combined, represent 17 different sounds. This disparity between the sounds of the language and the means of representing them made the reading of shorthand exceedingly difficult and uncertain.

In the last century three systems were published, by Tiffin, 1750; Lyle, 1762; and Holdsworth and Aldridge, 1768; and in the present century five systems have appeared, by Row, 1802; Towndrow, 1831; Pitman, 1837; De Staines, 1839; and Bell, 1857, based on the phonetic principle; but excepting phonography, they were wanting in all the main requisites of a shorthand system—simplicity of construction, facility in execution, and elegance in effect.

The shorthand of the Romans, practised by Tiro, first the slave and afterwards the freedman of Cicero, was really an abbreviated longhand. The Roman letters were shorn of their just proportions, initial letters often served for whole words, and terminations, in which Latin abounds, were either abbreviated or omitted. By systematizing these mutilations, Tiro constructed a system of swift writing, which served him, as Cicero's amanuensis, in good stead, and doubtless we owe to it much of what remains to us of the writings of Cicero.

The history of shorthand, properly so called, with an alphabet of simple signs as substitutes for the ordinary letters, dates from the reign of Elizabeth. Dr. Timothy Bright, a learned man, the author of several medical works, and the compiler of an abridgement of John Fox's *Book of Acts and Monuments of the Church*, in the year 1588 published 'Charactery; an Art of Short, Swift and Secret Writing by Character.' In this ingenious work Bright claims the invention of the art of shorthand. His claim may justly be disputed, for his system is not shorthand in the present sense of the word. It is not based on a shorthand alphabet, but is a system of arbitrary marks for words: thus *abound*, *about*, *accept*, *accuse*, *advance*, &c.

Two years after the appearance of this work, Peter Bales published *The Writing Schoolmaster*. This system also was composed of arbitrary characters.

In the year 1602, a little above threescore years before Wilkins published his celebrated 'Essay towards a Real Character and a Philosophical Language' (1668), appeared 'The Art of Stenography, or Short Writing, by Spelling Charactery, invented by John Willis, Bachelor in Divinity.' The author intimates in the title of the work the grand distinction between it and the previous attempts that have been made in the art, by describing it as '*spelling* charactery' the others having been *verbal* charactery. John Willis's alphabet is:

a b c d e f g h i j k l m n o

p q r s t u v w x y z

The inadequacy of this alphabet is proved by the fact that not one of its letters was used in the same sense by the inventors of systems in the following century, when shorthand began to be popular. Sixteen years after the publication of John Willis's system, Edmund Willis published 'An Abbreviation of Writing by Character' (1618). This system exhibits a considerable improvement in its alphabet, and fifteen of its letters were adopted by subsequent shorthand authors.

The next name on the roll of shorthand authors deserving of mention here is that of Rich, 1654—1669. His system was used by Dr. Doddridge, who reprinted it for the benefit of his theological students, and strongly recommended its adoption by young persons.

Mason followed in 1672—1707. The alphabet has now become much simplified. Mason's system was adopted by Thomas Gurney in 1740, and has since been known as Gurney's shorthand. In the earliest edition to which we have access (1753), there is no mention of Mason as the inventor of the system.

The principal shorthand authors in the eighteenth century were Macaulay, 1747; Angell, 1758; Byrom, 1767; Taylor, 1786; and Mavor, 1789; and in the present century, Clive, 1810; Lewis, 1815; Moat, 1833; Pitman, 1837; Fancutt, 1840; Bradley, 1843. Of these systems, except Pitman's phonography, the one that has obtained the greatest amount of popularity is Taylor's and a few private persons and reporters use it to the present day. Its alphabetic signs are well chosen, but, as we have already noticed, it fails to supply signs for three consonant sounds heard in the English language, and it makes no pretension to express all the vowel and dipthong sounds. The following is Taylor's alphabet:

b c d f g h j k l m n

p q r s t v w x y z

ch sh th

The reader who wishes to learn a good practical shorthand, is referred to Pitman's *Phonographic Teacher* and other publications, published by Fred. Pitman, 20 Paternoster Row, London.

SHORT-SIGHT. See SIGHT, DEFECTS OF.

SHOT is a term applied to all solid balls fired from any sort of firearms; those for cannon and carronades being of iron, those for small arms, of lead. The latter are known as bullets and small-shot. The shot used for guns at present vary from the 3-pounder, for boat and mountain artillery, to the 13-inch shot, which weighs about 300 lbs. as a shell, or 700 lbs. as an elongated bolt. Generally, shot are cast. There are simple practical rules for calculating the weight of *spherical* shot from the diameter, and *vice versâ*, which are often useful in reading of artillery actions. Given the diameter in inches, to find the weight in pounds: Cube the diameter, and multiply the result by 14; reject the two right-hand figures; those remaining give the weight in pounds.—Given the weight in pounds, to find the diameter in inches: Multiply the cube-root of the weight by 1·923, and the result is the diameter of the shot in inches.

Small-shot is of various sizes, from swan-shot, nearly as large as peas, to dust-shot. It is made by dropping molten lead through a colander in rapid motion from a considerable height into water. The lead falls in small globular drops. The holes in the colanders vary in size according to the denomination of the shot, No. 0 requiring holes $\frac{1}{10}$th inch in diameter, No. 9, $\frac{1}{160}$th inch. The colanders are iron hemispheres, 10 inches in diameter, and are coated within with the *cream* or scum which is taken off the molten metal. A small portion of arsenic is melted with the lead, and the fusion in the colanders is maintained by those vessels being surrounded by burning charcoal. The discovery of the advantage attending a long fall was made in England towards the end of last century. Previously the shot had dropped from the colanders at once into the water. The lead was then so soft that the shot were flattened by the water. The fall through the air enables the lead to cool and harden before taking its plunge. The smaller sizes require less fall than the larger—100 feet suffices for sizes Nos. 4 to 9—the larger sorts demand 150 feet. The highest shot tower is at Villach in Carinthia, where there is a fall of 249 feet. After cooling, shot is sifted in successive sieves to separate the sizes. Misshapen shot are found by their inability to roll: and finally, the whole are polished by rotary motion in small octagonal boxes, in which a little plumbago has been thrown. See also CASE-SHOT or CANISTER-SHOT, and GRAPE-SHOT.

SHOTTS, a small and ancient village of Lanarkshire, close to the Kirk of Shotts, about 16 miles east of Glasgow. About 3 miles to the south-east of the Kirk, modern S., or S. Proper, began to rise at the close of the last century, when the Shotts Iron Company erected their extensive iron works there. S. may be said to consist of three villages—viz., Stane, Shotts Iron-works, and Dykehead, of which the united population in 1881 was 2985. In the same year, the population of the civil parish of Shotts was 11,214. Valuable coal and ironstone, peculiarly suited for the manufacture of iron, abound in the district, and a large number of workmen are employed in iron-making and moulding. Until recently, there was no railway communication from and to S. for passengers; but since the opening of the Clelland and Midcalder branch of the Caledonian Railway, S. forms the half-way station between Edinburgh and Glasgow on that line.

SHOULDER-JOINT, THE, is a ball-and-socket joint. The bones entering into its composition are the humerus or arm-bone, and the scapula or shoulder-blade, the large globular head of the former being received into the shallow glenoid cavity of the latter, an arrangement by which extreme freedom of motion is obtained, while the apparent insecurity of the joint is guarded against by the strong ligaments and tendons which surround it, and above by the arched vault formed by the under surface of the acromion and coracoid processes. See SCAPULA. As in movable joints gener-

ally, the articular surfaces are covered with cartilage, and there is a synovial membrane which lines the interior of the joint.

The most important connecting medium between the two bones is the capsular ligament, which is a fibrinous expansion embracing the margin of the glenoid cavity above, while it is prolonged

Fig. 1.—The left Shoulder-Joint and its Connections.

1, the clavicle or collar bone; 2, the acromion process; 3, the coracoid process; 4, the capsular ligament; 5, the coracohumeral ligament; 6, the tendons of the biceps muscle; 7, the shaft of the humerus or arm-bone; 8, the greater tuberosity of the humerus; 9, the lesser tuberosity; 10, the neck of the scapula; 11, anterior surface of the scapula.

upon the tuberosities of the humerus below. From its relations with the surrounding muscles, the ligament derives much of its strength. Accordingly, in paralysis of the arm, one or two fingers can often be pressed into the joint towards the head of the glenoid cavity, from which the head of the humerus is now separated.

The shoulder-joint exhibits the following varieties of motion: 1. Flexion, to a great extent; 2. Extension, in a much more limited degree; 3. Adduction, in an oblique direction, forwards and inwards; 4. Abduction very freely; 5. Circumduction; and 6. Rotation slightly.

The morbid affections of the shoulder-joint may be divided into (1) those arising from disease, and (2) those dependent on an accident. The most common diseases are acute and chronic inflammation of the joint, which often terminate in its anchylosis or immobility. The principal accidents are fractures and dislocations. There may be fracture (1) of the acromion process, or (2) of the coracoid process, or (3) of the neck of the scapula, or (4) of the superior extremity of the humerus; or two or more of these accidents may be associated. Again, the head of the humerus may be dislocated from the glenoid cavity as the result of accident in three different directions—viz. (1), Downwards and inwards into the axilla, which is by far the most common form; (2) Forwards and inwards; and (3) Backwards on the infra-

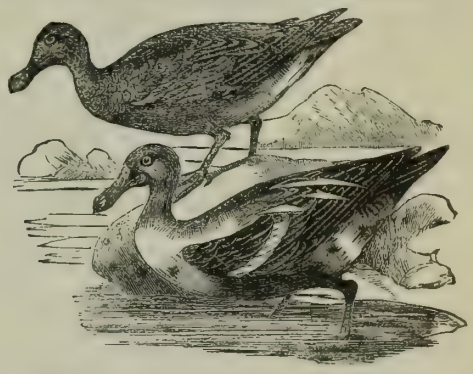
Fig. 2.—Dislocation of the Shoulder-Joint downwards.

1, the clavicle; 2, the acromion process; 3, the coracoid process; 4, the glenoid cavity; 5, the head of the humerus lying in the axilla.

spinous fossa, or the dorsum of the scapula. The first of these varieties is of such common occurrence, that persons of ordinary intelligence should know how to recognize, and even (in an emergency) to treat it.

The bones are in the position shown in the figure; and the following are the most prominent symptoms: 'The arm is lengthened; a hollow may be felt under the acromion, where the head of the bone ought to be; the shoulder seems flattened; the elbow sticks out from the side, and cannot be made to touch the ribs; and the head of the bone can be felt if the limb be raised, although such an attempt causes great pain and weakness, from the pressure exerted on the axillary plexus of nerves.'—Druitt's *Surgeon's Vademecum*, 8th ed. p. 282. There are at least five methods of treating this form of dislocation. It is sufficient to notice two of them. 1. Reduction by the heel in the axilla. The patient lies on a couch, and the operator sits at the edge, and puts his heel (the shoe or boot being previously removed) into the axilla, to press the head of the bone upwards and outwards, and at the same time pulls the limb downward by means of a towel fastened above the elbow. There is a figure of this operation in the article DISLOCATIONS. 2. Reduction by the knee in the axilla. The patient being seated in a chair, the surgeon places one of his knees in the axilla, resting his foot on the chair. He then puts one hand on the shoulder, to fix the scapula, and with the other depresses the elbow over his knee.—For a description of the symptoms and mode of treatment of the other forms of dislocation, and of the different varieties of practice, we must refer the reader to any systematic treatise on Surgery.

SHO'VELLER (*Rhynchaspis*), a genus of ducks of the section having no lobe or pendent membrane on the hind toe, and remarkable for the expansion of the end of the mandibles in adult birds, particularly of the upper mandible. The lamellæ of the man-



Shoveller, female and male (*Rhynchaspis clypeata*).

dibles are long and very delicate. The legs are placed near the center of the body, so that these birds walk much more easily than many of the ducks. The Common S. (*R. clypeata*) is smaller than the wild duck, but rather larger than the widgeon. The S. is a winter visitant of Britain, but not very common. A few remain all the year. It is widely distributed over Europe, Asia, and North America. Its flesh is very highly esteemed. A species of S. is found in Australia.

SHOWERS OF FISHES have occasionally fallen in different parts of the world, exciting great astonishment. Instances of this kind have occurred in Britain. A few years since, a shower of small three-spined sticklebacks fell near Merthyr-Tydvil in Wales, sprinkling the ground and house-tops over an area of at least several square miles. They were alive when they fell; yet if caught up by a whirlwind from any of the brackish ponds near the sea in which this species of fish abounds, they must have been conveyed through the air a distance of almost thirty miles. Another similar instance occurred at Torrens, in the isle of Mull, in which herrings were found strewed on a hill five hundred yards from the sea, and one hundred feet above it.

Showers of fishes occur much more frequently in those tropical countries where violent storms, sudden gusts of wind, and whirlwinds are most common. In India, a shower of fishes varying from a pound and a half to three pounds in weight has been known to fall. Sometimes the fishes are living, more frequently they are dead, and sometimes dry or putrefying. They are always of kinds abundant in the sea or fresh waters of the neighborhood; and it cannot be doubted that they are carried up into the air by violent winds or whirlwinds; although they sometimes fall at a considerable distance from any water which could supply them. The sudden reappearance of fresh-water fishes in ponds which have been dried up for months in tropical countries, is often popularly ascribed to their falling from the clouds; but the truth is, that they have been buried in the mud below, existing probably in a state analogous to that of animals in cold climates during hybernation. A pool, the bottom of which has long been dry, and on which grass has grown and cattle have walked, is again filled with fishes in a few hours after it is filled with water.

SHRA'PNELL SHELL. See SHELLS.

SHREW (*Sorex*), a genus of small quadrupeds of the family *Soricidæ*. They are often popularly confounded with mice and rats, but are really very different, having insectivorous and not rodent teeth. The head is very long; the snout elongated, attenuated, and capable of being moved about; the eyes small; the tail long; both body and tail covered with fine short hair; the feet have a broad sole and 5 toes. The genus has recently been subdivided, and the British species belong to more than one of the subdivisions. The COMMON S. of Britain (*S.* or *Corsira vulgaris*) was, until recently, confounded with *S. araneus*, a species common in continental Europe. It is nearly 2¾ inches in length from the snout to the root of the tail, the length of which is about

Common Shrew (*Sorex vulgaris*).

1¾ inches. It abounds in dry fields, gardens, and hedge-banks; feeding chiefly on insects and worms, for which it grubs with its long snout amongst the roots of the herbage. It burrows, and makes long *runs* just under the surface of the ground. It is an excessively pugnacious little animal, and the males have fierce combats in spring, in which many are killed. Cats kill the S., but do not often eat it, probably on account of its strong musky smell; but it is the prey of weasels, hawks, owls, and shrikes. Harmless and inoffensive as it is, it has long been very generally regarded with dread and aversion by the vulgar. (See White's *Natural History of Selborne*.)—Another and even smaller species, *S. pygmæus*, is found in Ireland, where it is called the Shrew Mole.—The WATER S. (*S. fodiens* or *Crossopus fodiens*) is larger than the Common S., being fully 3 inches long, and the tail 2 inches. It is of a blackish-brown color, gray or white on the underparts. It burrows in the banks of streams, and is very aquatic in its habits. It is found in many parts of Britain.—Some of the Indian species of S. attain a much larger size, as that called the Musk Rat (q. v.). There is an Italian species which is the smallest of all known Mammalia. It is only about 1½ inch in length, exclusive of the tail, which measures about 1 inch.

SHREW MOLE (*Scalops*), a genus of insectivorous Mammalia, of the family *Talpidæ*, and very nearly allied to the moles. There are 6 incisors, 2 canine teeth, 8 false molars, and 6 true molars in each jaw. The ear is destitute of auricle; the eyes are very small, and much concealed; the feet are 5-toed, the fore-feet large, as in the mole. The whole figure, and also the habits, resemble those of the mole.—There are several species, all natives of North America.

SHREW'SBURY, a parliamentary and municipal borough and market-town, the capital of Shropshire, stands on the Severn, by which it is nearly surrounded, 163 miles north-north-west of London by the London and North-western Railway. It is irregular in plan, contains many inferior houses, partly built of timber, but often of very picturesque appearance. In the modern quarters, the houses are handsome and regular. Two bridges, the 'English' and the 'Welsh,' cross the Severn, and connect the town with the suburbs of Abbey-Foregate and Coleham on the east, and Frankwell on the west. To the north, is the other suburb of Castle-Foregate. The town contains interesting remains of the ancient walls, the castle, two monasteries, and a Benedictine abbey. The remains of the Abbey Church now form the church of Holy Cross. There are other ecclesiastical edifices, a Free School, with an income from endowment of £3100 a year, and 22 exhibitions to the universities; a number of other important schools, institutes, hospitals, &c. The Town and County Hall, the Public Rooms, a handsome Greek structure, and the Market-hall, erected in 1867—1868, in the Italian style, are worthy of mention. S. carries on manufactures of linen-thread, canvas, and iron-wares, and there is a salmon-fishery on the Severn. The Brawn and 'Shrewsbury Cakes' made here have long been held in esteem. The borough returns two members to the House of Commons. Pop. (1871) 23,406; (1881) 26,478.

S., called by the Welsh Pengwern, was named by the Anglo-Saxons *Scrobbes-Byrig*, and of this the modern name is a corruption. The town connects itself intimately with the history of the country from the 12th to the 17th century. It was taken by Llewellyn the Great, Prince of North Wales, in 1215, during the disturbances between King John and the barons; and in 1403, Henry IV. here defeated the insurgent Percies and their allies with great slaughter. It was taken by the Parliamentarians in 1644.

SHRIKE or BUTCHER-BIRD (*Lanius*), a genus of birds of the family *Laniadæ* (q. v.), approaching more nearly in character to the *Falconidæ* than any other of that family; having a short, thick, and compressed bill, the upper mandible curved, hooked at the tip, and furnished with a prominent tooth, the base of the

Great Gray Shrike (*Lanius excubitor*).

bill beset with hairs, which point forwards. The species are numerous, most of them natives of warm climates, although some occur in the more northern parts of the world. They prey on insects and small birds, and have a remarkable habit of impaling their prey on thorns; so that the nest of a S. may be discovered by the numerous insects impaled in the neighborhood of it. Shrikes kill and impale many insects which they never eat, leaving them to dry in the sun; and in confinement they make use for this purpose of a nail, if provided with it, or stick portions of their food between the wires of the cage. They can imitate in some degree the notes of many birds, particularly those which are the utterance of distress, and they seem to make use of this power in order to attract birds within their reach. The most common British species, rarely seen, however, except in the south of England, is the RED-BACKED S. (*L. Collurio*), a bird only about 7¼ inches in length, about a third of the length being formed by the tail, which is square at the end. Insects are the chief food of this bird, but it also preys on small birds, young frogs, and even young pheasants.

The GREAT GRAY S., or SENTINEL S. (*L. excubitor*), is about the size of a thrush. It is a rare bird in Britain, but common in some parts of Europe, and is found also in Asia and North America. It was formerly used by falconers in catching hawks, of which it is greatly afraid, screaming loudly on their approach: the falconer waited in concealment, after fastening some pigeons and a S. to the ground, until the scream of the S. gave him notice to pull the string of his net.

SHRIMP (*Crangon*), a genus of crustaceans, of the order *Decapoda*, suborder *Macroura*, and family *Crangonidæ*, allied to lobsters, crayfish, and prawns. The form is elongated, tapering, and arched as if hunch-backed. The claws are not large, the fixed finger merely a small tooth, the movable finger hook-shaped. The beak is very short, affording a ready distinction from prawns. The whole structure is very delicate, almost translucent; and the colors are such that the creature may really escape observation, whether resting on a sandy bottom, or swimming through the water. The quick darting movements of shrimps, like short leaps, however, betray them to any one who looks attentively into a pool left by the retiring tide on a sandy shore. When alarmed, they bury themselves in the sand, by a peculiar movement of their fanlike tail fin.—The COMMON S. (*C. vulgaris*) is very abundant on the British coasts, and very generally elsewhere on those of Europe, wherever the shore is sandy. It is about two inches long, of a greenish-gray color, dotted with brown. It is in great esteem as an article of food, and is generally taken by nets in the form of a wide-mouthed bag, stretched by means of a short cross-beam at the end of a pole, and pushed along by the shrimper wading to the knees. Sometimes a net of larger size is dragged along by two boats. The supply of the market with shrimps affords employment to a great number of people.—The other species of S. seem to be equally fit for the table. Several are occasionally taken on the British coasts, but belong rather to more southern climates. Shrimps are very interesting inmates of the aquarium.

SHRO'PSHIRE, or SA'LOP, a frontier county in the west of England, bounded W. by North Wales, and E. by Stafford and Worcester. Area, 841,167 acres; pop. (1871) 248,111; (1881) 247,993. The Severn, the principal river, enters the county from Montgomeryshire, about 12 miles west of Shrewsbury. It pursues a generally south-east course of 70 miles across the county, is navigable throughout, and is joined by two considerable trib-

utaries, the Tern and Teme. To the north and north-east of the Severn, the country is generally level, and is under tillage; to the south and south-east, it is hilly and mountainous, and here cattle-breeding is extensively carried on. A breed of horned sheep is peculiar to this county. More than three-fourths of the whole acreage are arable, or in pasture and meadow. The soil is generally fertile and well cultivated, though there are still extensive tracts of waste land. S. is remarkable for its mineral wealth. The coal, iron, copper, and lead fields of Coalbrookdale, Snedshill, Ketly, &c., are very productive. Several thousand persons are employed in raising coal, iron, stone, and lime, and in the iron manufacture. The county returns four members to the House of Commons. Capital, Shrewsbury.

SHROUDS are very strong ropes passing from the heads of the lower masts in a ship to the chains or channels on her sides, for the purpose of affording lateral support. They are crossed by thinner ropes, called ratlines, to form steps or ladders. The top-mast shrouds in ship-rigged vessels are similar, except that they terminate in a row of dead-eyes on the outside of the tops.

SHRO'VETIDE (Anglo-Saxon *scrifan*, to shrive, to confess) literally means 'confession-time,' and is the name given to the days immediately preceding Ash-Wednesday, which, as indeed the whole period after Septuagesima Sunday appears to have been, were anciently days of preparation for the penitential time of Lent; the chief part of which preparation consisted in receiving the sacrament of penance, i. e., in 'being shriven,' or confessing. In the modern discipline of the Roman Catholic Church a trace of this is still preserved, as, in many countries, the time of the confession, which precedes the paschal or Easter communion, commences from Shrovetide. These days were sometimes called Fasting-tide or Fast-mass, names which are still retained among the population in some parts of great Britain. The name of S. was retained in England after the Reformation, although the practice of 'shriving,' in which it had its origin, was abandoned. The precept of 'shriving' having been fulfilled, the faithful, upon the eve of entering upon the Lent, were indulged with permission to give themselves up to amusements, and to festive celebrations, of which the counterpart is still seen in the continental carnival. In England, the pastimes of football, cock-fighting, bull-baiting, &c., were, down to a late period, recognized usages of S.; and the festive banquets of the day are still represented by the pancakes and fritters from which Pancake Tuesday took its name, and by the 'collops' which gave its title to Collop Monday. These usages are gradually disappearing.

SHRUB (see SYRUP), a kind of liqueur made chiefly in the West Indies. It consists of lime or lemon-juice and syrup, to which a small portion of rum is added; other flavoring materials are used occasionally.

SHRUBS are plants with woody stem and branches like trees, but of smaller size, not generally exceeding 20 feet in height, and branching near the root, so as to have no main stem of considerable height. When a shrub is of small size and much branched, it is often called a *bush*. There is no more important botanical distinction between trees and shrubs, and the same genus very often includes species of both kinds. Many shrubs, as honeysuckle, are climbers.

In point of Law, whoever plants a shrub thereby makes it part of the soil, and it becomes a kind of fixture, incapable of being removed by tenants. But if the tenant is a nurseryman, who makes a business of planting and removing shrubs, it is otherwise. Whoever unlawfully and maliciously cuts, breaks, barks, or roots up a shrub growing in a pleasure-ground, garden, or ground adjoining a dwelling-house, if the injury exceed one pound in value, is guilty of felony, and liable to penal servitude for three years; and wherever the shrub is situated, if the damage amount to one shilling, the person is liable to be imprisoned or fined by a justice of the peace.

SHUGSHU'T, a small town of Turkey in Asia, in Anatolia, on the left bank of the Sakaria, 95 miles in direct line south-east of Constantinople. On an adjacent hill is the tomb of Othman (q. v.), founder of the Ottoman dynasty. The tomb, resembling the handsomest and most ancient of the Turkish sepulchres at Constantinople, stands amid a grove of cypresses and evergreen oaks. Pop. estimated at about 8000.

SHUMALA'RI. See HIMALAYA.

SHU'MLA, a city of Bulgaria, about half-way along the line of railway which connects Rustchuck and Varna, and 60 miles S. S.W. of Silistria. It is bounded on the north and west by mountains, and on the south and east by an undulating plain furrowed by valleys that extend north to the Danube. Its situation is pleasing, and the character and distribntion of its buildings give it a picturesque appearance. The roads from the former Turkish fortresses on the Lower Danube and in the Dobrudscha on the north, and from the passes of the Eastern Balkan on the south, converge upon S., and for this reason it is an important strategic position. Under the Turkish sway, S. was one of their most important strongholds, with very strong and extensive fortifications, and possessed a citadel, arsenal, capacious magazines, large and numerous barracks, and a military hospital. The plain around was also studded with detached forts. In S. are nearly 40 mosques. Wine and silk are largely produced; there are manufactures of copper, tin, and leather. The inhabitants during the Turkish supremacy were estimated at about 20,000, and were for the most part Turks or Mohammedans. S. was attacked in vain by the Russians in 1774, in 1810, and in 1828. The Congress of Berlin, which established Bulgaria as an autonomous principality in 1878, resolved that the fortifications of S. and other Bulgarian towns should be destroyed.

SHUNT SYSTEM OF RIFLING is a very ingenious arrangement for securing the accurate centering of a projectile discharged from a rifled cannon. To obtain precision of aim and range, it is absolutely essential that the axis of a projectile should, at the moment of discharge, coincide exactly with the axis of the bore. This can scarcely be obtained unless the shot fits with extreme tightness into the gun; and if it does so, and the gun is a muzzle-loader, it is scarcely possible to load it. The ordinary principle has the projectile smaller than the bore, so as to pass readily into the gun, resting, of course, on the bottom of the bore. The projectile is covered with a soft metal, as lead, which expands with

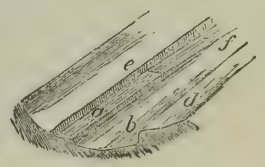


Fig. 1.

the pressure behind, and fits the shot tight into the grooves; but from the fact that it rested (at the commencement of the expansion) on the bottom of the bore, the axis of the shot is always below the axis of the bore. To obviate this, Sir William Arm-

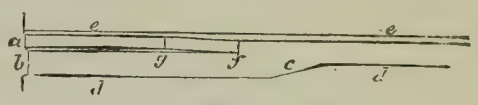


Fig. 2.

strong designed the 'shunt' system, which in some respects was found admirably effective. In rifling the gun, the groove for 14 inches from the muzzle consists of a wide, deep indentation (*b* in figs. 1 and 2), and at the side of it a narrow indentation of less

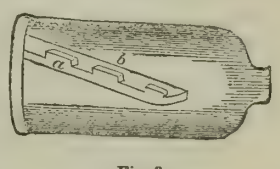


Fig. 3.

depth, *a*; from 14 inches to 22 inches from the muzzle, this narrow groove gradually deepens, till it attains the level of the broad groove, after which they run together for a short distance, until a shunt at *c*, fig. 2, narrows the whole groove on the same side as *a* to the original width of *b*. Projecting from the shell (fig. 3) is an iron flange *a*, too high to pass the narrow groove, and still higher, by its side, a narrow band of zinc or of brass studs, *b*. Each of these passes freely along the broad deep groove of the bore.

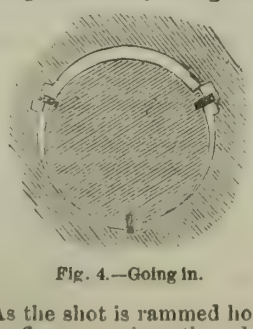


Fig. 4.—Going in.

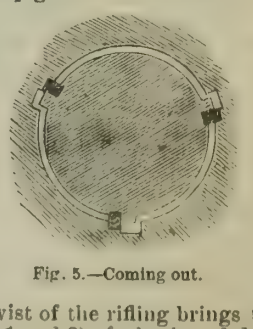


Fig. 5.—Coming out.

As the shot is rammed home, the twist of the rifling brings the iron flange against the edge *d* (figs. 1 and 2) of the broad deep groove, which enables both the flange and zinc band to pass freely until past *f* (fig. 2), where the inclined plane ends. At *c*, however, where the groove becomes narrowed to only the width of the flange and band together, the shot is shunted over to the left. In this position it is rammed home. In coming out, of course, the

pressure of the twist is reversed, and the zinc band presses against the straight edge *e*; on reaching *f*, the force of the exploded powder behind drives the shot on, while the inclined groove from *f* to *g* flattens down the zinc band, so that the projectile ceases to lie on the bottom of the bore, and is firmly centered by its several bands on the shallow grooves (whatever their number may be) round the bore's circumference. The lead fitting at the back of the shot has been meanwhile driven by the explosion into the deep wide grooves, so as to stop windage.

The sections of the muzzle in this article, figs. 4 and 5, are necessarily exaggerated in regard to the position of the shot, to show the principle. In reality, there is only a minute difference between the diameters of bore and projectile.

The shunt system having been found to be complicated, and liable to damage projectile and gun, was superseded in 1865 by the Woolwich system, a modified form of the French rifling (for which see RIFLED ARMS).

SHU'SHA, or SCHUSCHA, a fortified town of Russian Transcaucasia, in the government of Elisabetpol, and 120 miles south-west of the town of Schemacha. It was founded by Nadir Shah, and occupies a strong position on a mountain, accessible only on one side. Pop. (1880) 24,500.

SHU'STER, a city of Persia, in Khuzistan, on the Karun, 30 miles east-south-east of Dizful, at the foot of a range of sandstone hills. In the early part of the present century, it was an important town and the capital of the province; but it was nearly depopulated by an epidemic in 1832, and was much damaged by an inundation in 1840. On a height stands the castle, commanded, however, by a loftier elevation. The walls have been allowed to fall, and a fourth part of the town is in ruins. Customs are collected here, but the trade is not extensive. Pop. about 8000.

SHUTTLE, the instrument used to carry the weft-thread in weaving. See LOOM.

SIA'LOGOGUES are substances which, by local stimulating action, increase the secretion of saliva. Amongst the substances which thus act as direct stimulants to the Salivary Glands (q. v.), we may especially mention Horse-radish root, Mezereon bark, and Pellitory-root. Horse-radish root when chewed, produces a copious flow of saliva, and has been found useful in aiding deglutition in cases of paralysis of the tongue. If Mezereon bark is used in the same way, the saliva should be frequently ejected, in consequence of the acrid properties which it absorbs from the drug. Pellitory root is the best of this class of remedies. Fragments weighing from half a drachm to a drachm may be frequently chewed when we wish to increase the flow of saliva in cases of facial neuralgia, rheumatism of the muscles of mastication, and paralysis of the tongue.

SIA'M (native name *Thái* = the Free, or *Muang Thái* = the Kingdom of the Free), the chief state of Indo-China, is bounded on the S. by the Gulf of Siam and the Malay Peninsula. On the W., N., and E., the frontier line is ill defined and fluctuating, owing to many tribes being only partially under subjection, and to the constant wars of aggrandizement between S. and the Malayan and Burmese races on the west, and the Cambodian and Cochin-Chinese races on the east. According to a recent account, the country lies in lat. 4°—21° N., long. 96°—102° E.; is 1200 miles in length, and about 350 miles in extreme breadth. Area estimated at from 190,000 to 290,000 sq. m.; pop. stated at from 6,000,000 to 10,000,000. The kingdom consists of 41 provinces, each governed by a Phraya or functionary of the highest rank. There are numerous districts beyond the limits of the kingdom proper, as the Layos, Malayan, and Cambodian dependencies, which are more or less under subjection to S., and pay tribute generally once in three years. S. itself pays tribute to China, but only as a matter of usage and convenience, for it receives from that country more than a return, in the remission of duties upon Siamese vessels bound to Chinese ports. Cambodia is situated between S. on the west and Cochin-China, and as sovereignty over it is claimed by both these countries, and as it is too feeble to resist the claims, it pays tribute to both.

Surface, Hydrography, Coast-line, Soil, and Climate. — The mountains which cover the northern districts of the country, and form natural barriers along its east and west frontiers, are branches of the great system of the Himalaya. Though the northern dependencies of S. are mountainous, the kingdom proper is a vast plain, which only becomes hilly on its northern frontier. The great river of the country, the Nile of S., is called by foreigners Menam, or more commonly Meinam; but the Siamese call all rivers by this name, and distinguish the river by adding to the name Menam the name of the chief town or village on its banks; thus, Menam Bangkok is the river of Bangkok, that is, the great river of the country, which Europeans and other foreigners have agreed to call Meinam. This river, the great life-sustaining artery of the country, rises among the mountains of the Chinese province of Yunnan, whence it flows south, and after a course of more than 800 miles in this direction, throws itself by three mouths, which are from 6 to 8 fathoms deep, into the Gulf of Siam, about 30 miles (18 miles in direct line) below Bangkok. It receives a number of important affluents, notably the river Phitsalok, which joins it in lat. about 17° 35′ N. The annual inundation of the Meinam, the occasional non-occurrence of which entails failure on a great portion of the rice-crops, commences in June, and ends in November. Impregnated with the rich soil which it brings from the interior, its waters, in August, overflow the banks to a height sometimes exceeding six feet above the ordinary level. The tract of country within the direct influence of the inundations is estimated at 12,000 sq. m.; but, properly speaking, the actual valley of the Meinam, commencing 450 miles above the mouth of that river, and with an average breadth of 50 miles, has an area of upwards of 22,000 sq. m., and forms a tract of country the fertility of which is not exceeded in any other quarter of the globe. Of the other great rivers, the chief is the Mei-kong, which flows through the eastern districts of the empire, and is said to be 1600 miles long. The coast-line, fringing the edge of the Gulf of Siam, may be roughly estimated at 1100 miles, exclusive of minor windings.

The principal ports on the coast-line are Paknam (pop. 6500), defended by three forts; Paklat, a few miles above Paknam (pop. 7000), defended by a fort on each side of the river; Meklong, at the mouth of the river of the same name, long. 100° 10′ E., a beautiful city, with floating bazaars, fine pagodas and gardens, and a pop. of 10,000; Chantaburi, long. about 103° E., near the mouth of a river which, though short, fertilizes with its inundations a considerable district, a place of active trade with China and Cochin-China, with a pop. of 6000; and Bangplasoi, 27 miles east-south-east of Paknam, engaged in a profitable fishery and in agriculture, pop. 6000. The breadth of the Malayan Peninsula, in lat. 11° N., is only 50 miles, and here two streams, the one flowing west to the Bay of Bengal, and the other east of the Gulf of Siam, offer great facilities for the construction of a ship-canal, for their sources being near each other, a few miles of canalization are all that would be required to connect them, and thus form a sea-way across the peninsula, which would shorten the voyage between India and Eastern Asia by many days, and often by weeks.—The climate of S. is, for a tropical region, salubrious; the resident missionaries speak highly in its favor. The mean temperature at Bangkok, for a series of eight years, was 81° 14′; the maximum heat, within the same space, was 97°, and the minimum 54°. Hurricanes and typhoons are almost unknown in S., though it is visited every year by the south-west and north-east monsoons —the former bringing clouds, thunder-storms, and rain, the latter bringing refreshing weather.

Agriculture, Flora, and Fauna.—In S., few of the instruments in use in scientific agriculture are known, and in many parts of the country, in 1855, the ground was prepared for the seed by turning herds of buffaloes into the fields to trample down the weeds and move the soil, and afterwards by harrowing the ground with thorny shrubs. But the soil here is so rich that the smallest outlay of capital and labor is awarded by abundant harvests. A much more advanced system of agriculture, however, has been introduced within recent years, and the quantity of agricultural products exported has greatly increased. Rice and sugar are the principal crops. Of the other products, the chief are *Aquila*, or eagle-wood, renowned for its perfume, and extensively used on that account at funerals, marriages, and other ceremonies in Eastern Asia; gutta-percha; cardamons; gamboge; bamboo; the rattan; valuable palms; the guava; mango; daurien, esteemed the king of fruits in S.; the mangosteen, and many other fruit and other trees, including teak and a variety of valuable ship and house timbers. Among the animals, the most famous is the elephant, which abounds in the forests. It is against the law of S. to kill elephants, as these animals are considered the property of the king; but many of them are nevertheless slain for the sake of their tusks. A variety of this animal, said to be pecular to S., is the white elephant, which is not really white, but of a light mahogany color. This animal is held in the highest veneration, the cause of which is, that he is 'supposed to be the incarnation of some future Buddha, and will therefore bring blessings on the country which possesses so great a treasure.' He is fed upon fresh grass, and sugar-canes and plantains, served in rich dishes, is covered with ornaments, inhabits a building attached to the palace, enjoys the rank of nobility, and is tended by a staff of officers, guards, valets, &c.

Tigers abound, especially in the Laos country in the north; tiger-cats, rhinoceroses, boars, wild pigs, elks, and deer of many kinds, tenant the woods. Crocodiles, lizards, and serpents of various kinds are numerous. Excellent fish are found on the coasts and in the rivers.

Minerals.—Gold is found among the mountains, and silver in combination with other metals; copper, tin, lead, and iron are abundant, and are extensively worked by the Chinese. Precious stones are found in great number and variety.

Manufactures.—Vases, urns, and other vessels, in the manufacture of which gold is embossed upon silver, are made here in great numbers, and have an oriental celebrity. Gold-beating, iron-founding, and manufactures of fine cloth, glass-wares, and pottery are carried on.

Commerce, Exports, and Imports.—In former times, Bangkok (q. v.), the capital, was the most commercial city east of the Cape of Good Hope, after Calcutta and Canton, and 60 British ships were engaged in trade with the river Meinam. But in 1855, such had been the influence of bad legislation, and such the destructive progress of monopoly, that the foreign trade had become reduced almost to nothing. Sir John Bowring, Her Majesty's Plenipotentiary, arriving in S., negotiated a treaty of friendship and commerce with the Siamese rulers (signed at Bangkok, April 1855), which provides that British subjects are permitted to trade freely in all the seaports of S., may purchase lands, houses, &c., and may profess the Christian religion undisturbed. By this treaty, all monopolies are rescinded, British traders purchasing directly from the producer, and selling directly to the purchaser, without the interference of any third party. Export duties are levied upon all goods that leave the country, but they pay one impost only, whether this be levied under the name of inland-tax, transit-duty, or duty on exportation.

Prior to 1856, the British arrivals amounted to only 12 per annum; in 1858, they amounted to 81 vessels; and in 1881, the entries at the port of Bangkok, which is the center of the foreign trade of S., included 268 British vessels (of a total of 524 vessels) of 110,625 tons. In the years 1876–80, the total exports had an annual value of from £1,600,000 to £2,200,000; the imports from £1,000,000 to £1,300,000. The trade with Britain fluctuates in an extraordinary manner. Exports to Britain vary from £20,000 to £340,000; imports from Britain, from £15,000 to £30,000. The chief articles exported were rice and sugar, and the principal imports of British goods were iron and machinery. These statistics are for the port of Bangkok alone. The public revenue is variously estimated at from £1,000,000 to £3,000,000; but in any case the tax collectors, who have only a nominal salary, appropriate fraudulently a large proportion of the total.

Inhabitants and Government.—The Siamese proper, that is, the Thái race, form about a third of the entire population. 'They are gentle, timid, careless, and almost passionless.' They differ in several respects from many eastern nations. Lying, though frequently resorted to as a protection against injustice and oppression, is not a national characteristic. The Siamese are inclined to be idle, inconstant, and exacting; but they are sincere, very affectionate in their domestic relations, witty in conversation, and, like the Chinese, expert in mimicry. About a third of the whole population are Chinese, who are great emigrants, but who, wherever they go, preserve their own language, customs, costume, habits, and social organization. There are, it is estimated, 1,500,000 Chinese in S.; in Bangkok alone there are 200,000. All the active business of the country is in their hands. The Laos people (see SHAN STATES) are also very numerous in the country, and there are considerable numbers of Malays and Cambodians.

The religion of the Siamese is Buddhism (q. v.), which inculcates the highest veneration for life in whatever form. A Siamese will not kill vermin or serpents; and the tameness of many creatures that in Europe flee from the presence of man, is observed by all strangers. The use of Betel (q. v.) is almost universal in Siam. All the *belles* of S. stain their teeth black. The Siamese are extremely ceremonious in their intercourse one with another. An inferior crouches and crawls on the ground before a dignitary, and speaks of himself as 'your slave—a hair—a little beast.' They are a small well-proportioned race, with olive-colored skin, and black hair, of which all that they allow to grow is a tuft about two inches long on the top of the head—the rest being shaven off. They are remarkably fond of jewelry and ornaments, and the dresses of the higher functionaries and nobles is splendid and beautiful. They are fond of music; have a number of good native instruments, as well as the common European ones, and are skilful performers.

The government is an absolute and hereditary monarchy, and there are two kings. The First King is the actual monarch; the Second King, who receives about one-third of the revenue, and has an army of 2000 men, seems to occupy the place of first counsellor, and is invariably consulted by the First King before any decisive step in the administration of affairs is taken. The present first king Phrabat Somdetja Phra Paramínthara, was born in 1823, and ascended the throne on his father's death, October 1, 1868. The second king, Kromam Bawarawichai Chau, son of the last named, succeeded his father in 1868. Since a decree of 1874 the king shares the legislative power with the Supreme Council of State and with his cabinet or Senabodi.

History.—The annals of the Siamese begin about five centuries B.C. But nothing authentic is known of the history of the country till 1350, in which year Ayuthia, the former capital, was founded. Cambodia was first conquered in 1532, and in this century the Siamese dominion extended to Singapore. The present dynasty ascended the throne in 1782. There have been numbers of Protestant and Catholic missionaries in S. since the year 1828, but so far as the Siamese are concerned, their labors have been almost if not altogether fruitless.—For further information on this most interesting country and people, see Bowring's *Siam* (Lond. 1857).

SIAM, GULF OF, an important arm of the Chinese Sea, is bounded on the N. and W. by Siam, on the S.-W. by the Malay peninsula, and on the N.-E. by Cambodia. At its entrance between Cambodia Point and the peninsula of Patani on the Malay Peninsula, it is 235 miles wide, and from the line drawn between these two points it extends inland in a north-west direction to the mouth of the Meinam, a distance of 450 miles. Four great rivers, navigable to a considerable distance from their mouths, and the chief of which is the Meinam (see SIAM), fall into the gulf. It is unvisited by hurricanes of any kind, and shipwrecks here are very rare.

SI'AMESE TWINS, a name given to two youths, Eng and Chang, born of Chinese parents in Siam, in 1811, having their bodies united by a band of flesh, stretching from the end of one breast-bone to the same place in the opposite twin. The survival to advanced life of such a *lusus naturæ* makes this one of the most remarkable cases on record. A union of the bodies of twins by various parts is not an unusual occurrence (see MONSTROSITY). Ambrose Paré has depicted instances of union by the back, belly, and forehead. The last occurred in two girls, who lived to the age of ten years, when one of them dying, a separation was made: the wound of the living girl assumed a bad character, and soon proved fatal. The Hungarian sisters, who lived about a century since, were united by the back, had one passage from the intestines, and each had one from the urinary organs. They died when they were 22 years of age. The Siamese twins were purchased of their mother at Meklong, a city of Siam, and were brought to America by Captain Coffin and Mr. Hunter in 1829. On examination, the connecting band seemed to have united them at first face to face, but constant traction had so changed its direction, that they stood partially side by side. Its length above was about two inches; below, nearly four; from above, downwards, it measured three inches; and its greatest thickness was one and a half inch. It was covered with skin, and when the center was touched, both felt it; but on touching either side of the median line, only the nearest individual was sensible of it. The connection between the Siamese twins presented many interesting points in regard to physiology and pathology, for although they formed two perfectly distinct beings, they appeared most frequently to think, act, and move as one individual.

After realizing a competence by the exhibition of themselves in the various countries of Europe, the Siamese twins settled in one of the southern states of America, where they were married to two sisters and had offspring. Owing to domestic quarrels, however, two houses were found necessary, each living with his wife a week at a time alternately. Ruined by the civil war in America, the Siamese twins again made the tour of Europe, and exhibited themselves to the public. They died in 1874, the one surviving the other an hour or two only.

For a full account of the structural peculiarities of such cases, see St. Hilaire's *Histoire des Anomalies de l'Organisation d'Homme et des Animaux.*

SIARA, properly, CEARA (q. v.).

SIBBALD, SIR ROBERT, an eminent Scottish naturalist, born at Edinburgh, 15th April 1641, of a good family (the Sibbalds of Balgonie, in Fife), studied at the High School and university of Edinburgh, and afterwards pursued his medical studies at Leyden, Paris, and Angers; settled as a physician in Edinburgh in 1662, devoted much time to botany and zoology, and aided Sir Andrew Balfour in establishing a botanic garden in Edinburgh. Having inherited an estate, he retired from medical practice, but continued his scientific pursuits; was appointed by Charles II. his Majesty's Geographer for Scotland, and was encouraged to prepare a work on the geography and natural history of his native country. His death is supposed to have taken place in 1722. He published many pamphlets on medical subjects, natural history, Scottish history, antiquities, &c. The work for which he is now chiefly remembered is his *Scotia Illustrata, sive Prodromus Historiæ Naturalis*, &c. (fol. Edin. 1684), a work of great merit for its time, but his *Collection of Several Treatises in Folio concerning Scotland, as it was of Old, and also in Later Times* (Edin. 1739), is not without value.

SIBE'RIA, a vast territory in Northern Asia, belonging to Russia. In England the name is generally applied to all the Russian possessions in Asia, with the exception of the Transcaucasian and Armenian provinces. Siberia so defined is bounded on the N. by the Arctic Ocean; on the E. by the seas of Kamtchatka, Okhotsk, and Japan, all of them arms of the Pacific

Ocean; on the W. by the Ural Mountains, Ural River, and Caspian Sea. The southern boundary is made to include the recent Russian acquisitions in Turkestan, runs from Lake Issyk Kul N. N. E., then eastwards by Kiahta to the Argun river, which it follows to the Amur; the latter it follows to long. 135° E., where it trends in a S. S. W. direction, ascending the Usuri tributary for 200 miles, and then runs straight to the sea at the northern frontier of Corea. In the official language of Russia, however, Siberia is not of so wide extent. The Russian possessions in Turkestan form a separate division under the name of CENTRAL ASIA, and to this portion of the empire the governments of Akmollinsk, Semipalatinsk, Turgai, and Uralsk are now attached. Geographically speaking, these governments belong to Siberia; as do also considerable areas east of the Ural Mountains, which for administrative purposes form part of the European governments of Perm and Orenburg. The following article deals mainly with the region officially termed Siberia; for the Russian possessions in the Turkestan territory, see ASIA, CENTRAL.

The following are the subdivisions or governments of Siberia:

Divisions and Provinces.	Surface in Eng. Sq. Miles.	(Pop. 1870).
1. The Eastern Seaboard	708,253	43,320
2. Amur-land	107,514	22,297
3. Yakutsk	1,500,141	231,977
4. Transbaikalia	210,799	430,780
5. Irkutsk	279,963	378,244
6. Yeneseisk	958,042	372,862
7. Tomsk	329,783	838,756
8. Tobolsk	565,920	1,086,848
Total	4,660,415	3,405,084

(With Central Asia, but excluding the Caucasus, the total area of Russian Asia is nearly 6,000,000 sq. miles, and the pop. 8,500,000). It thus appears that in Siberia Proper there are about three inhabitants to every four English sq. miles. The northern and eastern shores are very irregular in form, jutting out frequently into bold peninsulas and promontories, and being indented with numerous immense inlets, chief of which are the estuaries of the Obi (575 miles in length) and of the Yenesei; the Gulf of Anadir, and the Sea of Okhotsk. All the island groups to the north of S., and since 1875 the whole of Sakhalin or Saghalien on the east coast belong to Siberia; whereas, since 1875, all the Kurile Islands are Japanese. The Liakhoff group, near the mouth of the Lena, consists of three islands, from 60 to 100 miles long by 20 to 40 broad, and of numberless islets: they are completely barren, and present in their soil and subsoil alternate layers of sand and ice, in which are imbedded the remains of animals.

The northernmost point of Siberia and of the old world is Cape Chelyuskin, or North-east Cape. Professor Nordenskiöld, who in 1878—79 sailed along the whole coast of S. from east to west, found Cape Chelyuskin to be in lat. 77° 41′ N. A country of such vast extent as S. (greatly larger than Europe) must necessarily exhibit great varieties of climate; and we accordingly find in the northern regions, much of which lie far within the Arctic Circle, an extensive tract bordering on the ocean, composed of swamp, moorland, and mossy flats, covered with snow and ice for one half of the year, and even during the greatest heats of summer, released from its icy bonds only to the depth of a few inches below the surface of the soil. The ocean, its northern boundary, is frozen for miles seaward during more than half the year, and during the remaining months, the numberless icebergs and floes which crowd the sea, and continually come into collision, render the navigation so dangerous that no complete hydrographic survey of the coast has yet been made. On the southern boundary of this semi-barren zone, stunted misshapen bushes and trees are found; and as we advance southwards, vegetation appears in the form of extensive forests of birch, fir, and larch, which clothe the plains and hill-sides, and are interspersed with stretches of pasture of moderate quality. After crossing the parallel of lat. 64° N. in West S., and that of lat 61° N. in East S., the more hardy cereals, barley, oats, and rye, begin to appear, and the soil increases in fertility, sometimes to an extraordinary extent, thick woods of Siberian cedar and other trees clothe the mountain sides, and the valleys, especially along the banks of rivers, are in a state of continuous cultivation.

The whole of Western S. is one great plain, sloping from its southern boundary, where the average elevation is 2000 feet, northwards to the Arctic Ocean; with the exception of the small corner in the south-west, which is drained into the Caspian and Aral Seas. The fertility of a great portion of the governments of Tobolsk and Tomsk, especially of the *Baraba* and *Ishim* steppes, is proverbial, and they are the great granaries of Russia and Northern Europe. But the warmest and perhaps most fertile part of Western S. is the valley of the Yenesei, north of the Sayansk Mountains. Eastern S. is more hilly and less fertile than the western portion, but the valleys and hill-sides afford good pasture. Four-fifths of S. is drained by the three immense rivers Obi (q. v.), Yenisei (q. v.), and Lena (q. v.), and by a number of smaller rivers, all of which flow to the Arctic Ocean. S. has a large number of lakes, some of which are little else than salt marshes; the largest of them are Lake Baikal (q. v.) and Lake Balkash (q. v.). The chief mountain-range of S. is the Altai chain, which forms the southern boundary towards Mongolia, and ramifies eastwards and northwards from the region of Lake Baikal, covering a large portion of the surface of Eastern Siberia. East of Baikal, the continuation of the Altai is rather a lofty tableland, running to Behring Straits, with many nearly parallel ridges; this plateau is the 'Great Divide' between the Lena and the Amur. The best defined and loftiest range is the Yablonovoi Mountains, or section of the Stanovoi Mountains, culminating on the frontier in a peak 8370 feet high. Farther east is the Stanovoi proper. Lofty mountain-chains traverse the island of Saghalien and the peninsula of Kamtchatka, in which there are 21 active volcanoes, the loftiest of which is Kliutshewsker: elevation, 15,000 feet.

Among the wild animals of S. are the reindeer in the northern flats, and on the high mountains of the south; the arctic or black fox, and white bear in the north; the sable, ermine, marmot, marten, squirrel, Caspian antelope, and wild sheep—all in the south; and the lynx, wolf, wild-boar, and glutton are generally diffused. Camels are found among the Kirghiz, along with the broad-tailed sheep, the Russian sheep being also domesticated in S.; and horses of good quality, an inferior sort of cattle of the Russian breed, and a large wolfish-looking dog, used chiefly to draw sledges, complete the list of domestic animals. Fresh and salt water fish abound, and feathered game is plentiful in the south. The mineral wealth of S. is great: gold, silver, copper, and lead are found in all the mountainous districts on the west and south; platinum, iron, and precious stones, including diamonds, are found on the eastern slopes of the Ural; zinc, antimony, arsenic, plumbago, and valuable emerald and topaz mines are worked in the districts north of the Amur; and porphyry, malachite, jasper, and salt (from the steppes) are common. The great majority of the inhabitants of the central and western provinces are Russians and Poles, or of Russian and Polish descent, and these have been sent to the country either as exiles, on account of political or criminal offences, or as government colonies. The most abandoned class of exiles are kept to hard labor in the mines; others are put to less laborious, but still compulsory work; and a third portion are settled in specified districts, under surveillance of the police, and allowed to employ themselves as they choose. This last class chiefly employs itself in trapping those animals whose skins and furs form valuable articles of trade.

In the north-west are found the Samoieds, and adjoining them the Ostiaks, both of whom live by hunting and fishing alone. In the south are the nomad tribes of the Kirghiz (q. v.) and Kalmucks (q. v.), both cattle-breeding peoples, though the latter have now partially adopted a settled mode of life, and manufacture iron and gunpowder. Next to them, on the borders of Manchuria, are the Buriats, a people of Mongol origin, and the most numerous tribe in S.; to the north of whom are the Yakuts and Tunguses, of Tartar origin, who are spread over the whole of Eastern S., from the town of Irkutsk to the Stanovoi range; and live mostly by hunting. The Tchuktchis, an Esquimaux race, and the Koriaks inhabit the north-east corner, and the Manchus are the population of the Amur territory. Manufactures are unimportant, and are confined to the principal towns; the barter trade in European goods is carried on at Obdorsk, Ostrovnoe, Yakutsk, and Petropavlovsk; and the transit-trade with China through Kiahta (q. v.), the imports from China being tea of the finest quality, sugar, silk, cotton, wool, grain, fruits, &c.; and the exports to that country, cotton and woollen cloths, linen, furs and skins, leather, and articles of gold and silver. The exports to Russia are the natural produce of the country, and are transported westward to the frontier by alternate land and river carriage, to Tobolsk, thence over the Ural Mountains to Perm. Reindeer sledges are the usual means of transport in winter. Fairs are held at stated periods in certain localities, and much of the trade of the country is there transacted.

The chief towns in Siberia Proper are Tobolsk, pop. 20,000; Tjumen, 13,000; Tomsk, 24,000; Irkutsk, 27,000. S. seems to have been first made known to the Russians by a merchant named Anika Stroganoff; and soon after, the conquest of Western S. was effected by the Cossack Vassili Yermak, an absconded criminal, at the head of a numerous band of wild followers. After Yermak's death in 1584, the Russians pursued their conquests eastward, founding Tomsk in 1604, and though they often experienced serious reverses, their progress was rapid, the Sea of Okhotsk being reached in 1639, and Irkutsk founded in 1661. Frequent disturbances have occurred between the Russians and the Chinese and Tartars, which have resulted in the extension southward of the Siberian boundary into Manchuria and Turkestan (q. v.). In 1845 the left bank of the Amur became Russian.

In 1858 the frontier was extended along the sea-board south of the river to the frontier of Corea. The Russians have now a large number of steam-vessels on the Amur. Recent voyages of exploration point to the practicability of opening direct and extensive commerce between Archangel and the rivers Obi and Yenesei. The Lena is also navigable for a great distance from its mouth. During the last 250 years, above 1,000,000 exiles have gone to S., if we include women and children accompanying their banished relatives. The yearly average is 8000 or 9000. Accounts as to their treatment vary greatly; some affirming that all are fairly used; some, that they, even political exiles, are very harshly dealt with. The manufacturing industries of S. are developing slowly; its mines are extensively wrought; but agriculture is practised only by the Russian settlers.—See Atkinson's *Siberia* (1858); Eden's *Frozen Asia* (1880); Lansdell's *Through Siberia* (1882); 'Asia' in *Stanford's Compendium* (1882).

SI'BYL (Gr. *Sibulla;* etymology doubtful), the name anciently given to several prophetic women, whose history has come down to us in a wholly mythical form. Their number is differently given; some writers (Ælian, for example) mention only four—the Erythræan, the Samian, the Egyptian, and the Sardian; but in general ten are reckoned, viz., the Babylonian, the Libyan, the Delphian, the Cimmerian, the Erythræan, the Samian, the Cumæan, the Trojan or Hellespontian, the Phrygian, and the Tiburtine. Of these, by far the most celebrated is the Cumæan, identified by Aristotle with the Erythræan, and personally known by the names of Herophile, Demo, Phemonoë, Deiphobe, Demophile and Amalthæa. She figures prominently in the 6th book of Virgil's *Æneid*, as the conductor of the poet into the realm of the shades. The Roman legend concerning her (as recorded by Livy) is, that she came from the east, and appearing before King Tarquin the Proud, offered him nine books for sale. The price demanded appeared to the monarch exorbitant, and he refused to purchase them. She then went away, destroyed three, and returning, asked as much for the remaining six as for the nine. This was again refused, whereupon she destroyed other three, and once more offered to sell him the rest, but without any abatement of the original price.

Tarquin was struck by her pertinacity, and bought the books, which were found to contain advices regarding the religion and policy of the Romans. They were preserved in a subterranean chamber of the temple of Jupiter on the Capitoline, and were originally intrusted to two officials (*duumviri sacrorum*), appointed by the senate, who alone had the right to inspect them. The number of keepers was afterwards increased to 10 (*decemviri*), and finally, by Sulla, to 15 (*quindecemviri*). In the year 84 B.C., the temple of Jupiter having been consumed by fire, the original Sibylline books or leaves were destroyed, whereupon a special embassy was despatched by the senate to all the cities of Greece, Italy, and Asia Minor, to collect such as were current in these regions. This being done, the new collection was deposited in the temple of Jupiter after it had been rebuilt. Spurious Sibylline prophecies—or what were regarded as such—accumulated greatly in private hands towards the close of the Republic; and Augustus, fearing, perhaps, that they might be turned to political uses, ordered them all to be given up to the city-prætor, and burned them. More than 2000 were destroyed on this occasion. The remainder were kept in the temple of Apollo, on the Palatine, under lock and key; but the whole perished during the burning of Rome in the time of Nero. Other collections were made; and as late as the 6th c., when the city was besieged by the Goths, there were not wanting some who pretended to predict the issue from a consultation of these venerable oracles. It is, however, beyond doubt, that as early, at least, as the 2d c. A.D., when enthusiastic men sprung up in the Christian church, prophesying in a poetic-oracular style (whence they were sometimes called *Sibyllists*), the Sibylline books were much interpolated and falsified to assist the progress of the new faith. The utterances of these Christian Sibyllists form a special department of early ecclesiastical literature, and are a mixture of Jewish, Pagan, and Christian ingredients. The collections of them also bear the name of 'Sibylline Books.' An edition of the *Oracula Sibyllina* was published by Gallæus in 1689.—See works on the Sibylline Books by Bleek (1819), Volkmann (1853), Ewald (1858).

SICI'LIAN VE'SPERS, the name given to the massacre of the French in Sicily, on the day after Easter (March 30) 1282, the signal for the commencement of which was to be the first stroke of the vesper-bell. In the articles NAPLES, KONRADIN, MANFRED, &c., it is related how Charles of Anjou, the brother of Louis IX. of France, had deprived the Hohenstaufen dynasty of Naples and Sicily, and parcelled out these kingdoms into domains for his French followers; but his cruelty towards the adherents of the dispossessed race, his tyranny, oppressive taxation, and the brutality of his followers, excited among the vindictive Sicilians the deadliest animosity. The aged Giovanni da Procida, a steady partisan of the Hohenstaufen family, took the lead in directing and systematizing a conspiracy against Charles and his followers; and after a visit to Pedro of Aragon (the husband of Constance the cousin of Konradin, and the next heir to Naples and Sicily), whom he found willing to undertake the conquest of Sicily, he returned to his self-imposed duty in the island. On the evening of Easter-Monday, the inhabitants of Palermo, enraged (according to the common story) at a gross outrage which was perpetrated by a French soldier on a young Sicilian bride, precipitated the accomplishment of the scheme by suddenly rising upon their oppressors, putting to the sword every man, woman, and child of them, not sparing even those Italians and Sicilians who had married Frenchmen. This example was followed, after a brief interval, by Messina and the other towns, and the massacre soon became general over the island; the French were hunted like wild beasts, and dragged even from the churches, where they vainly thought themselves secure. More than 8000 of them were slain by the Palermitans alone.

Only one instance of mercy shown to a Frenchman is on record. The governor of Messina also succeeded in passing the strait with his garrison before it was too late. The 600th anniversary of the Sicilian Vespers was celebrated with much enthusiasm in 1882, Garibaldi (shortly before his death) having come to Palermo on purpose to be present. He was, however, too feeble to take part in the ceremonies.—See Amari, *La Guerra del Vespro Siciliano.*

SICILIA'NA, in Music, a name given to a slow, soothing, pastoral description of air, in $\frac{6}{8}$ time; so called because the dance peculiar to the peasantry of Sicily possesses this character.

SI'CILY, the largest, most fertile, and most populous island in the Mediterranean Sea, lies between lat. 36° 38′—38° 18′ N., and between long. 12° 25′—15° 40′ E., and is separated from the mainland of Italy by the Strait of Messina. Its shape roughly resembles a triangle (whence the early Greek navigators gave it the name of *Trinacria*, the ('Three-cornered')—the eastern coast, from Capo del Faro in the north to Capo Passaro in the south, forming the base; and the northern and south-western coasts the sides which gradually approach each other towards the north-west. The length of the base is 145 miles; of the northern side, 215 miles; and of the south-western, 190 miles: the circumference of the island, including the sinuosities of the coast, is estimated at 624 miles. Area about 10,000 sq. miles. Pop., at the census of 1871, 2,584,099; of 1881, 2,928,840. Capo Passaro, at the south-eastern extremity, is only 56 miles from Malta; and Capo Boco, near Marsala, at the north-western, only 80 miles from Cape Bon on the African coast.

Physical Geography.—The island of S., like the mainland of Italy, is traversed throughout its entire length by a chain of mountains, which may be looked upon as a continuation of the Apennines (q. v.). This chain, beginning at Capo del Faro on the Strait of Messina, runs in a south-south-western direction as far as Taormina, where it turns off to the west, and stretches across the whole island, keeping, however, much nearer to the northern than to the south-western coast. The first part of the chain, from Capo del Faro to Taormina, is called the Peloric range (anc. *Neptunius Mons*), which in Monte Dinnamare attains the height of 3260 feet; the second and much the longer part is called the Madonian range (anc. *Nebrodes Montes*), which, in the Pizzo di Palermo, rises to an elevation of 6328 feet. It forms the great watershed of the island. Towards the north-western coast, the chain breaks up into irregular and often detached masses, such as Monte Pellegrino (1963 feet) and Monte San Giuliano (2184 feet). About the center of the chain, a range branches off through the heart of the island to the south-east; at first wild and rugged, but afterwards smoothing down into table-lands, which in turn slope away tamely to the sea. There are innumerable other spurs to the south from the great Madonian chain, of inferior length and elevation, but none of these require special mention.

The volcano of Etna, which rises in solitary grandeur on the eastern coast, is separately described. See ETNA. S. is not, on the whole, a well-wooded country, but forests of considerable size are found here and there—as, for example, the royal forests near Caronia and Mezzojuso, the forest-zone of Etna, &c.—In the interior of the island there is not much level land, but on several parts of the coast there are extensive plains, generally of great fertility. The principal of these are the great plain of Catania (anc. *Campi Leontini*) out of which rises Etna; the plains of Palermo, termed the *Conca d'Oro*, or 'Golden Shell,' of Castellamare, of Licata and Terranova.—Although rivers are numerous, none are navigable. The largest are the Simeto or Giarretta, the Cantara, the Salso, the Platani, and the Belici.

Climate.—The climate of S. is very warm, but salubrious, except in low-lying places, where there is a mephitic atmosphere. The best health is enjoyed in the lower region of Etna, which is very densely peopled, although exposed to eruptions and violent earthquakes. The heat is intense in summer when the sirocco blows. After the autumnal equinox, violent winds are prevalent, torrents of rain fall, and all along the coasts the atmosphere is

charged with moisture and fogs. The earthquakes begin about the end of winter, and do great damage. Snow and ice are rarely to be seen except on Etna.

Geology and Mineralogy.—The primary rocks in the mountainous districts are chiefly quartz, granite, and mica. In some parts these are overlaid by limestone rocks. Most of the lower ranges of hills are of calcareous formation, and are rich in metallic ores. Sulphur forms the chief mineral wealth of Sicily. Immense beds of it are found in the central and northern parts of the island. The English export about 42,000 tons of it per annum, and the mines are worked by Cornish miners and their descendants.

Soil, Agriculture, &c.—The soil of the island is so fertile that very little labor is required to raise the crops. In many valleys there is rich soil to the depth even of 40 feet. In Catania, decomposed lava is spread over the ground, greatly increasing its fertility. The crops of grain are large, and might be prodigious if agriculture were better understood; the harvests are such that they recall to mind the words of Livy, in speaking of S.: 'Populoque Romano, pace ac bello, fidissimum annonæ subsidium' (lib. xxvii. 5). In the most ancient times, agriculture was sedulously prosecuted, but it began to decline when the island was deprived of its independence by the Carthaginians. In more recent times, the restrictions on the exportation of grain served not only to keep agriculture from making any progress, but also to put a drag upon the commerce of the country, which, on every attempt made to raise itself, was met by fresh obstacles in the shape of new taxes. The Italian government has greatly alleviated the obstacles to agriculture, and the salutary effects of the change of system are already apparent. The soil produces corn, maize, flax, hemp; excellent cotton near Mazzara and in Catania; sugar, equal to that of the East Indies, along the southern coast; grapes (350,000 acres), olives (125,000 acres, with an annual yield in oil of 15,000 tons), saffron, oranges, lemons, citrons, pomegranates, figs, pistachios, dates, castor-oil, mulberry, sumach, tobacco, and manna. The vine has been cultivated with the greatest care at Marsala since 1789, when an English firm settled there began to export it. Now, upwards of 5,000,000 gallons are annually exported to England, America, and India.—S. possesses the best tunny-fisheries in the Mediterranean. The fisheries for coral at different places on the coast are also industriously carried on, and on an average, about 2100 lbs. are annually obtained.

Manufactures, Commerce, &c.—The manufactures of S. are insignificant, and are nearly altogether confined to silk, cotton, and leather.—The most important articles of export are sulphur, sumach, fruits, and wine; of import, cottons, woollens, silks, linens, earthenware, hardware. Great Britian, France, and the United States are the countries with which the Sicilians chiefly carry on commerce. The statistics of exports and imports are untrustworthy; but the latter considerably exceed the former. More than 200 miles of railways have recently been constructed.

Religion, Education, &c.—With the exception of about 58,000 Greeks, and a few thousand Jews, the inhabitants are all Roman Catholics; but though equally ignorant, they are not so superstitious as the Neapolitans; at least their superstition has not destroyed their love of political freedom, as has repeatedly been evinced in their history—most recently in the ardor with which they responded to the summons of Garibaldi to liberate themselves from the tyranny of the Bourbons. There are three universities—at Palermo, Catania, and Messina; and also a Collegio de' Nobilé at Palermo.

Political Divisions.—S. is divided into 7 provinces or prefectures—viz., Palermo, Messina, Catania, Noto or Siracusa, Caltanisetta, Girgenti, and Trapani. Each province is subdivided into 3 or 4 districts, and these again into numerous *communi* or 'townships.' Over the province is placed an *intendente*, or, as he is now called, a 'prefect;' over the district, a sub-prefect; and over the commune a *sindaco* ('syndic,' or 'mayor'). The prefect presides over every department of the provincial administration, and also over the provincial council—a body composed of from 15 to 20 landholders, who meet once a year, and sit for 20 days, examining the accounts of the province, and framing the provincial budget. The two surbodinate divisions have also their 'councils;' and the members of all three are appointed either by the king or by the prefect. Of course, this insular self-government does not supersede the necessity of sending Sicilian deputies to the national parliament at Rome.

History.—S. was inhabited, in pre-historic times, by a people who bore the name of *Siculi* or *Sicani*, and who—according to a universally received tradition—crossed over into the island from the southern extremity of the mainland. Their names and every fact that we can ascertain about them, lead to the supposition that they were members of the great Latino-Italian family that, entering Italy from the north, gradually pushed its way across the Apennines to the peninsula of Bruttium (see article Rome). Beyond this rational conjecture, however, we cannot proceed, and the actual history of S. only begins to emerge out of utter darkness with the establishment of Greek and Phœnician colonies.

The earliest Greek colony, that of Naxos, was founded 735 B.C.; the latest that of Agrigentum, 580 B.C. During the intervening century and a half, numerous important colonies were established (either directly from Greece or as offshoots from the older Greek settlements in the island); Syracuse (734 B.C.), Leontini and Catana (730 B.C.), Megara Hyblæa (728 B.C.), Gela (690 B.C.), Zancle, later Messana (date of origin uncertain), Acræ (664 B.C.), Himera (648 B.C.), Mylæ (date of origin uncertain), Casmenæ (644 B.C.), Selinus (628 B.C.), Camarina (599 B.C.), Agrigentum (580 B.C.). The earlier history of these cities is almost unknown. What is recorded is vague and general. We read that they attained great commercial prosperity, that they subjugated or wrested from the Siculi, Elymi, and other 'native' tribes large portions of neighboring territory; and that their governments (like those of the republics in the mother-country) were at first oligarchical, and latterly democracies or 'tyrannies;' but it is not till the period of the 'despots' that we have detailed accounts. Then the cities of Agrigentum and Gela acquire prominence — the former under the rule of Phalaris (q. v.), becoming for a short time, probably the most powerful state in Sicily; and the latter, under a succession of able tyrants, Cleander, Hippocrates, and Gelon (q. v.), forcing into subjection most of the other Greek cities. Gelon, however, transferred his government to Syracuse (one of his conquests), which now became the principal Greek city of Sicily—a dignity it ever after retained.

Contemporary with Gelon, and possessed of the same high capacity for governing, were Theron, 'tyrant' of Agrigentum, and Anaxilaus, tyrant of Rhegium, and conqueror of Zancle, to which he gave the name of Messana. Meanwhile, the Carthaginians—a people wholly different from the Greeks in language, religion, origin, and civilization—had obtained possession of the Phœnician settlements in Sicily. The first appearance of the Carthaginians in the island dates from 536 B.C.; but the steady growth of the Greek cities in wealth and power, long confined their rivals to the north-western part, where their principal colonies were Panormus, Motya, and Soloeis. The first open trial of strength took place in the great battle of Himera, where the Carthaginian army was utterly routed by Gelon, and its leader, Hamilcar, slain. The Gelonian dynasty at Syracuse fell 466 B.C., after experiencing various fortunes. During the next fifty years, the island had peace. In 410 B.C., however, the war between the Carthaginians and Greeks for the possession of the island was renewed. The successes of the former were great and permanent. Selinus, Himera, Agrigentum, Gela, and Camarina, fell into their hands in less than five years; and it was not till Syracuse had got a new 'tyrant,' the famous Dionysius (q. v.) the Elder, that fortune again began to smile on the Greeks. Even he, however, could not wrest from the Carthaginians what they had already won; and after the war of 383 B.C., a peace was concluded, which left Dionysius in possession of the eastern, and the Carthaginians of the western, half of the island.

The dissensions and tumults that followed the decease of Dionysius, illustrate forcibly the peculiar dangers to which the Greek republics, either at home or abroad, were prone; but we can only afford to notice the triumph of the popular party under Timoleon (343 B.C.), and the splendid victory of the latter over the Carthaginian generals, Hasdrubal and Hamilcar, at the river Crimisus, 340 B.C. Once more Greek influence was in the ascendant, but the rule of the bold and ambitious tyrant Agathocles (317—289 B.C.) proved in the main disastrous to Greek supremacy. After his death, Syracuse lost her hold over many of the Greek cities, which established a weak and perilous independence, that only rendered the preponderance of the Carthaginians more certain. Finally, Pyrrhus (q. v.), king of Epirus, was invited over to help his countrymen, and in 278 B.C. he landed in the island. The brilliant adventurer—one of the most romantic figures in classic history—for a time swept everything before him. Panormus, Ercte, and Eryx were captured; and though he failed to make himself master of Lilybæum, he might probably have forced the Carthaginians to surrender it, had he not been thwarted in his designs by the miserable discords and jealousies of the people whom he came to save. As it was, Pyrrhus left Sicily in about two years; and in all likelihood the island would have sunk into a Carthaginian possession, had not a new power appeared on the stage—viz., the Roman.

The struggle for supremacy between Rome and Carthage—the most tremendous struggle in ancient history—is sketched in the article Rome, and in the biographies of the leading generals, and therefore need not be narrated here. Suffice it to say, that in 246 B.C., Carthaginian S., and in 210 B.C., the whole island became a Roman 'province'—the first Rome ever held. Henceforth it shared the fortunes of the great state to which it was annexed, and its special history need only be rapidly glanced at. In 135—132 B.C., and again in 103—100 B.C., it was the scene of two formidable slave-insurrections, during which it was frightfully devastated. Its fertility, and the wealth of its citizens and landholders, were also powerful temptations to greedy and unscrupulous gov-

ernors, of whom we have a specimen in Verres (prætor 73—70 B.C.), 'damned to everlasting fame' in the Orations of Cicero. Augustus visited S., after the close of the civil wars, and established some colonies; but it does not seem to have prospered under the empire; and in 440 A.D. it was conquered by the Vandals under Genseric. The Vandals, in their turn, were compelled to cede it (480 A.D.) to Theodoric, king of the Ostrogoths, in whose hands it remained till 535 A.D., when Belisarius conquered and annexed it to the Byzantine empire. In this condition it remained till 827, when the Saracens invaded the island, and after a protracted struggle, lasting for 114 years, expelled the Byzantine Greeks, and made themselves masters of Sicily. They kept possession of it for upwards of a century, but after a contest of 30 years, were driven out by Robert Guiscard (q. v.) and Roger de Hauteville, at the head of a body of Normans, aided by the 'native' inhabitants, whom we conjecture to have been much the same as they were in the old classic times—for the successive waves of barbaric and Saracenic invasion that swept over the island, appear to have left little trace of their action.

Even to this day, it is highly probable that the people of S. are largely the descendants of the early Siculi. The Normans held rule in the island from 1072 to 1194; and the Norman 'Kingdom of Sicily and Naples,' or 'Kingdom of the Two Sicilies,' dates from 1130, when Roger II. obtaining possession of most of the continental dominions of his uncle, Robert Guiscard, assumed the title of king. During the rule of the Swabian dynasty (see HOHENSTAUFEN, HOUSE OF), 1194—1258, the political history of S. is the same as that of Naples; but in 1282, after the dreadful massacre of the French, known as the Sicilian Vespers (q. v.), it again became independent, chose for its king Pedro III. of Aragon, who was the sole representative by marriage of the House of Hohenstaufen, and remained in the possession of the Aragonese sovereigns till 1505, when the union of the crowns of Castile and Aragon—in other words, the rise of the Spanish monarchy in the persons of Ferdinand and Isabella, placed it under the dominion of Spain. The fortune of war also gave Ferdinand the possession of Naples; and the Spanish kings retained both countries until the war of the Spanish Succession, 1700—1713 (see SUCCESSION WARS). By the treaty of Utrecht (1713), S. was separated from Naples; and handed over to Victor Amadeus, Duke of Savoy, who, however, restored it to the crown of Naples by the treaty of Paris, seven years after, receiving in exchange the island of Sardinia. From 1720, the two countries continued under the same dynasty, the House of Austria, 1720—1734; and the Spanish Bourbons, 1734—1860 (if we except the brief rule of the French in Naples, 1806—1815, when Joseph Bonaparte, and afterwards Joachim Murat, were kings), down to the period of Garibaldi's invasion (see ITALY, and GARIBALDI), which resulted in the annexation of both to the new kingdom of Italy under Victor Emmanuel.

SICULIA'NA, a city of Sicily, province of Girgenti, and 8 miles west-north-west of the city of that name. It stands on the sea, and has a small, badly-situated harbor. Pop. 5764.

SI'CYON, the principal city of a very small but exceedingly fertile state of ancient Greece, Sicyonia, situated in the north of the Peloponnesus, having the Corinthian Gulf for its northern boundary, with Achaia on the W., Phlius on the S., and Corinth on the E. The territory was level towards the sea, somewhat mountainous in the interior, and well watered by the two rivers Asopus and Helisson, between which, on a triangular plateau, was situated S., about two miles south of the Corinthian Gulf, and ten north-west of Corinth. Round the three sides of the plateau ran a wall, which, combined with the precipitous nature of the heights that surrounded it, rendered the position of S. one of great strength. It is supposed that at one time it had, like Athens, a double wall reaching from the city to the port on the Sea of Corinth. S. was anciently celebrated as a chief seat of painting and statuary (tradition asserting that the former was invented there), it having given its name to a school of painting which included among its disciples Pamphilus and Apelles, both natives of Sicyon. It was also the native city of Aratus (q. v.), the general of the Achæan League. There exist at the present day a few remains of the ancient city, as well as of the more modern buildings erected by the Roman conquerors of Greece, near which stands a small modern village named *Vasilika*.

SIDA, a genus of plants of the natural order *Malvaceæ*, containing a large number of species, annual and perennial herbaceous plants and shrubs, mostly natives of warm climates, and widely diffused. They generally abound in mucilage, and some of them are used in medicine in India, as the Mallow and Marsh-mallow are in Europe. They have also strong pliable fibres, which are employed for cordage and for textile purposes.—*S. tiliæfolia*, an annual, has long been cultivated in China, where it is called *King-Ma*, for the sake of its fibre, which is used like that of hemp. It is too tender for the climate of Britain, but its cultivation has been introduced into Italy and France.

SIDDONS, MRS. SARAH, was the daughter of Mr. Roger Kemble, a provincial actor, and was born at Brecon, in South Wales, on July 5, 1755. As a mere child, she was brought on the stage on the occasion of a benefit of her father's; and from that time up to her 15th year, she continued to act as a regular member of his company. An attachment having sprung up between her and a young Mr. Siddons, an actor, with the somewhat reluctant consent of her parents, she was married to him at Trinity Church, Coventry, on 26th November 1773, and in company with her husband, went to act at Cheltenham theater. Here she speedily drew great attention; and Garrick, hearing her praises in London, sent to Cheltenham a trusty emissary to report upon her. The result was an engagement offered her at the London Drury Lane Theater, where, 29th December 1775, she made her first appearance, acting Portia in *The Merchant of Venice* to the Shylock of Mr. Garrick. Her beauty and fine person pleased the audience, but as an actress she made no great impression, and at the close of the season she failed to secure a re-engagement. It was considered that this was to some extent due to her having vexed the irritable vanity of Garrick, by an unintentional error in stage business, which made him act with his back to the public in one of his pet passages, a mortification which the great man was little enough to remember and resent.

Leaving London thus in failure in 1776, in 1782 she returned to it, to run a career of triumph as indisputably the greatest actress of her time. The intervening years she had passed in the exercise of her art on the stages successively of Birmingham, Manchester, York, and Bath, till the growth of her provincial reputation determined her recall to the metropolis. In 1784, her popularity was temporarily obscured by a calumny industriously circulated, which charged her with ungenerous and illiberal conduct towards certain of her fellow-performers; but with this trivial exception, till on the 29th June 1812, in her great character of Lady Macbeth, she took her leave of the public, her course was one long series of successes. Subsequently, she occasionally consented to reappear on the stage for charitable ends, or to promote a stage 'benefit,' in which she had a kindly interest. Her death took place in London, on the 8th June 1831.

As a tragic actress, Mrs. S. has probably never in this country been equalled; as a woman, she was of unblemished reputation, and enjoyed the respect of all who knew her. She was the ornament of every society into which she went, and such was the estimation in which she was held, that she had access at will to almost any. Her genius is said to have been strictly a *stage* genius; elsewhere, she seems to have been a woman of no extraordinary parts. But she had a certain way of making her mediocrities imposing. She carried her tragedy manners with her to the drawing-room or the dinner-table: Scott has recorded the amusement with which at Abbotsford he heard her stately blank verse to the domestic:

'I asked for water, boy! you've brought me beer;'

and Sidney Smith used to say, it was never without a certain awe that he saw her '*stab the potatoes.*'

SIDE-BONES are enlargements situated above a horse's heels, resulting from the conversion into bone of the elastic lateral cartilages, They occur mostly in heavy draught horses with upright pasterns, causing much stiffness, but, unless when of rapid growth, little lameness. They are treated at first by cold applied continually, until heat and tenderness are removed, when blistering or firing must be resorted to.

SIDE'REAL CLOCK, a clock so regulated as to indicate *sidereal time*. See DAY. The sidereal clock is a most important aid to the practical astronomer, and is one of the indispensable instruments of an observatory.

SIDERO'GRAPHY (Gr. *sideros*, iron). The name applied by the inventor, Mr. Dyer, to a process of printing with compound iron (or rather steel plates, for they are case-hardened after engraving) plates, instead of plain plates of copper or steel. It is the plan now usually employed in printing bank-notes in which more than one color is given. The colored parts of the design are cut out of the main plates, and movable pieces are exactly fitted in, so that they can be retracted or pushed forward at will. They are withdrawn whilst the main plate is receiving its ink, and they are pushed forward beyond whilst receiving their supply of ink. This being done, they are brought to one plane, and form a complete plate for printing from.

SIDERO'XYLON, a genus of trees of the natural order *Sapotaceæ*, having evergreen leaves and axillary clusters of flowers, natives of warm climates, and very widely distributed. They are remarkable for the hardness of their wood, which is sometimes called Iron-wood, and is at least in some species so heavy as to sink in water. The wood of *S. inerme*, called *Melkhout* at the Cape of Good Hope, is there much used for making boats, bridges, agricultural implements, &c.

SI'DI-BEL-A'BBÈS, a town of Algeria, in the province of Oran, and 50 miles south of the town of that name. It is fortified, and contains barracks, telegraph and post offices. Markets take place here every week. The soil in the vicinity is fertile; grain, tobacco, and fruit are the chief products. Pop. of commune, 6458.

SI'DLAW HILLS. See FORFARSHIRE and BIRNAM.

SI'DMOUTH, a market-town and watering-place on the south coast of Devonshire, at the mouth of the little river Sid. S. was a borough and market-town, governed by a port-reeve, as early as the 13th century. It was anciently a place of some importance as a fishing-town and seaport, but the fishery has declined, and the harbor is in great measure filled up with sand and shingle, so than it is now accessible to small boats only. The town has for many years past been a favorite watering-place, remarkable for the mildness and salubrity of its climate. The hills on each side of the valley of the Sid rise to a considerable height, and, where they terminate on the sea-coast, form bold and lofty cliffs, east and west of the town, known respectively as Salcombe Hill and High Peak, about 500 feet above the sea. Owing to the narrowness of the valley, the town presents no large frontage towards the sea; but the esplanade, protected by a sea-wall, 1700 feet in length, built in 1838 to stop the encroachment of the sea, forms an excellent promenade. Villas and detached houses extend for some distance inland, up the valley of the Sid, on both sides of the stream. The town is neatly, though irregularly built, lighted with gas, and paved, and contains baths, public rooms, &c. Pop. (1881) 3501. Some Roman remains have been found here. S. gives the title of viscount to the Addington family.

SIDNEY, SIR PHILIP, the son of Sir Henry Sidney, and Mary, sister to Robert Dudley, the favorite to Queen Elizabeth, was born at Penshurst, in Kent, on 29th November 1554. When ten years old, he was sent to school at Shrewsbury, whence, in 1569, he went to Christchurch, Oxford. From Oxford, he passed to Cambridge, which he left with a high reputation for scholarship and general ability. In 1572, as the custom then was for young men of rank, he went abroad on his travels. He was in Paris when the massacre of St. Bartholomew took place, and narrowly escaped being one of its victims. Thereafter, he visited Belgium, Germany, Hungary, and Italy; and in 1575, he returned home, perfected in all manly accomplishments. His uncle, Dudley, Earl of Leicester, was at this time in the zenith of his fortunes, and for S. a court-career lay temptingly open. As a courtier, his success was great; and with Queen Elizabeth he became, and continued while he lived, a special favorite. In 1576, as a mark of her approval, he was sent on an embassy to the court of Vienna, from which he returned in the course of the year following. Shortly after, he had the boldness to address to the queen a 'Remonstrance' against her proposed marriage with Henry, Duke of Anjou, a union to which she seemed herself not indisposed. It is significant of the high favor in which he was held by her, that Elizabeth, imperious as she was in temper, and little inclined to brook such interference, seems scarcely at all to have in this instance resented it. About this time, a quarrel with the Earl of Oxford led to S.'s temporary retirement from court, during which, at Wilton, the seat of his brother-in-law, the Earl of Pembroke, he wrote his celebrated *Arcadia*.

In 1583, he consoled himself for the marriage of Lady Penelope Devereux, to whom he had been ardently attached, and who figures as the Stella of his poems, by himself marrying Frances, the daughter of Sir Francis Walsingham. By this lady, he had one daughter, who survived him. In the spring of 1585, he is said to have meditated sailing with Sir Francis Drake in an expedition against the Spaniards in the West Indies, but to have been expressly forbidden by Elizabeth, on a ground of anxiety 'lest she should lose the jewel of her dominions.' It does not seem nicely consistent with this pretty story, that later in the same year she appointed him governor of Flushing, whither he went to take part in the war then being waged between her allies, the Hollanders, and the Spanish. As it proved, she thus sent him to his death. At the battle of Zutphen, in Gelderland, after behaving with conspicuous gallantry, and having a horse killed under him, he received a musket-shot in the thigh, and after lingering for some days in great suffering, he died at Arnheim, on the 7th October 1586, in the 33d year of his age. A beautiful trait of humanity is recorded of him as he was being borne wounded from the field. He complained grievously of thirst, and a bottle of water was procured for him, from which, as he was about to drink, he was touched by the wistful look up at it of a mortally wounded soldier, who lay close by, and taking it untasted from his lips, he handed it to his fellow in need, with the words: 'Thy necessity is yet greater than mine.' The estimation in which S. was held by his countrymen was shown in the passion of grief with which the news of his death was received. His body was brought to England, and after lying for some time in state, was buried with great solemnity in the old cathedral of St. Paul's, a general mourning on the occasion being observed throughout the country. The universities issued three volumes of elegies on his death, and Spenser, in his *Astrophel*, mourned for the loss of one who as a friend had been dear to him.

The love and admiration which S. won from his contemporaries was mainly a tribute to the singular beauty of his character. His short life was illustrated by no brilliant achievement; and his literary genius, though true and exquisite in its kind, would scarcely of itself have sufficed to account for the fervor of regard he inspired. But the purity and nobility of his nature, and the winning courtesies in which its gentle magnanimity expressed itself, took captive all hearts whilst he lived, and have since kept sweet his memory. 'Sublimely mild, a spirit without spot,' he lives in the history of his country, as a rare and finished type of English character, in which the antique honor of chivalry is seen shading into the graces of the modern gentleman. His *Arcadia*, overrun as it is with the fantastic affectations of the time, may still be recognized by the reader who has patience to peruse it, as a work of indisputable genius, flushed with the lights of a fine imagination, and in its purity and tenderness of sentiment, giving an authentic reflex of the lovely moral nature of the writer. His other chief work, the *Defense of Poesie*, published in 1595, after all that has since been written in the way of philosophical exposition on this and cognate subjects, will even now be found to repay the attention of the reader. Many of his shorter poems, more especially some of his sonnets, are also of rare merit. See Fulke Greville's Biography of S., Zouch's Memoirs of S. (1808) and H. R. Fox Bourne's *Memoirs of Sir Philip Sidney* (1862).

SIDNEY, or SYDNEY, ALGERNON, grand-nephew of the famous Sir Philip Sidney, was born in the year 1622. He received a careful education, and accompanied his father, the Earl of Leicester, to Denmark and France, whither the latter had been sent on embassies. In 1641 he served with some distinction against the rebels in Ireland, of which country his father was then Lord-lieutenant for the king. Subsequently, in 1643, along with his elder brother, the Viscount Lisle, he crossed to England, ostensibly to take service under the king, then at war with his parliament. The two brothers, however, on their arrival, joined the parliamentary forces. At the battle of Long Marston Moor, in which he was sharply wounded. Algernon's courage and capacity were conspicuous; and in evidence of the estimation in which he came to be held by his party, we find him, in 1646, Lieutenant-general of the Horse in Ireland, and governor of Dublin; and subsequently, in 1647, after receiving the thanks of the House of Commons for his services, appointed governor of Dover. The year before, he had been returned to parliament as member for Cardiff. In 1648 he was one of the judges at the king's trial, and though, for some reason not explained, he neither was present at the passing of sentence, nor signed the warrant of execution, his general approval of the proceedings is not doubted. He is reported to have afterwards spoken of the execution as 'the justest and bravest action that ever was done in England or anywhere else.' In principle a severe republican, he resented the usurpation of power by Cromwell, and during the Protectorate lived in retirement at the family seat of Penshurst, in Kent.

In 1659, on the meeting of the restored parliament, S. was again in his place. He was nominated one of the Council of State, and shortly after despatched to Denmark on a political mission. After the Restoration, he lived precariously on the Continent, flitting about from place to place, but in 1677, a pardon was procured him from Charles II., and he returned to his native country. Nevertheless, he was still obdurately republican in his opinions, and it is undoubted that he schemed for the overthrow of the monarchy, and the establishment of a republic in its stead; for this end he solicited the aid of the French monarch, and there is evidence of his having been supplied with money by Barillon, the French ambassador. Obscurely his designs were suspected, and in June 1683, when the Rye House Plot was announced, the opportunity was seized to get rid of a man felt to be dangerous. Along with his friend Lord Russell and others, he was arrested, and committed to the Tower. On the 21st November, he was tried for high treason before the brutal Jefferies, and on the merest mockery of evidence, found guilty, and condemned to die. On the 7th December he was beheaded on Tower Hill. He met his death with heroic firmness, amid general sympathy and indignation. He has ever since enjoyed a sort of canonized reputation as a patriot hero and martyr, and it cannot be held undeserved, narrow and impracticable as we must admit his views to have been. In the history and theory of government, S. was more deeply learned than any man of his time. His *Discourses concerning Government* were first published in 1698; in 1704, another edition was issued, a third appeared in 1751, and the fourth in 1772. S.'s life has been written by S. W. Meadley (Lond. 1813). See also Blencowe's *Sidney Papers* (Lond. 1813).

SIDNEY SUSSEX COLLEGE, Cambridge, was founded in 1598 by Lady Frances Sidney, Countess of Essex, or rather by her

executors, in obedience to the instructions of her will. They obtained of Queen Elizabeth a mortmain for the purpose, and purchased of Trinity College the site of the ancient convent of Franciscans, or Gray Friers. There are 10 fellowships.

SI'DON (Hebr. Zidon, perhaps 'fishing-place'), ancientry, a city of Phœnicia, situated on the east coast of the Mediterranean, in lat. 33° 34′ 5″ N., 45 miles south of Berytus. It was built on a rising mound, protected by the sea on the north and west; while the bed of a river formed a natural fosse to the south, and the high hills shielded it to the east; a double harbor gave shelter to its ships both in summer and winter. It soon rose, both by its exceptional position and the daring and enterprising character of its inhabitants, to the highest rank among the cities of Phœnicia (q. v.), so that the whole country is sometimes designated by the name of S., 'the Great,' 'the Metropolis.' The extensive commerce of S. is well known from ancient authorities. Its colonies extended over the coast of Asia Minor and the adjacent islands, the coast of Thrace and Eubœa, and even some parts of Sicily, Sardinia, Spain, the coast of Cornwall and the Baltic shores, the northern parts of Africa, and, in fact, nearly the whole of the ancient world. Their manufactures of glass and linen, purple dye and perfumes, were sources of unbounded wealth; and, whether they were the skilful workers, or merely the exporters and traders of those 'divine' works in gold and silver, ivory and bronze, which were the marvel of both Greeks and Hebrews, so much seems certain, that they managed to be considered unanimously the most skilful workmen of their time.

Although one of the cities assigned to the Israelites by Joshua, it never in reality belonged to them, but, on the contrary, was every now and then in arms against them, either singly, or in league with some of their deadliest enemies, and even subjugated them for a time. After being conquered itself by Tyre, the daughter-city, it attempted to throw off the yoke at the invasion of Phœnicia by Shalmanezer, to which king it surrendered. Under Assyrian, Chaldean, and Persian domination, it retained a kind of independence for its internal affairs, and under the Persians, actually reached its highest prosperity. But an unsuccessful revolt against that power, under Ochus, ended in its temporary ruin (351 B.C.). Speedily rebuilt and repeopled, it opened its gates to Alexander the Great (333 B.C.), and from that time forth it fell successively into the hands of Syrian, Greek, and Roman rulers. Through the middle ages, little is heard of it, except that it was taken by the Crusaders. During part of the 17th and 18th centuries, it again became an important place of commerce; but misrule and violence put an end to its rising prosperity, and the number of its inhabitants has sunk to about 5000. There is still some little export of silk, cotton, and nut-galls. It is now called Saida, occupies a place somewhat to the west of the ancient city, and belongs to the Turkish pashalic of Acre. See PHŒNICIA.

SIE'BENBÜRGEN (Seven Castles), the German name of the Austrian principality of Transylvania (q. v.).

SIE'BENGEBIRGE, a collection of conical heights in Rhenish Prussia, on the right bank of the Rhine, about 22 miles above Cologne. The highest of the peaks is the Löwenkopf or Löwenberg, 1560 feet high; but the most famous is the Drachenfels (q. v.).

SIEGE (Fr. a seat, a sitting down) is the sitting of an army before a hostile town or fortress with the intention of capturing it. With certain elements, the success of a siege is beyond doubt; the result being merely a question of time. These elements are: first, the force of the besiegers shall be sufficient to overcome the besieged in actual combat, man to man. If this be not the case, the besieged, by a sortie, might destroy the opposing works, and drive away the besiegers. The second element is, that the place must be thoroughly invested; so that no provisions, reinforcements, or other aliment of war can enter. The third element is, that the besiegers be undisturbed from without. For this it is essential that there shall not be a hostile army in the neighborhood; or, if there be, that the operations of the besiegers be protected by a covering army able to cope with the enemy's force in the field. The ancients executed gigantic works to produce these effects. To complete the investment, they built a high and strong wall around the whole fortress; and to render themselves secure from without, they built a similar wall facing outwards, beyond their own position. The first was circumvallation, the second contravallation. It was thus that Cæsar fortified himself while besieging Alexia, and maintained 60,000 men within his ring. In modern warfare, it is considered preferable to establish strong posts here and there round the place, and merely sentries and vedettes between.

Let us now assume that a fortress of great strength has to be reduced, and that the force of the enemy in the vicinity has been either subdued or held in check by a covering army. By rapid movements, the place is at once invested on all sides. This step constitutes merely a blockade; and if time be of little importance, is a sufficient operation, for hunger must sooner or later cause the fortress to surrender; but if more energetic measures are required, the actual siege must be prosecuted. Advantage is taken of any hidden ground to establish the park of artillery and the engineers' park; or if there be none, these parks have to be placed out of range. The besieging force is now encamped just beyond the reach of the guns of the fortress; and their object is to get over the intervening ground and into the works without being torn to pieces by the concentrated fire of the numerous pieces which the defenders can bring to bear on every part. With this view, the place is approached by a series of zigzag trenches so pointed that they cannot be enfiladed by any guns in the fortress. In order to accommodate the forces necessary to protect the workers, the trenches at certain intervals are cut laterally for a great length, partly encircling the place, and affording safe room for a large force with ample battering material. These are called *parallels*, and they are generally three in number. The distance of the first parallel will increase as small-arms become more deadly; but with the old smooth-bore muskets it was usual to break ground at 600 yards from the covered way of the fortress, while at Sebastopol, ground was broken at 2000 yards, and in the siege of Paris by the Germans, the lines were begun at least 4 miles from the city.

The locality of the parallel being decided on, a strong body of men is sent to the spot soon after nightfall. The attention of the garrison is distracted by false alarms in other directions. Half the men are armed cap-à-pie, and lie down before the proposed parallel; while the other half, bearing each pick and shovel, and two empty gabions, prepare for work. Each man deposits the gabions where the parapet of the trench should be. He then digs down behind them, filling the gabions with the earth dug out; and, after they are filled, throwing it over them, to widen and heighten the parapet. Before daylight, the working-party is expected to have formed sufficient cover to conceal themselves and the troops protecting them. During the day, they—being concealed from the garrison—widen and complete their parallel, making it of dimensions sufficient to allow of wagons and bodies of troops with guns passing along. During the same night, other parties will have been at work at zigzags of approach from the depôts out of range to the first parallel, which zigzags will be probably not less than 1000 yards in length. The profile of a completed trench is shown in fig. 1, the shaded portion representing a gabion. As a rule,

Fig. 1.—Profile of a Trench.

the defenders will not expend ammunition on the first parallel, for its extent (often several miles) will render the probability of doing material damage extremely small. For this reason also, the dimensions of the parapet and its solidity are of far less importance in the first parallel than in the more advanced works of attack.

The first parallel AAA, fig. 2, being completed, the engineers

Fig. 2.—Siege Works.

select points near its extremities, at which they erect breast-works, B, B, to cover the bodies of cavalry, who are kept at hand to resist sorties from the garrison. The length of the parallel is usually made sufficient to embrace all the works of two bastions at least. Sites are then chosen for batteries, C, C, which are built up of fascines, gabions, sandbags, and earth. They are placed at points in the parallel formed by the prolongation of the several faces of the bastions, ravelins, and other works of the fortress, which faces the batteries are severally intended to infilade by a ricochet fire. Other batteries will be formed for a vertical fire of mortars and shell-guns. By these means it is hoped that the traverses on the hostile ramparts will be destroyed, the guns dismounted, and the defenders dispersed, before the final approaches bring the assailants to the covered-way. The sappers will now commence their advance towards the points, or salient angles, of the two bastions to be attacked. If, however, the trench were cut straight towards the fortress, its guns could easily destroy the workmen, and enfilade the approach. To prevent this, it is cut in short zigzags—as at D—the direction always being to a point a

few yards beyond the outmost flanking works of the garrison. The side of each trench nearest the fortress is protected by gabions and sandbags, as in the case of the parallel.

At intervals, short spurs of trench, incipient parallels, are cut, as at E, to contain small-arms-men, to act as guards to the sappers. The second parallel is about 300 yards from the enemy's works, and has to be more strongly formed than the first. It often terminates in a redoubt, F, to hold some light artillery, and a strong force of infantry, who could assail any sortie in flank; or it may run into the first parallel, as G, giving easier access for troops than through the zigzags. The second parallel is riveted with sandbags, in which loopholes are left for musketry. After passing the second parallel, the angles of the zigzags become more acute, to prevent enfilading. At about 150 yards, certain demi-parallels, H, are cut, and armed with howitzer batteries, to clear the covered-way, while riflemen also act from it. The third parallel is at the foot of the glacis. Thence the place, after being sufficiently battered, is taken by a storming-party, who make their way over the glacis, or the covered-way is topped by the double sap, as in fig. 3; which is a safer plan for the army generally, though much more deadly to the sappers. When the crest of the covered-way has thus been reached, batteries of heavy artillery will be there established, for the purpose of breaching the walls of the ravelin and bastion; while at the same time miners will first seek to destroy the defenders' counter-mines (which would otherwise be likely to send these batteries into the air), and then will excavate a tunnel to the ditch, at the foot of the counterscarp.

Fig. 3.—Double Sap.

If the breach becomes practicable, a storming-party will emerge from this tunnel or gallery, and seek to carry the opposite work by hard fighting. If inner works still subsist, which would tear assailants to pieces, the double sap may be continued across the ditch, if a dry ditch, right up the breach, that counter-batteries may be formed. If the ditch be wet, means must be adopted for a causeway or a bridge. By these means, however obstinate may be the defence, if the besieging force be sufficiently strong, and aid do not arrive from without, the ultimate success of the attack becomes certain. Vauban raised attack to a superiority above defence, first, by the introduction of ricochet fire, which sweeps a whole line; and secondly, by originating parallels. Before his time, the whole attack was conducted by zigzag approaches; in which the troops actually in front could be but few, and were therefore unable to withstand strong sorties of the garrison, who, in consequence, frequently broke out and destroyed the works of the besiegers, rendering a siége an operation of a most uncertain character.

SIEGE-ARTILLERY is heavy ordnance used for battering purposes, and of too weighty a character to take the field. A siege-train of guns and their ponderous ammunition is usually maintained in the rear of an army, ready to be brought up for use when required.

SIE'GEN, a manufacturing town of Prussia, in Westphalia, stands on the Sieg, 38 miles south-south-west of Arnsberg. In 1880, it had 15,024 inhabitants, who are engaged in manufacturing leather, cotton, and woollen goods. S. is also said to produce the best iron in the west of Germany. In the vicinity are numerous iron mines and smelting furnaces. Its iron and steel wares are noted; especially its files.

SIEGFRIED. See NIBELUNGENLIED.

SIEMENS' FURNACE. See GLASS, IV. 777.

SIE'NA, a city of Central Italy, 60 miles south of Florence. Pop. (1881) of town, 7903; of commune, 25,204. It is situated on three little hills, separated from each other by valleys, and higher than other hills surrounding them. Its climate is on this account very salubrious, notwithstanding the deficiency of water caused by its elevated position; to remedy which, subterranean aqueducts had been excavated five miles in length, some of them dating as far back as the Roman dominion. Its environs are not beautiful, consisting of naked clay-hills, capped with sandstone, but the city is surrounded by trees and avenues, which have a fine effect. The handsome square, Piazza del Campo, is one of the finest in Italy. Eleven streets lead out of it, and it is surrounded by handsome buildings. In this square there is also the famous tower called the *Mangia*, of prodigious height; there are also other towers here and there, seen from a great distance—remnants of the habitations of the feudal lords. The streets are narrow, some paved with tesselated bricks, and others flagged. There are many ancient Gothic palaces, not remarkably handsome.

In the Piazza del Campo stands the Palazzo Pubblico, built in the 13th c., in which there are magnificent rooms, and paintings by eminent artists. S. has a fine cathedral, erected, it is said, on the foundations of the Temple of Minerva, begun in 1059; the façade built in the 13th century. It is faced with black and white marble, and is covered with ornaments and sculptures. The pavement is of marble tesselated, representing many biblical subjects. In the different chapels, and in the baptistery, there are frescoes, paintings, and statues, by a number of distinguished masters. The other churches are also rich in works of art. Of the many oratorios, the most noteworthy is that of St. Catharine (q. v.), occupying the house of the saint. S. is an archiepiscopal see. The Sienese are singularly industrious, and have numerous manufactories of cloth and woollen, silk and linen stuffs, of felt and straw hats, of wax and beet-sugar. There are marble quarries in the neighborhood. There is a university, founded in 1330, famous especially as a school of medicine, which has upwards of 100 students. The Italian spoken at S. is reckoned among the purest.

S. was founded as a Roman colony in the time of Julius Cæsar, under the name of Sena, or Sena Julia. There are no remains of antiquity; and it does not appear to have been a place of any consequence until the middle ages, when it became one of the powerful city republics of Italy. It embraced the Ghibelline cause, and in conjunction with the forces of Pisa, defeated the Tuscan Guelfs, in the memorable battle of Monte Aperto (1260). At the height of its greatness, it is said to have contained 200,000 inhabitants. S. produced a 'school' of artists, of whom the most distinguished names are Guido da Siena, Simone Memmi, Sodoma, Beccafumi, and Baldassare Peruzzi.

SIENNA EARTH. See BURNT SIENNA.

SIE'RRA, a name applied in Spain, and in countries in which the Spanish language has prevailed, to a ridge of mountains. The word means *saw*, and is descriptive of the notched or saw-like skyline of certain mountain ranges.

SIE'RRA LEO'NÉ (Mountain of the Lion), a British colonial settlement on the Sierra Leone coast, Western Africa. The settlement consists chiefly of a peninsula, just to the south of the Sierra Leone River, on which the capital, Freetown, stands; a strip of territory along the coast to Sherboro River, 50 miles to the south; and the Isles de Los, and Sherboro (added in 1862). The area is stated at 468 sq. miles (other accounts say 1000), and the pop. in 1881 was 60,546 (of whom only 250 are whites). In 1883 an additional strip of territory extending from Sherboro to near the borders of Liberia was annexed by Britain. Along the coast stretches a belt of rich low-lying land, and elsewhere in the colony there are fertile tracts; but the interior is a mass of rugged mountains, with a generally barren soil. The climate is humid and unhealthy—the wet season, lasting from May to November, being specially pestilential. Tropical fruits and plants grow luxuriantly in the more favorable regions, and coffee, sugar, indigo, and cotton have been introduced by the British. In 1872, the exports amounted to £358,636, the chief articles being gold, cotton goods, ground-nuts, palm-oil, hides, palm-nuts, manufactured tobacco, and timber. In the same year, the imports amounted to £411,936, and the chief articles were cotton goods (nearly one-half of the whole value), gunpowder, ready-made apparel, hardware, haberdashery, and rum. In 1877, S. L. and Gambia exported to Great Britain goods valued at £176,111, and imported thence to the value of £604,391; in 1880, the corresponding exports were valued at £157,964, and the imports at only £388,650. The colony is ruled by a crown-appointed governor, assisted by a council. In 1866, S. L., the Gambia, the Gold Coast, and Lagos were placed under one general government, to be called the 'Government of the West African Settlements.'

The settlement of S. L. was established in 1787, when 470 destitute negroes were removed to it from London by a body of philanthropists; and 1196 negroes were sent to it from Nova Scotia—the climate of which had proved too severe for them—in 1790. The population was also increased by other bands of people of color; and after the abolition of the slave trade in 1807, the slaves captured by British cruisers have been put ashore, and settled here. In 1820, the settlement contained only 12,000 inhabitants, or less than a fifth of its present population.

SIERRA MA'DRÉ, a name given to central portions of the great chain of Cordilleras or Rocky Mountains, in Mexico, from lat. 19° to 25° N., and in New Mexico, to the great western range, from lat. 34° to 38° N. These ranges, but partially explored, contain some of the richest silver mines in the world.

SIERRA MORE'NA, a mountain-range in Spain, on the southern border of New Castile, and between the modern provinces of Ciudad Real and Jaen. It separates the upper portions of the basins of the Guadiana on the north, and of the Guadalquivir on the south, and rises in its highest point to 5500 feet above the sea. It is frequently mentioned in *Don Quixote*, and is the scene of many of the incidents therein described.

SIERRA NEVA'DA (*Snowy Range*), a mountain-range of Spain in Andalusia, extending east from Padul, 12 miles south of Granada, to the frontiers of the modern province of Almeria, is 60

miles in length, from 20 to 30 miles in breadth, and covers an area of upwards of 1000 square miles. It is continued on the north-east by the Sierra de la Filabras, and forms a portion of the watershed between the streams that flow into the Mediterranean and those that flow into the Atlantic. The peak of Mulhacen reaches a height of 11,678 feet, and is the highest summit not only of the Spanish Peninsula, but of the whole of Europe west of the Alps. The peak of Veleta is 11,387 feet high. The range receives its name from the perpetual snow which covers the highest summits. The views from the summits, from which, on the south, may be seen the faint outline of the African coast, on the north, the jagged sierras of the Castiles, can hardly be surpassed in beauty and magnificence by any in Europe.

SIERRA NEVADA, a range of mountains in California, forming a portion of its eastern boundary, is the source of a multitude of rivers, which swell the Sacramento and San Joaquin. The range extends from north-west to south-east 450 miles, and is united to the coast-range, which runs parallel with the Pacific, by Mount San Bernardino. Among the higher peaks of the S. N. are Saddle Peak, 7200 feet high; Table Mountain, 8000 feet; and the Buttes, 9000 feet. Here are immense deposits of gold quartz, with steam and water power crushing-mills; deep tunnels and mines, increasing with their depth their yearly product.

SIEYÈS, EMMANUEL JOSEPH, COMTE, who, as the Abbé S., prominently figures in the history of the French Revolution, was born at Fréjus, May 3, 1748. He was educated at the university of Paris with a view to his entering the church; and on the completion of his studies, he obtained the appointment at Treguier, in Bretagne (1775), whence, in 1780, he was transferred to the cathedral of Chartres, of the diocese of which he became chancellor and vicar-general. He had early imbibed the extreme liberal opinions on all matters social and political which were preparing the French Revolution; and when, in 1789, the States-general were summoned, he issued his famous pamphlet, entitled *Qu'est-ce que le Tiers Etat?* This work, which claimed for the people political recognition, naturally enough obtained an immense popularity for its author, and procured his election as one of the deputies for Paris. Mainly through his urgency and influence it was that, on June 16, 1789, the representatives of the people took the decisive step of constituting themselves into an independent body, and became the National Assembly. Of this body he continued for some time to be one of the most prominent and leading figures. In 1791, he was elected to the Legislative Assembly, then convened, as member for the department of Paris. By this time, however, he had sunk somewhat from his first pre-eminence; bolder and fiercier spirits had passed him in the race for power and popularity, and where he had once led, he now reluctantly followed. In the Convention of 1792, to which he was elected as deputy of the department of La Sarthe, he prudently refrained from any active participation in the debates, and on the occasion of the king's trial, he recorded a silent vote.

Whilst Robespierre and his party were in power, he consulted his safety by retiring from Paris. When afterwards asked what he had done during the Reign of Terror, he quietly replied: *J'ai vécu* ('I have lived'). On the fall of Robespierre, he returned to his post in the Convention, and resumed his active interest in affairs, becoming a member of the new Committee of Public Safety. He was engaged chiefly in the department of foreign policy, and he went as ambassador to Holland and Berlin successively to negotiate treaties of alliance. He became a member of the Directory in 1799, and among other reactionary measures, he succeeded in closing the celebrated Jacobin Club. Perceiving that a stable government was on no other terms possible, he became anxious to secure the co-operation of some powerful military leader, the more particularly as he was ambitious above all things of giving France a 'constitution' (of which he had drawn up one or several); and on the return of Bonaparte from Egypt, he entered into a league with him, the result of which was the revolution of the 18th Brumaire (November 9, 1799), and the institution of the Consulate, S., Napoleon, and Roger Ducos being the three first consuls. Speedily, however, S. discovered in his new ally his master.

As to the distribution of power in the new constitution to be formed, he and Napoleon differed irreconcilably; the man of bayonets was the stronger; his political nostrums never got beyond the paper on which they were written; and finally, in disgust at the subordinate position into which he found himself about to sink, S. threw up his place in the government. As a reward of his services, he received on his retirement a sum of 600,000 francs and the estate of Crosne; afterwards exchanged for the equivalent of a splendid hotel in Paris and the lands of Fainanderie, in the park of Versailles. Also the title of Count was conferred upon him. Subsequently, the presidency of the Senate was offered him, but he declined it, and never afterwards concerned himself in public affairs. Banished at the Restoration, he did not return to France till after the revolution of 1830; and in Paris, on June 20, 1836, he died. During the revolution, S. drew up a good many papers of one kind and another; but he is chiefly remembered for his plan of a new constitution, which, however, is very little known. Mignet's *Histoire de la Révolution* contains a description of it; and under the title of *Théorie Constitutionelle* of S., and *Constitution de l'An VIII.*, M. Boulay (de la Meurthe) published (Par. 1836) from S.'s own *Mémoires inédits* a more detailed account.

SIGHING, THE ACT OF, is nothing more than a very long-drawn inspiration, in which a larger quantity of air than usual is made to enter the lungs. This is continually taking place to a moderate degree, and Dr. Carpenter remarks that it particularly occurs when the attention is released, after having been fixed upon an object which has strongly excited it, and which has prevented our feeling the insufficiency of the ordinary movements of respiration. Hence this action is often a simple result of deficient aëration; while in other cases, as is universally known, it is excited by a depressed state of the feelings.

SIGHT, DEFECTS OF. Under this head we shall consider such affections of the eyesight as are due to some known or unknown peculiarity of the optical apparatus (including the optic nerve) not dependent on disease—viz., *short-sight, long-sight, double vision, color-blindness,* and *night-blindness.*

Short-sight, near-sight, or *myopia* (derived from the Greek words *myo,* I close, *ops,* the eye), is often popularly confounded with dim or weak sight; but in reality, short-sight applies exclusively to the *range* and not to the *power* of sight, and a short-sighted person may possess the acutest power of vision for near objects. In this affection, the rays which ought to come to a focus upon the retina converge to a point more or less in front of it. The cause of this defect probably differs in different persons. It may arise from over-convexity of the cornea or the lens, from undue density or abundance of the humors of the eye, from elongation of the globe in its antero-posterior diameter, or from an imperfect power of the eye to adjust itself to objects at various distances. The distance at which objects are perceived most distinctly by the perfectly normal eye ranges from 16 to 20 inches; an eye which cannot perceive objects distinctly beyond 10 inches may fairly be regarded as short-sighted; and in extreme cases, the point of distinct vision may be three, two, or even only one inch from the eye. Short-sight is frequently hereditary in families. As a general rule, the inhabitants of towns are much more liable to it than persons living in the country, and students and literary men are the most liable of all. While in the Foot-guards, consisting of nearly 10,000 men, 'not half-a-dozen men have been discharged, nor have a dozen recruits been rejected on account of this imperfection, in a space of 20 years, in one college at Oxford no less than 32 short-sighted men (or *myopes*, as they are termed by some oculists) were met with out of 127' (Donders, *On the Accommodation and Refraction of the Eye*, London, 1864, p. 342). The frequency of this affection in the cultivated ranks points directly to its principal cause—tension of the eyes for near objects.

The myopia depending, as Donders believes, upon prolongation of the visual axis, this eminent physiologist inquires: 'How is this prolongation to be explained? Three factors may here come under observation: 1. Pressure of the muscles on the eyeball in strong convergence of the visual axes; 2. Increased pressure of the fluids resulting from accumulation of blood in the eyes in the stooping position; 3. Congestive processes in the base of the eye, which, leading to softening, give rise to extension of the membranes. That in increased pressure, the extension occurs principally at the posterior pole, is explained by the want of support from the muscles of the eye at that part. Now, in connection with the causes mentioned, the injurious effect of fine work is, by imperfect illumination, still more increased; for thus it is rendered necessary that the work be brought closer to the eyes, and that the stooping position of the head, particularly in reading and writing, is also increased. Hence it is that in schools where, by bad light, the pupils read bad print in the evening, or write with pale ink, the foundation of myopia is mainly laid. On the contrary, in watchmakers, although they sit the whole day with a magnifying glass in one eye, we observe no development of myopia, undoubtedly because they fix their work only with one eye, and therefore converge but little, and because they usually avoid a very stooping position.'—*Op. cit.*, pp. 343, 344.

So far from short-sightedness improving in advanced life, as is popularly believed, it is too frequently a progressive affection; and every progressive myopia is threatening with respect to the future. 'If,' says Donders, 'it continues progressive, the eye will soon, with troublesome symptoms, become less available, and not unfrequently, at the age of 50 or 60, if not much earlier, the power of vision is irrevocably lost, whether through separation of the retina from the choroid, from effusion of blood, or from atrophy and degeneration of the yellow spot.'

In the treatment of myopia the principal objects are: 1. To prevent its further development and the occurrence of secondary

disturbances; and 2. By means of suitable glasses, to render the use of the myopic eye easier and safer.

1. To effect, if possible, the first object, the patient must look much at a distance, but as we cannot absolutely forbid his looking at near objects, spectacles must be provided which render vision distinct at from 16 to 18 inches. Moreover, it is desirable that at intervals of a half hour work should be discontinued for a couple of minutes, and no working in a stooping position should be permitted. The patient should read with the book in the hand, and in writing should use a high and sloping desk.

2. The optical remedy for short-sight obviously consists in concave glasses of a focus suited to the individual case. At first sight, it might be supposed that glasses with a concavity exactly sufficient to neutralize the defect in the eye, would always suffice; and when the glasses are used exclusively for distant vision (for example, in the double eye-glass, which is only at intervals held before the eye), or when the affection is slight, and the eye is otherwise healthy, perfect neutralization is admissible; but so many circumstances forbid the complete neutralization of the myopia, that an oculist of reputation should always, if possible, be consulted as to the choice of spectacles. Glasses, if injudiciously selected, usually aggravate the evil they are intended to remedy; and in connection with this subject, we must warn our readers against the prevalent habit of employing a single eye-glass; it is most prejudicial to the eye which is left unemployed, and often leads to its permanent injury.

Long-sight and *presbyopia* (derived from the Greek words *presbys* an aged person, and *ops*, the eye), are usually considered by English writers as synonymous terms. Donders, who is now universally accepted as the highest authority on this department of eye-affections, maintains that 'the term presbyopia is to be restricted to the condition in which, as the result of the increase of years, the range of accommodation is diminished, and the vision of near objects is interfered with.' As from youth up to extreme old age, the vision of near objects becomes progressively more and more difficult, it is impossible to fix any limit as the commencement of presbyopia.

In practice, however, a word is required which indicates the condition in which the eye, at an advanced period of life, and sometimes sooner, requires convex spectacles for distinct near vision, as, for example, for reading, and this word is *presbyopia*. In this state, the nearest point of distinct binocular vision is found to lie about 8 inches (or double the ordinary distance) from the eye, and at this point Donders arbitrarily places the commencement of presbyopia. This condition, which is as natural as a concomitant of advanced life as gray hairs or wrinkles, is occasionally met with in young persons. In these cases it generally arises from intestinal irritation, and may be a precursor of amaurosis; hence such cases should be carefully watched. In ordinary presbyopia, the defect is at once remedied by the use of glasses of low convex power, as of thirty or twenty-four inch focus, which should, however, only be worn during reading, and writing, and not constantly. Although the improper use of convex glasses is not by any means so dangerous as the inconsiderate use of concave glasses, the advice of a good oculist regarding the choice of spectacles is well worth his fee.

Double vision, or *diplopia*, is of two kinds. It may arise from a want of harmony in the movements of the two eyes, the vision of each eye singly being perfect; or there may be double vision with one eye only. The first form may occur (1) in cases of squinting, or (2) in cases of paralysis of one or more of the muscles of the orbit. In cases of Squinting (q. v.), the vision of the most distorted eye is almost always imperfect; and it is well known that impressions on the two retinæ are similar in kind but dissimilar in form. The mind takes cognizance only of the former; so that a person with a bad squint sees objects with the sound eye only. But if the sight of both eyes is nearly equal, as often is the case, when the squint is not very well marked, double vision results whenever both eyes are employed together, in consequence of images of nearly equal intensity falling on non-corresponding parts of the two retinæ. This variety of double vision, although annoying, is perfectly harmless. When double vision arises from muscular paralysis, disease of the brain of a serious nature is to be apprehended, although the affection sometimes appears to arise from exposure to cold. The second form of double vision—viz., double vision with a single eye, is a much more rare affection than the preceding one, and depends upon some irregular refraction of the cornea or lens.

Color-blindness is noticed under its own name.

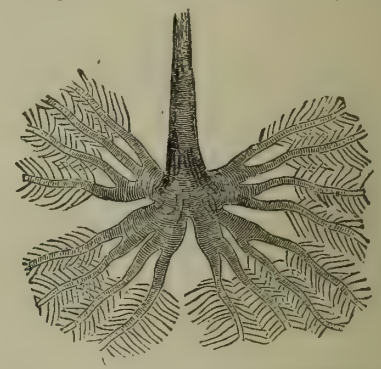
Night-blindness, or *hemeralopia* (from the Greek, signifying 'day-sight'), is a peculiar form of intermittent blindness, the subjects of which see perfectly with an ordinary light, but become entirely and almost instantaneously blind as soon as twilight commences. It is seldom met with in this country except among sailors just returned from tropical regions. It is frequent among the natives of some parts of India, who attribute it, as our own sailors do, to sleeping exposed to the moonbeams. The most probable cause of the affection is, however, exhaustion of the power of the retina from over-excitement from excessive light, so that this organ is rendered incapable of appreciating the weaker stimulating action of twilight or moonlight. All that suggests itself in the way of treatment is to protect the eyes from strong light during the day, and to prescribe quinine and a nourishing mixed diet.

Snow-blindness must be regarded as an allied affection to the preceding. See VISION.

SIGHT OF A GUN. See GUNNERY.

SIGILLA'RIA, a genus of fossil plants which are of importance because of their singular structure, and their remarkable abundance in the coal measures. They seem to have contributed more than any other genus of plants to the formation of coal. The roots of S. are found preserved in the shale which forms the floor of all coal-seams. These roots were originally supposed to be distinct plants, and have received the generic name of Stigmaria. The most feasible notion, and that generally accepted regarding them, was that they were fleshy water-plants, with numerous linear leaves, articulated to the stem by papillæ, which were buried in deep cylindrical hollows in the stem. Brongniart first suspected that they were roots, and Binney placed the question beyond doubt by discovering a specimen in which the trunk of a S. rose from the crown of a Stigmaria. Several observers have subsequently seen these fossils also in actual contact.

It is believed that the mud (now converted into shale) in which they grew was very soft, and easily permitted the passage of the large roots, while they gave off all round innumerable large hollow rootlets. The stems of S. are abundant in the coalbeds. They are marked by parallel longitudinal flutings, and regular scars formed by the base of the leaf-stalks, which had fallen off. They are known to have attained a height of 70 feet, and a diameter of 5 feet. The stem rose without branching till near the summit, when it branched several times dichotomously. The proportion of woody matter to cellular tissue in the stem was very small. The woody fibre is characterized by the abundance of



Trunk of Sigillaria rising from the Stigmaria Roots (*E. W. Binney*).

scalariform vessels, similar to those which occur in *Lepidodendron*, and in the recent vascular Cryptogamia. The stem is seldom found preserved so as to exhibit any structure, or even its cylindrical form; it generally occurs as a double layer of coal, showing on the outer surfaces the scars produced by the bases of the leaf-stalks. The form and arrangement of these scars have been used to distinguish the species, and indeed, no other materials exist, for hitherto no foliage of any kind has been certainly found connected with the trunks. The restoration of the genus has been consequently quite imaginary.

Some, with Brongniart, have supposed that the trunk terminated in a crown of simple leaves, like that of many palms, and that it was a gymnosperm near to the Cycads. Others, with King, consider that the fronds of *Pecopteris nervosa*, which are very abundant in the coal measures, are its foliage, and they would restore it so as to have the appearance of a modern tree-fern. And others, with Binney, consider that its affinities are nearer to *Lepidodendron*, and that some of the numerous fragments which have been referred to this genus may really be the branches of Sigillaria. They would restore it as if it were a huge *Lycopodium*, and refer to it some of those fruits which, under the names of *Lepidostrobus* and *Flemingites* have been described by Brown, Hooker, and Carruthers.

SIGISMUND, emperor of Germany (1411—1437), was the son of the Emperor Karl IV. He was well educated, and having married Maria of Anjou, on her accession to the throne of Hungary he became chief administrator of that kingdom. The death of his wife in 1392 made him king of Hungary; and at the head of a numerous army of more than 100,000 men, composed of Hungarians, French, Germans, and Poles, he attempted to relieve the Byzantine empire from the fierce Turks, but was terribly de-

feated at Nicopolis (28th September, 1396). On his return to Hungary, he found on the throne a new monarch, Ladislas of Naples, who imprisoned him (1401); but through the good offices of his elder brother, Wenceslas, he was freed, and obtained the throne (1402), rewarding his elder brother by snatching from him his kingdom of Bohemia, which he retained for some time.

In 1411, he was proclaimed emperor, on the death of Rupert. He was present at the Council of Constance, which he had prevailed upon Pope John XXIII. to hold for the purpose of putting an end to the Hussite and other schisms. He contented himself with protesting against the violation of the imperial safe-conduct which was given to Huss, and ultimately consented to his judicial murder, for the purpose, as his apologists say, of conciliating the council, and so settling the disputes concerning the papacy. His succession to the throne of Bohemia, after his brother's death, was opposed by the Hussites, who were now in insurrection; and after a fruitless attempt to conquer them, he confined himself to the defence of Hungary against the Turks, whom he defeated in a great battle near Nissa (1419). For ten years afterwards, he left Germany very much to the guidance of its self-willed petty rulers, who speedily brought the country into such a deplorable state that they were glad to beseech S. to return to the helm of affairs —which he did, but with little good effect. He obtained, by concessions to the Calixtines (q. v.), the crown of Bohemia in 1436; but once on the throne, he gradually withdrew these concessions, which provoked such discontent, that his death (1437) alone averted a civil war. S. possessed a large intelligence, and remarkable political talents, but these were much neutralized by his impetuosity, indecision, selfishness, and extraordinary avarice; and his well-meaning endeavors after peace and improvement ended in nothing. Carlyle distinguishes S. by the epithet *Supra Grammaticam*, in allusion to his answer to a cardinal at the council of Constance, who ventured to correct his majesty's grammar—'I am the Roman king, and above grammar.'

SIGISMUND, worthily surnamed the GREAT, king of Poland, was the youngest son of Casimir IV., and was born at Koziénicé, 1467. He was chosen Grand Duke of Lithuania, 1506, and succeeded to the kingdom of Poland on 8th December of the same year. The affairs of Poland and Lithuania were at that time in a sad condition; the southern portions of the country reduced almost to a desert by the ravages of the Tartars, while the east was continually in dread of the Russians, who had become an independent, united, and powerful monarchy. The Russians invaded Lithuania, and conquered some provinces, but S. gained a brilliant victory over them at Orsza on the Dnieper (14th July 1508). Bogdan, Prince of Moldavia and Walachia, now invaded the southern provinces, as that semi-barbarous race were accustomed to do without let or hindrance; but he was so decisively routed on the banks of the Dniester, that he gladly agreed to acknowledge himself a vassal of Poland. Disregarding the suggestions of the pope to head a crusade against the Turks, S. next read the Tartars, through his general, Ostrogski, a very forcible lesson, in 1512, against aggressive practices, which cost them 27,000 men, and assured the tranquility of his frontier for a long period. His alliance in 1513 with Stephen Zapoli, voyvode of Transylvania, whose daughter, Barbara, he also married, alarmed the Emperor Maximilian, who incited the Russians to resume their aggressions, which that ill-advised nation cheerfully agreed to do; paying dearly for their rashness, for their army of 80,000, which had invaded Lithuania, was met and cut to pieces (8th September 1514) by Ostrogski, with 32,000 men, at Orsza, leaving its standards, cannons, and other arms, 2 generals, 37 princes, 6000 prisoners, and 30,000 dead in the possession of the enemy. Subsequent invasions of Moscovites and Tartars were repelled as before, and a rebellion of the Walachs was punished by numerous defeats, chief of which was that of Obertyn (1531).

The insolence of the Teutonic Order, who had invaded Polish Prussia, was effectually chastised by S., who defeated their Grand Master Albert, his own nephew, in two great battles, in the latter of which the knights were assisted by the Danes (1520). In 1525, he agreed to confer on Albert the title of Duke of Prussia (now known as East Prussia) on condition of fealty and homage. The dukes of Prussia continued as vassals of the Polish crown till 1657. In 1526, S. alone of the monarchs of Christendom lent aid to Hungary against the formidable array of Solyman the Magnificent, and a numerous force of Polish cavaliers fought bravely on the fatal field of Mohacz (1526). The only other important event of S.'s reign was the introduction and extension of Lutheranism in Poland, a change which S. did nothing to prevent, only taking precautions, and sometimes severe ones, against its affecting the civil and political condition of the country. It is told of him that, when John Eck exhorted him to take severe measures with the Lutherans, whom he compared to goats among sheep ('the faithful Catholics'), S. replied that he was desirous of being 'king of goats as well as king of sheep.' After a long and glorious reign, S. died at Cracow, 1st April 1548, leaving the character of a just, wise, and magnanimous prince, who had restored to his country its ancient prosperity, and had raised it from the very feet of its enemies to a worthy superiority over them.

SIGNALS are the means of transmitting intelligence to a greater or less distance by the agency of sight or hearing. Incomparably the most powerful medium yet known for this purpose is the electric current. See TELEGRAPH. Sound signals have obviously but a short circuit. The electric current requires fixed apparatus establishing an actual communication between the two points; and is therefore inapplicable to the ordinary cases of ships interchanging signals with each other or with the shore; and, except under unusual circumstances, it would not apply to armies manœuvring in the field. For these purposes, so far as present knowledge extends, signals by sight or sound must always be the resort. For railway signals, see RAILWAYS.

The ancients seem to have elaborated a fair system of night-signals by torches for military purposes; but in naval affairs the ships sailed so close together, that orders could be communicated by word of mouth, while the turning of a shield from right to left sufficed as sailing directions to the several lines. In modern times, signalling between ships has become indispensable; but there is probably no department of practical science in which progress has been slower, and every so-called system of signals has been distinctly without any system whatever. In the time of James II., a signal could only be expressed by flags, in confusing number, hung in different parts of the vessel. By the commencement of the present century, thanks to Sir Home Popham and other inventors, the system had been adopted of hanging a number of flags under one another, each symbol or combination having an arbitrary conventional meaning attached to it.

Alterations in the specific flags have been made from time to time, but essentially this is the system now in use. The flags are either square, triangular of the same length, or pendants which are pointed and longer. These are of black, white, red, blue, and yellow (in the Austrian service alone green is added) in mass or in combination. Specimens of the flags in use in the present naval code are shown in fig. 1. The signalmen find, however, that at a

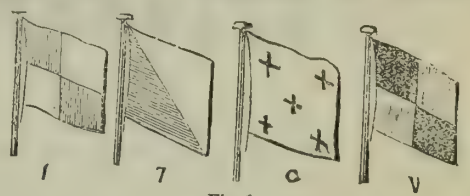


Fig. 1.

distance blue, red, and black are not readily distinguishable, nor yellow from white. It has consequently been the recent tendency, and apparently most justly, to reduce all the signs to black and white, singly or in combination, trusting to shape for different signals.

There are, however, disadvantages attending flags. In a still day, they are difficult to read; or the wind may so blow that they are only seen end on. At sea, the motion of a ship will generally neutralize these drawbacks; but the case is otherwise on shore, and it may consequently occur that the ship can communicate to the land, but cannot get a reply. To obviate this, signals representing solid figures are sometimes employed. To fulfil their conditions, they must appear the same in whatever lateral direction seen. But this limits the shapes to cylinders, cones, and the sphere, or combinations of those figures; and as the total number of distinguishable signs is reduced, signalling becomes reduced from the word-signal to the telegraph. This distinction should be clearly understood, as much is involved in it.

A word-signal, as in the present system, is where the whole word or message is sent up at once, and flies simultaneously; a telegraph signal is one in which the letters composing the word or numbers representing the signal are shown separately, and each is removed before another is shown. At sea, the word-system is best, for it involves no act of memory; and memory, even from signal to signal, is found difficult by signalmen in the turmoil of perhaps storm or fighting. On the other hand, the telegraph system involves far simpler apparatus, and the changes can be effected more rapidly. As regards the actual time required for a message, the word-system has the advantage in a message short enough for the whole to be shown at one time; but otherwise the difference is not material. If all advantages be balanced, it is probable that the telegraph system will eventually supersede the other entirely. Whether the word or the telegraph system be practised, another question is, whether to spell each word, or to use numerals and a code. Under the latter principle, about 14,000 of the words and sentences most commonly sent are arranged for easy reference in the signal-book. With the addition of 1 or 2 repeating symbols, the 9 numerals and 0 give combinations 4 together to this number. A combination of figures is arbitrarily

assigned to each expression; and the expression is communicated by representing those figures in their proper order. With the book of reference at hand, and intelligent signalmen, there can be no doubt of the superior rapidity of the 'code.' A code has also this further advantage, that the signals representing things and not words, it can be made international, the same symbols representing the same idea in every language. It is then only necessary for universal signalling that each nation should concur in the meaning to be attached to the several signs.

Many gentlemen of ability have devoted their attention of late years to the simplification of signals; among whom conspicuous positions must be assigned to Colonel Grant, Colonel Bolton, Mr. Redl, and Captain Colomb, R.M. Their principal object has been so to simplify the telegraph system that signals may be made with any apparatus, or without apparatus at all. To accomplish this, they have to a great extent, abjured color, and resorted to form and motion. Among the form telegraphs there is the principle of the old Semaphore (q. v.), in which each letter or number is shown by the position of two arms, as in fig. 2. The arms are heavy, and involve mechanism; besides which they are not always clear on a ship in motion beyond a short distance.

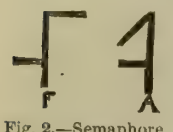


Fig. 2.—Semaphore System.

Very superior in visibility and simplicity is Redl's System of Cones. This consists of 4 cones fixed to a mast. The cones are collapsable, and are formed in a similar manner to umbrellas. Their usual condition is shut, and they can only be held open while a rope attached to each is pulled. With cones of 3 feet base, signalling is rapid and clear up to 5 miles, and the mast can be inserted at any place. The system is very simple: each cone represents a number, 1, 2, 3, or 4; then 1 and 4 shown represent 5; 2 and 4, 6; and so on, as in fig. 3.

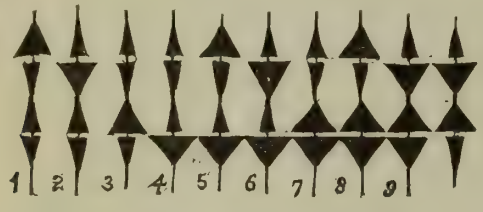


Fig. 3 —Cone System.

This very elegant system can be applied in military or naval operations. But its chief beauty is, that a person understanding it can make the same signals without the cones; for example: if a black flag represent an open cone, and a white flag a shut cone, a ship with 4 black and 3 white flags can make every signal. Again, the arm raised horizontally may represent the open cone; against the body, the shut cone; then two men standing on a cliff are as good as any signal-post, see fig. 4. Or if one person only

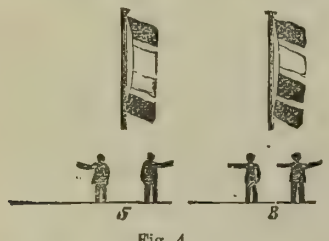


Fig. 4.

be present, he may represent an open cone by raising his arm with a handkerchief extended, and a shut cone by his arm without the handkerchief. He has only then to raise his arm four times in quick succession, with or without the handkerchief, to make the required signal. We have thus arrived at a universal system of the utmost simplicity, which in war and especially during invasion, might be of inestimable benefit to the nation. The code of signals cannot be too generally diffused by the government.

It only remains to apply the same system to night-signals. The old naval principle has been to hang dingy lanterns in various shapes—triangles, squares, crosses, &c. Besides requiring large bases to be at all visible, this has been found from the motion of a ship to be nearly useless. Redl's system has been applied by hanging four lanterns in a vertical line to represent the cones, and obscuring those which corresponded to shut cones. An improvement was found in introducing a red or green light in the middle, to show the relative positions of the four. The best night-signals are, however, flashing lights, as introduced by Colonel Bolton, and more elaborately by Captain Colomb, and adopted in the navy. This consists of a bright light, covered by a shade, which shade, by mechanism, can be lifted for any given time, exposing the light meanwhile. A flash of about half a second's duration is negative: a line of 1½ seconds, positive. Four exhibitions of the light then represent a symbol as in Redl's cones. If the same nomenclature be adopted, we should signal as in fig. 5. It will

Fig. 5.

be seen at once that this system produces results similar to Morse's Electric Telegraph. If the distance be within a mile or so, and the weather still, a bugle will answer equally well, long and short notes representing the positive and negative cones.

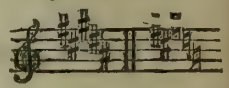
Heliography is now largely used for military signalling where there is plenty of sunshine. The heliograph is simply a mirror on a stand, capable of being swung horizontally as well as vertically, with a small hole in the mirror to look through, so as to direct it accurately. Two trained sappers with heliographs can easily flash signals to one another at a distance of 50 miles, and so communicate even without the help of a telescope.

SI'GNATURE, in Music. In writing music in any key with sharps or flats, the sharps and flats belonging to the key, instead of being prefixed to each note as required, are placed together immediately after the clef on the degrees of the staff to which they belong; and this collection of sharps or flats is called the signature. The signatures of the several keys generally in use are as follows:

The minor keys take the same signature with the major keys a third above them.

When a new key is introduced in the middle of a piece of music, the signature of the former key must be contradicted, and that of the new one appended. Thus a transition from the key of D major to that of D minor, is indicated thus:

from B major to B minor:



the sharps which are to continue being, in this last case, for distinctness' sake, appended in addition to the contradiction of those that are to be discarded. A transition to another key, which is not to continue for any length of time, is seldom indicated by a change of signature; but the sharp, flat, or natural sign is appended to any note as required, that sign affecting all the following notes of the same letter in the measure in which it occurs, unless contradicted. A sharp, flat, or natural thus introduced is called an accidental. Two accidentals are required in the ascending scale of every minor key, to sharpen the sixth and seventh of the tonic.

Besides the signature of the key, a signature of time precedes every musical composition. It consists of two figures placed over one another as a fraction, the denominator 2, 4, 8, or 16 standing for minims, crotchets, quavers, or semiquavers (i. e., halves, fourths, &c. of a semibreve), while the numerator points out how many of these fractional parts of a semibreve are contained in each measure.

Thus, indicates that there are two crotchets, and

three quavers, in the measure. When there are four crotchets (or a semibreve) in the measure, it is usual to write instead of .

SIGNATURE, in Printing, denotes the letters which are placed at the bottom of the first page of each sheet of a book, to facilitate the arrangement of the several sheets in the volume. The letters employed are those of the alphabet, with the exception of J, V, and W, three letters which have been invented since the use of signatures was introduced. See ALPHABET. As the first sheet of a work, containing the title-page, dedication, preface, &c., is generally printed last, the letter A is reserved (along with small letters, *a*, *b*, &c., should there be more sheets of introductory matter) for this and the signatures commence with B; after reaching Z, they commence again at the beginning of the alphabet, the letter being doubled for the sake of distinction, as AA, or A*a*, or more frequently 2A. Should the alphabet again be exhausted, 3A, 3B, &c., are next employed, and so on. This is the method employed in Britain; in France and Italy, figures are generally used. Signatures (as B2, B3, &c.) are also placed on certain pages of the same sheet, as a further direction to the bookbinder.

SIGNET, in England, one of the seals for the authentication of royal grants. Prior to 1848, all letters-patent and other documents which had to pass the Privy Seal, required first to have the signet affixed, and passed from the Signet-office to the office of the Privy Seal in the form of signet bills, verified by the signet-seal and superscription and the signature of the Clerk of the Signet. By act 11 and 12 Vict. c. 82, however, warrants under the royal sign-manual, countersigned by one of the principal secretaries of state, have been made *per se* sufficient authority for the Privy Seal to be affixed, and the Signet-office has been abolished. The signet in Scotland is a seal which seems to have been originally intended to authenticate royal warrants connected with the administration of justice. The principal class of agents or attorneys in Scotland are called Writers to the Signet, it is said from their having been originally clerks in the office of the Secretary of State, by whom writs passing the signet were prepared. See WRITERS TO THE SIGNET.

SIGNING, SEALING, and DELIVERY of a deed in English Law, is the mode of executing a deed. The main acts are, however, the sealing and delivery, for signature is not absolutely essential—at least in some kinds of deeds known to English law. The use of the seal is an ancient form of authenticating deeds, still kept up in England, though long superseded in Scotland by simple subscription. In practice, a wafer or seal is attached to the end of the English deed, and the party who executes it must, after signature, put his finger on the seal, and say: 'I deliver this as my act and deed,' at the same time handing the deed to the person who is to have the custody thereof.

SIGN-MANUAL, ROYAL, the subscription of the sovereign, which must be adhibited to all writs which have to pass the Privy Seal or Great Seal. When attached to a grant or warrant, it must be countersigned by one of the principal secretaries of state, or by the Lords of the Treasury. The sign-manual, in practice, consists but of the initial of the sovereign's name, with the letter R. added, for *Rex* or *Regina*.

SIGOURNEY, MRS. LYDIA HUNTLEY (Huntley being her maiden name), American authoress and poet, was born at Norwich, Connecticut, in 1791. She was, like most young ladies of ability in New England at that period, early engaged in teaching, and much of her early writings consist of tales, essays, instructive letters, and poems, for her pupils and the young. Her first published work was a volume of poems in 1815. In 1819, she was married to Mr. Charles Sigourney, a merchant of Hartford. In 1822, she published a descriptive poem on the *Traits of the Aborigines of America;* and in 1824, a *Sketch of Connecticut Forty Years Since*. These were followed by *Pocahontas and other Poems, Lays of the Heart, Tales in Prose and Verse*, &c. In 1840, Mrs. S. visited Europe, and on her return, with a freedom common to American authors, wrote her *Pleasant Memories of Pleasant Lands*. She compiled amusing and instructive books for the young, and was a constant contributor to magazines and other periodicals of poems, whose subjects, style, and sentiment gave her the designation of 'the American Hemans.' She died at Hartford, June 1865.

SIHU'N. See JAXARTES.

SIKHS. The term Sikh, a corruption of the Sanscrit *s'ishya*, signifying 'disciple,' is applied to a community of which the Punjab, in Northern India, constitutes, substantially, the confines. Less commonly, even among themselves, the members of this community are also known as Sinhs (vulgarly Singhs), that is, 'lions,' a title given them by Govind, the last and most influential of their hierarchs. Every name of a Sikh male now terminates with the word Sinh.

Originally a body of mere religionists, the Sikhs, what from the energy which they developed under repression, and the inducements to join them which they offered as proselytisers, grew, by degrees, in strength and numbers, and ended in a formidable nationality. Their originator, Nânak, was born in 1469, in the vicinity of Lahore, and died in 1539, not far from the place of his nativity. To him succeeded, in turn, nine pontiffs, each of whom, like himself, is popularly denominated guru, or 'teacher.'. These were Angad, Amardâs, Râmdâs, Arjunmall, Hargovind, Harrây, Harkrishna, Teghbahâdar, and, finally, Govind.

The aim of Nânak was pointedly humanitarian, and designed to combine Hindus and Mohammedans, at the cost of what he held to be only unimportant compromise, into one harmonious brotherhood. Sufficient proof of the comprehensive character of his scheme is afforded by the circumstance that he accepted concurrently the incarnations of Neo-Brahmanism and the mission of the Arabian prophet. His three immediate successors, while zealously protecting the interests of the infant sect, avoided secular pursuits, and held themselves aloof from political complications. Arjunmall, however, not content with signalizing himself as compiler of the *Adigranth*, and as founder of Amritsar, the holy city of the S., engaged with ardor in trade, and rendered himself conspicuous as a partisan of the rebellious Prince Khusrû, son of Jahângîr. Hargovind, who came after Arjunmall, called the S. to arms, led them in person to battle, and, though he remitted nothing of his assiduity as a guru, became an active and useful, though sometimes refractory, adherent of the Great Moghul, against whom his predecessor had plotted. Harrây subsequently espoused the part of Dârâ Shukoh, when contending with his brothers for the throne of India. Harkrishna, son of Harrây, died a child, and was only nominally a guru. Teghbahâdar, after a career of turbulence, was executed as a rebel, by command of Aurangzeb, at Delhi. However deficient in the qualifications demanded for spiritual leadership, it can scarcely be doubted that he contributed, to an important degree, in preparing for the complete change of Sikhism which was effected by his son, Govind.

The chief motive that instigated Govind, the tenth of the 'teachers,' to bring about this change was, with some probability, a desire to avenge the ignominious death of his father. He resolved to combat the Mohammedan power and, in deviation from the principles enunciated by Nânak, the Mohammedan religion as well. But Hinduism, with its social restrictions of caste, its fantastic fictions, and its irrational idolatry, likewise fell under his ban. God, he inculcated, is not to be found save in humility and sincerity. In what measure he was a man of thought is evinced by his legacy to his co-religionists, the second volume of the Sikh scriptures. A Sikh, it is therein taught, is to worship one God, to eschew superstition, and to practise strict morality, but equally is to live by the sword. The purport of this last injunction is unmistakable. Govind was assassinated, while in the imperial service, in 1708, on the banks of the Godâvarî. He died, it is true, without beholding the fulfilment of the purpose for which he had striven; but he had, nevertheless, succeeded in stirring his followers to an ambition for political independence—an idea which was ultimately transformed into a reality. His successor, but only as a temporal leader, Banda, suffered a cruel death. He did but little to advantage his sect; and his memory is not held in reverence.

With the decline of the Moghul Empire, the might of the S., in spite of their intermittent reverses, steadily increased, until, in 1764, they convened a general assembly, formally assumed the character of a substantive nation, and issued coin from which the name of the emperor was omitted. Their commonwealth was still denominated, as it had been by Govind, Khâlsa; and the component states of the federation, ordinarily said to have been twelve in number, were thenceforward distinguished as Misls. Foremost in influence among these states was that of Sukarchakiyâ, the chieftain of which was Mahâ Sinh, for whose son, the famous Ranjit Sinh (Runjeet-Singh, q. v.), it was reserved to consolidate the Misls into a unity subject to his own undivided control. The virtual headship of Ranjit Sinh dates from the year 1805, though it was not until 1838 that he attained the zenith of his ascendency. He died in the year following, at the age of 59. During 1845 and 1846, the S. ceased to exist as a nation; and their country has since been ruled by the English. Yet every loyal Sikh is still confident that his people is suffering but a transitory depression, and that it is destined to retrieve, and even to surpass, its bygone glory. In the meantime, the reputed son of a wife or concubine of Ranjit Sinh, Dilip Sinh, is a pensioner of the British government, has professed Christianity, and has taken up his abode in England.

Ethnologically considered, the S. are, in large proportion, of Jât origin; the Jâtas, whom some take to be one with the classical Getæ, being a tribe extensively diffused over the north of India. But other Hindus have helped to swell their ranks, and also not a few Mohammedans. The ten gurus are accounted Kshatriyas, or of the second Brahmanical caste, the martial. The descendants of these several races, from intermarriage and other causes, cannot, however, now be discriminated; and there is no division of the multiform population of India that strikes more than the S., as respects physical uniformity. For symmetry and comeliness,

and, it may be added, for courage and powers of endurance, the Lions of the Punjab are altogether remarkable.

Nânak's was, undoubtedly, by far the most successful of the repeated attempts which have been made to fuse together the incompatible dogmas of Hinduism and Islamism. None of the authors of these attempts seem, indeed, to have been acquainted with other than the mere surface of the two religions which they would have blended into one. With the Mohammedan, the existence of the Deity as a pure spirit, and his creatorship of the world, are fundamental postulates. On the other hand, the radical doctrine of the Hindu is pantheism, agreeably to which the universe, alternatively God, is a single eternal substance, under the twofold aspect of spirit and matter. These sets of first principles, which Nânak and his fellow-reformers could never have clearly apprehended, are palpably impossible of reconciliation.

Without rejecting all that is distinctive of his creed, no Hindu can assent to the theology of Islam; and, conversely, every intelligent follower of the Arabian prophet must be aware that the monism and the metempsychosis of Brahmanism are utterly antagonistic to the leading positions of his own faith. Govind, as we have seen, openly repudiated the notion of amalgamating Hinduism and Mohammedanism. An opportunity of becoming acquainted with his real views and those of Nanak in their fullness, has been provided for English readers by Dr. Trumpp's translation (London, 1877) of the *Adigranth* (the Original Record). The *Granth* contains also extensive quotations from Kubir and other predecessors of Nanak. A second *Granth*, by Guru Govind Sinh, has not yet been translated. These voluminous compositions are metrical throughout, and are in an archaic Indian vernacular, older than Hindi and Panjabi. They are written in the same character as the Sanscrit, the values of the letters being altered, though their forms are retained.

Among the numerous divisions into which Sikhism, as a system of belief and practise, has ramified, two, at least, apart from the great central sect, deserve specification. First are the Udâsîs, professors of indifference to mundane concerns; a sect whose origin is attributed to S'rîchand, a son of Nânak. These recluses, whom Amardâs refused to recognize as genuine S., have, to this day, numerous disciples. The Akâlîs sprang up just after the time of Govind. For extravagance of fanaticism, these Ishmaelites have, it is hoped, no rivals; and the style of their piety is comparable with that of a Thug.

As specimens of the superstitions of the S., it may be noted that, like the Hindus, they look upon the eating of beef as a deadly offence, and that, like the modern followers of Zoroaster, they attach sinfulness to the act of extinguishing a light with the breath. Some illustrations of practical Sikhism may also be gathered even from the few remarks that have been made touching the gurus. It is not irrelevant to add, that Amardâs humanely discountenanced the cremation of widows, and that Arjunmall committed suicide. The morality of ordinary S. is as positively maintained by one class of writers as it is denied by another. Evidence should seem to show that the agriculturists among them are much on a par, as to correctness of life, with other Indian cultivators of the soil. As to their soldiers, however, it has been observed that they are deeply tainted with those repulsive impurities for which the Persians are so infamous. Though forbidden the use of tobacco, they are under no restrictions as concerns indulgence in bhang, opium, and intoxicating drinks; and it would be gross flattery to commend them on the score of sobriety. As regards morality, there is reason to believe that they have greatly degenerated since the days of Govind.

The gross Sikh population has been most variously estimated by different statisticians, some of whom compute it at considerably less than half a million of persons, while others deem a million and a quarter, or even a million and a half, to be not excessive.

For the most satisfactory extant treatment of the subject of this article, the reader is referred to Captain J. D. Cunningham's *History of the Sikhs;* Sir J. Malcolm's *Sketch of the Sikhs; The Asiatic Researches*, vols. i. and xi.; the collective works of Professor H. H. Wilson, vols. i. and ii.; *The Calcutta Review*, vols. xxxi. and xxxiii.; and Dr. Trumpp's *Die Religion der Sikhs* (1881).

SIKH WARS, two brief but desperate contests waged between the British power in India and the Sikhs in 1845—1846, 1848—1849, which resulted in the destruction of the latter as an independent nation. The first had its origin in the dissensions which convulsed the Sikh country after the death of Runjeet Singh (q. v.), and which necessitated the exercise of a wary regard on the part of the Calcutta authorities. At length an army of Sikhs, flushed with their triumph over all lawful authority in their own country, crossed the Sutlej, and extended their ravages over British territory; but their advance guard was met by Sir Henry Hardinge, the governor-general, at the head of four regiments of infantry and one of dragoons, and routed at Mudki (q. v.) with heavy loss. Three days after, their main body, which had meantime crossed the river, and intrenched itself at Feroze-Shah (q. v.), was attacked by a larger force of British under Gough and Hardinge, and after a bloody conflict which lasted two days, also routed.

Still undismayed by these reverses, they again intrenched themselves at Sobraon; but a fresh body which had just crossed the Sutlej at Aliwal (q. v.), 19,000 strong, with 68 pieces of cannon, was wholly routed and driven across the river by Sir Harry Smith, at the head of 7,000 men, with 32 guns; and their main body was soon after similarly dispersed at Sobraon (q. v.). The British then crossed the river, took Lahore, and restored the authority of the young Maharjah, from whom they took the territory between the Beas and the Sutlej, the treaty confirming this settlement being made at Lahore, 9th March 1846. But the internal disturbances in the kingdom of Lahore soon became as active as before, and induced the Maharajah's prime-minister to put the country under the Company's protection; and a residency with a guard of regular troops was then established in the capital. On April 20, 1848, two British officers were murdered by a Sikh chief, the dewan Moolraj of Multan; and as this was found to be but a premonitory symptom of a general outbreak, a small force of British under Lieutenant Edwardes, aided by a body of Sikhs, under the Rajah of Bhawalpûr, gallantly attacked the army of Moolraj, which, after a desperate conflict of nine hours, they defeated on June 18, and, both sides in the meantime having received reinforcements, again on July 1. Multan was then laid siege to, but the defection of 5000 auxiliary Sikhs under Shere Singh (the son of the Sirdar Chuttur, Singh, the governor of Hazara, who had been for some time in revolt, and had driven the British from his district) compelled the British to retreat.

For some time, the British authorities in the Punjab were hampered by a want of military force, and though the Maharajah and much of his army still opposed the Sikh rebels, little reliance could be placed upon most of it. Shere Singh now succeeded in raising his army to 40,000, but was defeated by Lord Gough at Ramnugger (November 22). The inconsiderate haste of Gough at Chillianwalla (January 13) nearly lost him that great battle, which was saved only by the extreme valor of his soldiers; but amends for this fault was made at Gujerat (q. v.), where the power of Shere Singh and his allies was completely broken. Meanwhile, the fortress of Multan had, after a protracted bombardment, been captured; and the Company, seeing no other mode of protecting their territories from annoyance by these warlike fanatics, annexed the Punjab, March 29, 1849, thus terminating the existence of the Sikhs as an independent nation.

SI-KIA'NG, or WESTERN RIVER, a river at the southern extremity of China Proper. It is navigable for vessels not drawing more than 16 feet of water for about 100 miles from its mouth. The S. is remarkable for the purity and clearness of its waters.

SI'KKIM, a small protected state in the northeast of India, bounded on the W. by Nepaul, and on the S. E. by Bhotan. Area, 2544 sq. m.; pop. 50,000.—The district immediately to the south, of which Darjeeling (q. v.) is capital, is often called BRITISH SIKKIM. It was mostly taken from the Rajah of S. in 1850, in punishment of an outrage on British subjects.

SILE'NE, a genus of plants of the natural order *Caryophillaceæ;* with a tubular 5-toothed calyx; five notched or bifid petals, which terminate in a narrow claw at the base, spring from the stalk of the germen, and have each an appendage forming a *Corona* (q. v.) in the mouth of the corolla; ten stamens; three styles; the capsule 3-celled, 6-toothed, many-seeded. The species are numerous, mostly natives of the temperate parts of the northern hemisphere, annual and perennial plants; nine or ten of them natives of Britain, and others frequent in flower-gardens.—One of the most common British species is the BLADDER CAMPION (*S. inflata*), a perennial, which grows in cornfields and dry pastures, and near the sea-shore, has a branched stem fully a foot high, ovate-lanceolate bluish-green leaves, panicles of white flowers, and an inflated calyx, with a beautiful network of veins. The young shoots are sometimes used like asparagus, and have a peculiar but agreeable flavor, somewhat resembling that of peas. They are best when most blanched. The cultivation of this plant was long ago strongly recommended, but it has not obtained a place among garden plants.—The MOSS CAMPION (*S. acaulis*) is a pretty little plant, with beautiful purple flowers growing in patches so as to form a kind of turf, one of the finest ornaments of the higher mountains of Scotland, and found also in Cumberland and Wales.—Many species, some of them British, are popularly called CATCHFLY, from their viscidity, as *S. Anglica*, a species found in sandy and gravelly fields in many parts of Britain.

SILE'NUS, son of Pan and Gæa (the Earth), is generally represented as the chief of the Sileni or older Satyrs (q. v.), and the inseparable companion of Bacchus, with whom he took part in the contest against the Gigantes, slaying Enceladus. In most respects, he seems to have resembled the other satyrs, and to have borne

a strong likeness to Sir J. Falstaff, being in addition noted for his wisdom and his power of prophecy. S. had a temple at Elis.

SILE'SIA, a province of the kingdom of Prussia, included in the limits of the German empire, lies south of the provinces of Brandenburg and Posen, and is bounded on the E. by the Polish provinces of Russia and Austria, and on the S. and W. by the Austrian provinces of Silesia and Bohemia, and the kingdom of Saxony. It is divided into three governments: *Liegnitz*, in the west; *Breslau*, in the east; and *Oppeln*, in the south; and these, again, are subdivided into circles. Area, 15,666 English sq. m.; pop. (1871) 3,707,144, of whom 1,896,136 were Catholics, 1,760,341 Protestants, and 46,629 Jews; (1880) 4,007,925. Of the population, ⅛th speak Polish, more than 90,000 employ other Slavic dialects, and the rest use the German language. This province, the largest and much the most populous of the Prussian provinces, is crossed from north-east to south-west by a broad strip of mountainous country, which widens out at each extremity; and along the whole eastern boundary, and in the south, are ranges of low hills; in the north-west and center, the surface is flat and heathy, or sandy, with numerous stagnant pools.

S. is almost wholly included in the basin of the Oder (navigable as far south as Ratibor), which flows through it from south-east to north-west, and receives from each side numerous tributaries; but a small portion in the extreme south is drained into the Vistula, which here takes its rise. The soil is altogether fertile and well cultivated, more so, however, in Lower than in Upper S.; and cereals of all kinds, oil-plants, beet, hops, occasionally vines, and above all, flax and hemp, are the crops of the province; but of late years the cultivation of tobacco, and of plants yielding dyestuffs, has been receiving increased attention. Cattle and sheep, the latter excellent in quality, and partly of pure and mixed merino blood, are reared in the high-lands, the annual produce of wool averaging fully 140,000 cwt. The mines of S. are of great importance; iron, copper, and lead are the chief products; coal is found in abundance. The manufacture of lace, averaging in annual value £1,500,000, is carried on in the mountainous districts, chiefly around Schweidnitz; and the production of other fabrics, as linen, cotton and woollen goods, paper, iron, leather, glass, and earthenware, is vigorously carried on throughout the province The Oder, and the great central railway from Berlin and Posen to Vienna, afford ample facilities for commerce. There are a university at Breslau, gymnasia in the principal towns, and a great number of professional and industrial schools.

S. was inhabited at the beginning of the Christian era by the Quadi and Lygii, who, like the other German tribes, advancing westward in the 6th c., were succeeded by Slavic tribes. It formed part of the Slavic kingdom of Moravia, was next joined to Bohemia, and in the beginning of the 10th c. to Poland. In 1163, it was separated from the kingdom of Poland, but was ruled by dukes who were of the royal line of Piast; these dukes, to repeople the country, which had been devastated by the numerous civil wars, encouraged the settlement of German colonies, especially in Lower Silesia. The practice of division and subdivision of territory prevailed so extensively in S., that at one time it had no less than 17 independent dukes, and to save itself from re-incorporation with Poland, it acknowledged the sovereignty of the kings of Bohemia, with which, and with Germany, from the time of the Emperor Karl IV., it was indissolubly connected. In 1537, the Duke of Liegnitz, one of the numerous Silesian princes, entered into an agreement of mutual succession (*Erbverbrüderung*) with the Elector of Brandenburg, on the extinction of either reigning line; and the other ducal lines becoming gradually extinct, their possessions fell to Liegnitz or to Bohemia, or lapsed to the emperor.

In 1675, when the last ducal family, that of Liegnitz, failed, its territories of Liegnitz, Brieg, and Wohlau, would have fallen to Prussia, but the emperor of Germany refused to recognize the validity of the agreement of 1537, and took possession of the Liegnitz dominions, as a lapsed fief of Bohemia. The remainder of S. was thus incorporated into the Austrian empire. In 1740, Frederick II. of Prussia, taking advantage of the helpless condition of Maria Theresa of Austria, laid claim, on the strength of the agreement of 1537, to certain portions of S.; and without declaring war, marched into, and took possession of the province, maintaining his hold despite the utmost efforts of Austria in 1740—1742, and 1744—1745, called the *first* and *second* Silesian wars. After the *third* Silesian war, better known as the SEVEN YEARS' WAR (q. v.), it was finally ceded (1763) to Prussia.

SILESIA, AUSTRIAN, a duchy and crownland of the Austrian empire, bounded on the N.E. by Prussia, and on the S.W. by Moravia. Area, 1980 sq. m.; pop. (1876) 558,196. It is mountainous in the west, where the Spieglitzer Schneeberge, a summit of the Sudetic chain, rises to the height of 4512 feet. The crownland comprises 1806 sq. m. of level land, of which by far the greater portion is arable or under wood. The climate, though rough, is healthy, and the soil produces good crops of rye, oats, barley, flax, &c. Within the crownland rise the Oder and Vistula. Cattle-breeding and bee-keeping are important branches of industry; 110,000 head of sheep belong to the crownland. Iron, lead, and coal mining are profitably pursued. The manufactures are principally spirits, copper and iron wares, and linen and cotton fabrics.

SI'LEX (Lat. flint), a generic name given by some mineralogists to all those minerals of which silicia is the principal ingredient. See QUARTZ.

SI'LHOUETTE, the name given to a profile or shadow-outline of the human figure, filled in of a dark color, the shadows and extreme depths being sometimes indicated by the heightening effect of gum or some other shining material. This species of design was known among the ancients and was by them carried to a high degree of perfection, as the monochromes on Etruscan vases amply testify; but the name S. is quite modern, dating from about the middle of last century. It was taken from Etienne de Silhouette, the French minister of finance in 1759, who, to replenish the treasury, exhausted by the costly wars with Britain and Prussia, and by excessive prodigalities, inaugurated numerous reforms, and the strictest economy of expenditure. His extreme parsimony in all finance matters made him a choice subject for caricature; so that any mode or fashion that was plain and cheap —'surtouts' without plaits, trousers without pockets—was styled *à la Silhouette;* and profiles made by tracing the shadow projected by the light of a candle on a sheet of white paper being then much in vogue, have continued to bear the name. Although without merit as a work of art, the S. presents a clear and well-marked profile and such instruments as the Pantograph (q. v.), &c., used to be frequently employed to obtain profiles of a reduced size direct from the human features—Profiles cut out of black paper with scissors also receive the name of silhouettes.

Silhouette of Robert Burns.

SI'LICA. See SILICON.

SI'LICON, or SILI'CIUM (sym. Si, eq. 14 (in new system, 28), spec. grav. 2·49), is one of the non-metallic elements (see CHEMISTRY). It may be obtained in three different forms—viz., the *amorphous*, the *graphitoid*, and the *crystalline*. It is the first of these, the amorphous silicon, which is obtained by the processes in common use, the second and third being obtained from this first modification.

Amorphous silicon presents the appearance of a dull brown powder, which adheres to the finger, is insoluble in water and in nitric and sulphuric acids, but readily soluble in hydrofluoric acid, and in a hot solution of potash. It is a non-conductor of electricity, and when heated in air or oxygen, its external surface burns brilliantly, and is converted into silica, which fuses from the extreme heat, and forms a coating over the unburned silicon. *Graphitoid* silicon is obtained by exposing the amorphous variety to an intense heat in a closed platinum crucible. This form of silicon will not take fire when heated in oxygen gas, and resists the solvent action of pure hydrofluoric acid, although it rapidly dissolves in a mixture of nitric and hydrofluoric acids; moreover, as another point of difference, it is a conductor of electricity. For the description of *crystallized* silicon, we may refer to a treatise by Deville (in the *Ann. de Chimie*, 3d ser. vol. 49, p. 65), who obtained it in regular double six-sided pyramids of a dark steel-gray color.

Silicon, in a state of combination with oxygen, is the most abundant solid constituent of our globe; and, in less proportion, is an equally necessary ingredient of the vegetable kingdom, while in the animal kingdom it occurs in mere traces, except in a few special cases. It is never found in nature except in combination

with oxygen; but by a somewhat difficult process—which we need not here describe—it may be separated as a dark brown powder. It was first isolated by Berzelius in 1823. For our knowledge of the other modifications, we are indebted to Wöhler and Deville.

Silicon forms two oxides, one of which is only known in the hydrated state, while the other is the well-known compound, silica or silicic acid. *Hydrated oxide of silicon* is represented by the formula $2HO,3SiO$, and silicic acid by SiO_2. The hydrated oxide exhibits many interesting chemical properties, but is of no practical importance.

Silicic acid or *silica* exists both in the crystalline and in the amorphous form. The best examples of the crystalline form are rock-crystal, quartz, chalcedony, flint, sandstone, and quartzose sand. Silicia in this form has a specific gravity of about 2 9, and is only attacked with difficulty by potash or hydrofluoric acid. The amorphous form exists naturally in opal, and is obtained artificially as gelatinous silica, &c.; it differs from the former in its specific gravity, being about 2·2, and in its being rapidly dissolved by potash and by hydrofluoric acid.

Pure silica (as it occurs in rock-crystal, for example) is perfectly transparent and colorless, and is sufficiently hard to scratch glass. The heat of the oxyhydrogen blowpipe is required for its fusion, when it melts into a transparent glass, capable of being drawn out into elastic threads. Perfectly pure silica in its amorphous form may be obtained by various chemical processes. If a solution of silicate of potash or soda be treated with hydrochloric acid, the silicic acid separates as a hydrate, and on evaporating this to dryness, and treating it with boiling water, silicic acid remains as an amorphous powder, which, after being washed, dried, and exposed to a red heat, may be regarded as chemically pure. The hydrated silicic acid mentioned in the above experiment is soluble in water, and (more freely) in acids and alkalies. The solubility of hydrated silicic acid in water, accounts for the presence of silicic acid in mineral springs, and in the Geysers of Iceland, as well as for its gradual separation from these waters in the form of petrifactions. That silica or silicic acid is a true acid (although a feeble one), is obvious from its uniting with bases, especially those which are capable of undergoing fusion, and forming true salts, known as silicates. These silicates occur abundantly in nature; all the forms of clay, felspar, mica, hornblende, augite, serpentine, &c., being compounds of this description. Silicic acid combines with bases in various proportions.

The following table, borrowed from Miller's *Elements of Chemistry*, vol. ii., shows the combinations which are of the most usual occurrence:

	Examples.	Formulæ.
$2MO,3SiO_2$, or Sesquisilicates.	Silicate of lime	$2CaO.3SiO_2$.
	Meerschaum (hydrated silicate of magnesia)	$2MgO.3SiO_2 + 2HO$.
MO,SiO_2, Neutral silicates.	Wollastonite (silicate of lime)	$CaO.SiO_2$.
	Dioptase (hydrated silicate of copper)	$CuO,SiO_2 + HO$.
$2MO,SiO_2$, Dibasic silicates.	Olivine	$2(Mg.Fe)O,SiO_2$.
	Iron forge cinder	$2FeO,SiO_2$.
$MO,2SiO_2$, Bisilicates	The composition of many of the ordinary varieties of glass may be approximately represented by mixtures of different silicates which have this formula.	

In the above formulæ, MO stands for 1 equivalent of any metallic protoxide, such as lime, magnesia, or protoxide of iron.

The following are the general characters of the silicates: Most of them are fusible, the basic silicates fusing more readily than those which are either neutral, or contain an excess of acid. Excepting the silicates of the alkalies, no silicates are soluble in water. The anhydrous, neutral, and acid silicates of the earths resist the action of all acids except the hydrofluoric.

In conclusion, we may remark that silica derives its name from *silex*, flint, of which it is the essential constituent, and that it is largely employed in the manufacture of glass, china, and porcelain. For these purposes, it is obtained in a finely comminuted state by heating flints or portions of colorless quartz to redness, and plunging them in cold water. The silica splits up into a friable mass, which may be easily ground to a fine powder. The use of silica in giving firmness and rigidity to various parts of the animal organs, is exemplified in its free occurrence in the quill-part of the feather of birds, in the shields of certain infusoria, and in the spicula occurring in sponges; while its similar use in the vegetable kingdom is seen in its more or less abundant presence in the stalks of the grasses, more particularly in the cereals and in the bamboo (where it is especially deposited about the joints, and is known as *Tabasheer*), in the equisetæ, &c.

Silicon may be made to combine with several other elements beside oxygen, but, with the exception of silicofluoric acid, these compounds are of no practical value. Thus silicon and hydrogen form a hydride of silicon, a colorless and spontaneously inflammable gas. Nitride of silicon is a bluish fibrous body, while sulphide of silicon is a white earthy powder. Silicon unites with chlorine, bromine, and propably iodine and fluorine, in two proportions corresponding to its oxygen compounds. Fluoride of silicon (SiF_2) is a colorless pungent gas, liquefiable under strong pressure, and solidifying at—220°, inflammable, and a non-supporter of combustion. It is obtained by heating powdered glass with 12 times its weight of oil of vitriol, and when a stream of this gas is transmitted through water, a reaction takes place; two atoms of water and three atoms of the fluoride of silicon yielding silicofluoric acid (HF,SiF_2), which remains in solution, and silicon, which is deposited.

A saturated solution of this acid forms a very sour fuming liquid, which does not directly attack glass, but if allowed to evaporate on it, causes erosion from the fluoride of silicon becoming evaporized, and free hydrofluoric acid being left. A dilute solution is frequently employed in the laboratory as a precipitant of potash, which it throws down in a transparent gelatinous form. With salts of baryta, it gives a white crystalline precipitate. It combines with bases to form salts, none of which are of any special importance.

SI'LIQUE (*Siliqua*), in Botany, the fruit of the *Cruciferæ*, a capsule opening by two valves, which, when ripe, separate from the base upwards, leaving a central frame (*replum*), to which the seeds remain attached, and which is regarded as formed by parietal placentas, the valves giving way close to the suture. The seeds are either in one row or two. A SILICULE (*silicula*) is merely a silique of a different form, the true silique being long and narrow, the silicule broad and short, although Linnæus made this difference the foundation of the orders (*Siliquosa* and *Siliculosa*) of his class *Tetradynamia*, a distinction not now equally attended to in the subdivision of the natural order *Cruciferæ*.

SILI'STRIA, a town of the new principality of Bulgaria, is situated on the right bank of the Danube, which is here nearly one-fourth of a mile wide, and is studded with numerous islands. The houses are mean, and built generally of wood, though sometimes of stone, and also of mud; the streets, like those of most Moslem cities, are crooked, narrow, dirty, and ill-paved; and the manufactures are insignificant, though there is a considerable trade in wood and cattle. Pop. 20,000. The Dobrudscha, ceded by Turkey to Rumania in 1878, is bounded by a line running from a point just east of S. to Mangalia on the coast. The importance of S. lay formerly in its value as a military outpost of Turkey. Its walls were constructed of solid masonry, but consisted merely of a fortified *Enceinte* (q. v.) surrounded by a ditch, the great strength of the fortress depending upon the support given to it by detached works. S. is a town of great antiquity, and was a fortress under the Byzantines. Here, in 971, the Byzantine emperor, John Zimisces, routed the Russians under Sviatoslav. It has been repeatedly assaulted and taken by the Russians. In 1849, S. was made a stronghold of the first class, and was rendered almost impregnable by the addition (1853) of 12 detached forts on the south and east. On the outbreak of the Crimean war, the Russians laid siege to it, with an army of from 60,000 to 80,000 men, but were compelled to retreat after 39 days. The Congress of Berlin in 1878, when erecting Bulgaria into a principality, decreed that the fortifications of S., like those of the other Bulgarian cities, should be dismantled.

SILK AND SILKWORM. The name *silk* is derived, by the not unusual substitution of *l* for *r*, from Lat. *sericum* (Gr. *serikon*), so called as coming from the country of the Seres or Chinese. The SILKWORM is the caterpillar of the SILKWORM MOTH, of which there are numerous species belonging to the genus *Bombyx* and other genera of the family *Bombycidæ*, lepidopterous insects of the section popularly known by the name Moth (q. v.). The *Bombycidæ* have a very short and rudimentary proboscis, living for a very short time in their perfect state, and taking little or no food; the body is thick and hairy; the wings are large and broad, either extended horizontally when at rest, or inclined like the sides of a roof; the antennæ are pectinated. The caterpillars feed on the leaves and other tender parts of trees or other plants; the chrysalids are enclosed in a cocoon of silk, which gives to some of the species a great economical importance. The most important is the COMMON SILKWORM (*Bombyx mori*), a native of the northern provinces of China. The perfect insect is about an inch in length, the female rather larger than the male; the wings meeting like the sides of a roof; the color whitish, with a broad pale brown bar

across the upper wings. The females generally die very soon after they have laid their eggs, and the males do not survive much longer. The eggs are numerous, about the size of a pin's head, not attached together, but fastened to the surface on which they are laid by a gummy substance, which, when dry, becomes silky. They are laid in the end of summer, and are hatched in the beginning of next summer.

The caterpillar is at first very small, not more than a quarter of an inch in length, but rapidly increases in size, till, when full grown, it is nearly three inches long. It is of a yellowish gray color. The head is large. On the upper part of the last joint of the body is a horn-like process. The skin is changed four or five times during the growth of the caterpillar. Before each change

Silkworm Moth (*Bombyx mori*), in its various stages.

of skin, it becomes lethargic, and ceases to eat, whereas at other times it is very voracious. When the skin is ready to be cast off, it bursts at the fore part, and the caterpillar then, by continually writhing its body, without moving from the spot, thrusts it backwards; but silkworms frequently die during the change of skin. A very rapid increase of size takes place whilst the new skin is still soft. The natural food of the silk-worm is the leaves of the white mulberry, but it will also feed on the leaves of some other plants, as the black mulberry and the lettuce. When so fed, however, it produces silk of inferior quality. The silk-producing organs are two large glands (sericteria) containing a viscid substance, which extend along great part of the body, and terminate in two *spinnerets* in the mouth. These glands become very large when the change to the chrysalis or pupa state is about to take place. When about to spin its cocoon, the silkworm ceases to eat, and first produces the loose rough fibre which forms the outer part of the cocoon, and then the more closely disposed and valuable fibre of its interior.

In this process, the position of the hinder part of the body is little changed, but the head is moved from one point to another; and the cocoon when finished is much shorter than the body, which, however being bent, is completely enclosed in it. The cocoon is about the size of a pigeon's egg. Each fibre of silk, when examined by a microscope, is seen to be double, being equally derived from the two silk-producing organs of the caterpillar. A single fibre often exceeds 1100 feet in length. The time of the silkworm's life in the caterpillar state is generally about eight weeks. About five days are occupied in the spinning of the cocoon; after which about two or three weeks elapse before the cocoon bursts and the perfect insect comes forth. The natural bursting of the cocoon is, however, injurious to the silk, and the silkworm rearer prevents it by throwing all the cocoons into boiling water, except those which he intends to keep in order to the maintenance and increase of his stock. These he selects with care, so that he may have about an equal number of male and female insects, the females being known, even in the chrysalis state, by their larger size. The cocoons intended for the production of moths are placed on a cloth in a somewhat darkened room, of which the temperature is near, but does not exceed 72° F.; and the moths, when produced, show no inclination to fly away, but remain on the cloth, lay their eggs, and die there.

It is an interesting peculiarity of this valuable species of moth, that neither in the caterpillar nor in the winged state does it show that restless disposition which belongs to many others, the caterpillars remaining contentedly in the trays or boxes in which they are placed, feeding on the leaves with which they are there supplied, and at last only seeking a proper place to assume the chrysalis form on small bundles of twigs which are placed for that purpose above the trays; the perfect moths, in like manner, abiding almost in one spot, and scarcely caring to use their wings. Owing to this peculiarity it is capable of being reared and managed in a way which would otherwise be impossible.

The silkworm is liable to various diseases, particularly to one by which great numbers are often destroyed, and which is either caused or characterized by the growth of a small fungus known as *Silkworm-rot*, or *Muscardine* (q. v.).

Of the other species of silkworm, many are rapidly increasing in commercial importance. The following is an enumeration of the chief silk-producing insects; those in Italics are not as yet employed in manufactures:

Bombyx mori.—The common silkworm, native of India, and reared in other parts of the world.

B. cræsi.—Crosses have been obtained between this and B. mori, yielding excellent silk, at Mussooree.

B. textor—Native of Mussooree.

B. sinensis.—China.

B. Huttoni.—Silk collected in Mussooree.

B. Horsfieldi.—Native of Java.

Attacus atlas.—Native of India, and said to yield some of the 'Tusseh Silk.'

A. Guerini.—Native of Bengal.

A. ricini.—Native of Assam.

A. cynthia.—The 'Eria,' or 'Arrindy' silkworm, native of India, now extensively raised in Hong-kong, Nepaul, Mussooree, Java, and to some extent in Southern Europe. It feeds on the leaves of the Ailanto (q. v.) tree.

Antheræa Mezankooria.—The Mezankooria silk-moth.

A. Paphia.—The true Tusseh or Tussur Moth, native of Darjeeling, and other parts of Upper India. It is produced very extensively, and is chiefly collected in the jungle districts by the Sahars and other half-wild castes who live in the jungles. The cocoons are so carefully concealed in the leaves, that much care is required to discover them, the only indication being the dung of the caterpillar, under the trees. The tusseh silk is easily wound off from the cocoons in the same way as that of the common silkworm.

A. Assama.—The Moonga, or Moogha, native of Assam.

A. Pernyi.—North China.

A. Perrottetti.—North China.

A. Roylei.—Mussooree.

A. Helferi.—Darjeeling.

A. Jana.—Java.

A. Frithii.—Darjeeling.

A. Larissa.—Java.

The preceding seven are all called Tusseh moths.

Actias Selene.—Darjeeling.

Saturnia pyretorum.—China.

S. Grotei.—Darjeeling.

Lœpa Katinka.—Java.

Neoris Huttoni.—Mussooree.

Caligula Tibeta.—Mussooree.

C. Simla.

Salassa Lola.—South-east Himalaya.

Cricula triferrestrata.—Java.

It will be seen by the above list that hitherto very few of the silk-moths have been turned to man's profit. The first in importance after the common silkworm is the true *Tusseh*, next, the *Moonga*, the silk from both of which can be wound off the cocoon; and then the *Eria*, which cannot be wound easily, and is therefore generally carded.

Silk appears not to have been well known to the ancients; although several times mentioned in the translations of the Bible, the best authorities deny that it is in the original, or that it was known to the Hebrews. Among the Greeks, Aristotle is the first who mentions it, and he only says that 'Pamphile, daughter of Plates, is reported to have first woven it in Cos;' and from all the evidence which has been collected, it would appear that the natives of Cos received it indirectly (through the Phœnicians and Persians) from China. The silken webs of Cos found their way to Rome, but it was very long before they were obtainable except by the most wealthy. The cultivation in Europe of the worm itself did not take place until 530 A.D., when, according to an account given by Procopius, the eggs were brought from India (China) to the Emperor Justinian by some monks.

In China, the cultivation of silk is of the highest antiquity, and according to the greatest Chinese authorities, it was first begun by Si-ling, the wife of the Emperor Hoang-ti, 2600 years B.C., and the mulberry was cultivated for the purpose of feeding them only forty years later.

Since its introduction to Europe, it has always formed a great branch of industry in Italy, Turkey, and Greece, and it has been cultivated to some extent in France, Spain, and Portugal. In England, too, from time to time, laudable efforts have been made to cultivate it, especially by Mrs. Whitby of Newlands, Mr. Mason of Yately in Hampshire, and Lady Dorothy Neville of Dangstein in Hampshire; but this branch of industry requires a warmer and less variable climate and cheaper labor than we can command. Recently, silk has been successfully cultivated in New Zealand.

The quantity of silk raised in the world is enormous. Great Britain imports annually in the unmanufactured state: 'Raw' silk, about 6,500,000 lbs.; 'waste,' or knubs and husks, about 3,500,000 lbs.; besides undyed 'singles,' about 5700 lbs.; tram, about 7000 lbs.; organzine, about 39,000 lbs.; and dyed singles and tram, about 3000 lbs.; organzine, about 10,000 lbs. Singles, tram, and organzine are terms applied to the thread after it has undergone certain operations (to be afterwards described). The

total quantity is thus about 10,000,000 lbs., of the value of £5,000,000; and in addition to this we import manufactured silk goods to the value of about twelve millions and a half sterling; so that the

Ailanto Silkworm (reduced), showing the Cocoon of Silk attached to a Leaf.

importance of this little insect to Great Britain alone is represented annually by about £17,500,000. It requires 1600 worms to raise a pound of silk.

Rearing of Silkworms.—It is of the first consequence in the production of silk that one of the species of mulberry should be cultivated, and that it should be so favorably situated as to climate, that its foliage is in readiness for feeding the young worms when they are first hatched from the eggs. The species best adapted is the white mulberry, *Morus alba*. The extreme lateness of season at which the black mulberry produces its leaves, prevents its employment generally, besides which it will not bear the loss of its leaves so well. It is said that in some parts of China the silkworm is easily reared upon the trees in the open air. So little has it a tendency to wander far from the place of its birth, if food be at hand, that it only requires a warm dry atmosphere to bring it to perfection; but usually, even in China, and in all other countries, it is thought desirable to raise the silkworm in properly arranged buildings, and to supply it with mulberry leaves gathered from day to day. In India, China, and other tropical countries, the eggs hatch readily at the proper time by the natural heat; but in Southern Europe, artificial heat is almost always required; formerly, the heat of fermenting dung was found serviceable, and the warmth of the human body was also used, the eggs being carried in little bags in the bosom of the cultivators; but now they are regularly hatched by stove-heat, beginning with a temperature of 64° F., which is gradually increased through ten days to 82°, at which it is maintained until the eggs are hatched.

Experience has shown that the operation is facilitated by washing the eggs in the first place with clean water; and some cultivators also wash them in wine, the value of which is very questionable. Washing is found to remove a certain gumminess and other impurities from the eggs, which would otherwise impede the hatching. When the silkworms have been regularly developed

Fig. 1.

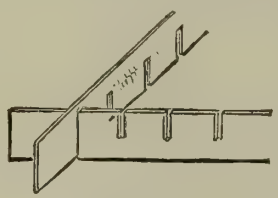


Fig. 2.

as above described, it is usual to place above the trays various little contrivances for the caterpillar to spin within: many of the Italian growers employ an ingeniously simple arrangement, which lasts many seasons, and when not in use, occupies very small space. It consists of a number of thin slips of wood, about an inch and a half broad, and all cut sufficiently long to reach across the trays. They are each cut at intervals of an inch half through,

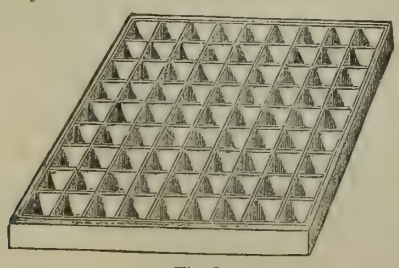


Fig. 3.

as in fig. 1, so that one will fit into another, as in fig. 2; and when complete, they all form a series of cells which, set in a tray, (fig. 3), form the very best receptacles for the silkworm to spin it. When not in use, the whole arrangement can be compressed into very small compass, as in fig. 4, for convenience of storage. Others use little cones of paper, or small twigs, amongst which the cocoons are spun.

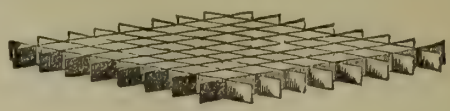


Fig. 4.

In feeding the worms, care is taken so to distribute the food on the shelves or in the trays that the insects shall not crowd together; and for this reason, the most careful cultivators chop the leaves small, and strew them very evenly about. Great care is taken not to let the worms of one hatch mix with those of another, unless of exactly the same age, otherwise the stronger insects would deprive the younger of their food. Many other niceties of attention are required, which altogether render the successful rearing of silkworms a matter of much anxiety and labor.

Fig. 5.

Fig. 6.

Preparation of Silk.—When the cocoons are completed, which is known by the absence of any sound within, they are carefully sorted, and a certain number are kept for laying. The sexes are readily known by the difference of shape as well as of size, the female being plumper, as in fig. 5, and the male (fig. 6), besides being much smaller, having a central depression and sharper extremeties. The French growers sort them into nine varieties, those which are less compact, or in which the worm has died—a fact known by external indications—being separated from the good ones.

When the sorting is finished, the cocoons are placed in an oven with a gentle heat, which kills the enclosed chrysalis, otherwise they would all become *perforated* by the insect eating through; they are then prepared for winding by first removing the flossy covering, which is often somewhat hard and compact. The cocoons are placed in basins of water, kept warm by charcoal fires, or, in the larger establishments, by steam. This softens and dissolves the natural gum which coats the silk, and makes the various coils of silk adhere together in the cocoon. The operator then takes a small branchy twig, and stirs them about in the water. This is sure to catch hold of any liberated ends which may be floating in the water. From three to five of these ends are taken and twisted together with the fingers, so as to unite them into one thread, which is passed through a polished metal or glass eye in the reeling-machine, which is so far from the hot-water basin as to give the softened gum on the silk time to dry in its passage from the basin to the reel. In large *filatures* or silk establishments, complex machinery is used for winding; but reeling apparatus of the greatest simplicity is used by the Chinese, East Indians, and others with almost equal effect, when carefully done, except in the amount of work accomplished.

In all cases, however, the principle is the same, and is very simple, as shown in fig. 7, in which *a* shows the small pan of

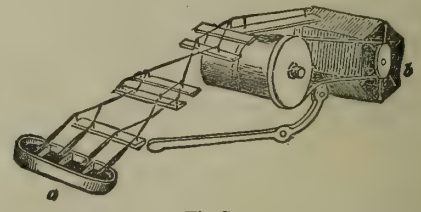


Fig. 7.

warm water holding the cocoons, the threads from which are gradually united, and wound on the reel *b*. Great care and skill are required in reeling silk from the cocoons, because, although the reeler starts with four or five cocoons, not only are their individual threads apt to break, but they are not all of the same length, so that one will run out before the others. These matters are carefully watched; and as often as a thread breaks, or a cocoon runs out, another thread is joined on, and is made to adhere to the compound thread on the reel by its natural gumminess. Each cocoon generally yields 300 yards of thread, so that it takes 1200 or 1500 yards to make 300 yards of the filament of raw silk, by which name the reeled silk is always known. The raw silk is made up into hanks of various sizes. That from China and Japan is tied in packages of six hanks each technically called *books*, and sometimes the ends of these books are covered with silken caps very curiously formed out of a single cocoon, so managed as to form a filmy cap sufficiently large to cover a man's

head. The method used by the Chinese to accomplish this is quite unknown in Europe. These caps or bags, when closed, are sometimes nearly a foot square, and much of the wadding used by the Chinese dressmakers for padding is made by placing these bags upon each other to the required thickness.

Notwithstanding the care taken in reeling the silk from the cocoons, and forming several threads into one, it is not ready for the weaver, but has to undergo the processes called collectively *throwing*. In this country, this is a special trade, the *silk throwster* usually conducting it in large mills with extensive machinery, where the above processes are all carried on generally by steam-power. The silk reaches the throwster in hanks as imported. These are put into clean soap and water, and carefully washed, ties having been placed at intervals, to prevent the silk entangling. After being dried by hanging in the drying-room, they are placed on large skeleton reels called *swifts* (fig. 8), so adjusted that they will hold the hanks tightly. Fig. 9 is a front view of a *swift*, and shows that the spokes, *a*, *a*, are in pairs. They are made of thin pieces of lance-wood, and each pair are rather nearer together at the axle than at the circumference, where they are connected together by a small band of cord, *bb*. These bands are so tied that they will slip down easily to admit of the hanks being placed; then, by pushing the cords upwards, the hank can be stretched to its fullest extent. This is necessary to compensate for the varying lengths of the hanks received from different countries.

When the *swifts* are set in motion, the silk is carried from the hanks to bobbins, upon which it is wound for the convenience of further operations. The bobbins are then taken from the *winding* to the *cleaning* machine, when they are placed on fixed spindles, so that they will turn with the slightest pull; and the thread is passed through a small apparatus attached to the machine, which is specially called the cleaner, and consists essentially of two polished smooth-edged blades of metal (*a*, *a*, fig. 10), attached to a part of the frame of the machine, *b*. They are held together by

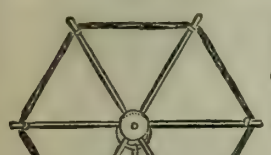


Fig. 8.

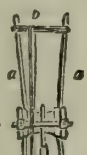


Fig. 9.

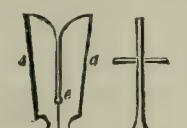


Fig. 10.

the screw *c*, and are slightly opened or closed by the other screw, *d*, so that the thread can be put between them down to the small orifice, *e*, and then, by tightening the screw, preventing its return, after passing through this small hole, which is the gauge of the thread, and which removes any irregularities or adherent dirt. The silk next passes over a glass or metal rod, and then through another small hole, much larger than that of the *cleaner*, and usually made of glass, on to the bobbin, upon which it is wound by the action of the machine. The next process is *twisting* the cleaned thread, by which it becomes better adapted for being combined with other threads.

Doubling is the next process, and this consists in running off a number of bobbins of *twisted* silk on to one bobbin of a larger size, which is put into the *throwing*-machine, when the ends of the *doubled* silk are passed through a smooth hole on to a large reel, which rewinds it into hanks, but twisting the threads into a fine cord as it goes from the bobbins to the reel. This operation of *throwing* derives its name from the Saxon *thrawan*, to whirl or twist. After this, the hanks have to be again wound on reels and bobbins for the weaver, the former for the warp, and the latter for the weft. For many purposes, only some of these operations are required. Thus for common and light fabrics, such as *Persian*, *gauze*, &c., only the two first are needed—viz., the *winding* and *cleaning*, and the material is called *dumb-singles*. If it has been *wound*, *cleaned*, and *thrown*, it is called *thrown-singles*, and is used for weaving common broad stuffs, or plain silks and ribbons. If *wound*, *cleaned*, *doubled*, and *thrown*, it is called *tram*, and is used for the richer silks and velvets, but only for the weft or shoot; and if *wound*, *cleaned*, *spun*, *doubled*, and *thrown*, it is called *organzine*, and is used for the warps of fine fabrics.

Before winding the cocoons, a flossy portion has to be removed; and after all has been wound off, another portion remains, like a compact bag; these are collected and sold under the name of *waste-silk*, and to these are added the fragments of broken threads, which accumulate in considerable quantities during the reeling and throwing operations. Formerly, very little use was made of waste-silk; not a little of it was employed by engineers and others for mere cleaning purposes; although, as early as 1671, a proposition was made by a manufacturer named Edmond Blood to make it available by carding it with teasels or rowing-cards. He took out a patent for this invention, but apparently did not bring it into use. Another patent was taken out by Mr. Lister of Bradford, which has done wonders; now the waste is all spun into yarn, thereby greatly economizing the use of silk, as the quantity of silk-waste always greatly exceeds the amount of good silk reeled off. The processes employed in the production of silk-yarn from the waste differ little from those for spinning other materials. See SPINNING.

The silk-manufactures of Britain are chiefly located in Spitalfields, London, at Macclesfield and Congleton in Cheshire, at Derby, and in Glasgow. The dyeing of silk is done chiefly in the neighborhood of London, at Nottingham, and at Manchester; and considerable quantities of silk goods are sent from India to be printed with patterns in London and other parts of England. These goods are chiefly the corah and bandana pocket-handkerchiefs, and Indian waist and turban scarfs.

SILK-COTTON. Under this name, various silky fibres are from time to time brought from tropical countries to Europe; they are all of the same general character, and are produced by the trees composing the genus *Bombax*, and other genera recently separated from *Bombax*, of the natural order *Sterculiaceæ*, known as silk-cotton trees. These trees are natives of the tropical parts of Asia, Africa, and America. The fibre fills their large woody capsules, enveloping the seeds, and is produced in great abundance; but is too short, too smooth, and too elastic to be spun by the machinery used for cotton; although attempts have been successfully made on a small scale in India to spin and weave it; and that of *Bombax villosum*, which is of a beautiful purple color, is woven into cloth and made into articles of dress in New Spain. Silk-cotton is much used for stuffing pillows, mattresses, and sofas. Sir James Emerson Tennent says it 'makes the most luxurious stuffing for them. It has the fault, however, of being easily broken and reduced to powder, but might probably be very useful in the manufacture of gun-cotton and collodion. The silk-cotton of the East Indies is imported into Britain under the name of *Moc-main*. —*Bombax ceiba*, the common silk-cotton tree of the West Indies and South America, attains a very great size, its trunk sometimes being so thick that it could not be encompassed by the outstretched arms of sixteen men, and canoes are hollowed out of it of an average burden of twenty-five tons. The wood is soft and spongy, but is used for many purposes, and when cut into planks, and saturated with lime-water, it bears exposure to the weather for many years.—*Bombax, Malabaricum*, or *Salmalia Malabarica*, is the common Silk-cotton Tree of the East Indies. It is a tall tree, covered with formidable thorns. Although it is a tropical tree, its leaves fall annually; and just before the fresh leaves appear, it is covered with crimson tulip-like flowers, so abundant, that when they fall, the ground for many roods on all sides is a carpet of scarlet.

The fibre of the capsules of *Chorisia speciosa* and *C. Pecholtiana* trees nearly allied to the genus *Bombax*, and natives of Brazil, is known as VEGETABLE SILK. It has a beautiful satiny lustre, and is very light, but no mode of spinning and weaving it has yet been invented.

SI'LKWORM GUT, a material used by anglers for dressing the hook-end of the fishing-line. It is prepared from the silkworm at the period when it is just about to spin, and the sericteria or silk vessels are distended with the secretion. The worms are immersed for twelve or fourteen hours in strong vinegar, and then taken separately, and pulled in two very gently. The skilled operator knows at sight if the soaking in vinegar has been sufficient, and if so, he lays hold of one end of the viscid secretion, which is seen in the silk glands, and attaches it to the edge of a board; the other end he stretches to the other edge of the board, and attaches it with a pin. When a number are drawn across the board, it is set in the sun for the threads to dry, when they are tied into bundles for use. They are chiefly produced in Italy and Spain.

SILL, the horizontal wood or stone base along the bottom of a window or door; also the wooden plate along the bottom of a partition.

SILLIMAN, BENJAMIN, American physicist, was born at North Strafford (now Trumbull), Connecticut, U. S., August 8, 1779. His father was a distinguished lawyer, and a brigadier-general in the War of Independence. He was educated at Yale College, New Haven, in which he was appointed a tutor in 1799, and was admitted to the bar in 1802, but soon after received from the college the appointment of Professor of Chemistry; which he accepted only on condition of visiting some of the seats of learning in Europe, to observe the progress of the science. His tour in Europe, 1805—1806, was one of the first of which an account was published in the United States. Uniting mineralogy and geology to chemistry, he made a geological survey of Connecticut, observed the fall of a meteorite; constructed, with the aid of Professor Hare, a compound blowpipe, and repeated the experiments

of Sir Humphry Davy. In 1822, he first established the fact of the transfer of particles of carbon from the positive to the negative electrode of the voltaic apparatus. In 1818, he founded the *American Journal of Sciences and Arts*, better known as *Silliman's Journal*, of which he was for twenty years the sole, and for eight more the principal editor. Besides his labors as professor and editor, he began in America the since widely-extended work of popular scientific education, by giving public lectures on his favorite sciences in all the chief cities. In 1830, he published a text-book on Chemistry, and soon afterwards edited an edition of *Bakewell's Geology*. An account of his last visit to Europe was published in 1851, and reached six editions. His last course of lectures was given in 1855, when his son, BENJAMIN SILLIMAN, jun., who had been his associate, became his successor. He died in November 1864.

SI'LLOTH, a town and watering place of England, of quite recent origin, in the county of Cumberland, at the terminus of a branch of the North British Railway, 20 miles west-north-west of Carlisle, is picturesquely situated on the Solway. The port is of growing importance, and possesses a good stone dock, with an area of five acres, having a fine jetty, 1000 feet long, projecting into the sea. S. is much resorted to for sea-bathing, the climate being mild and salubrious, and considered highly favorable for those affected with pulmonary complaints. The mean annual temperature is 49°, being the same as that of Worthing (q. v.) on the south coast of England, and only 1° below that of Torquay. According to the Registrar-general's returns, the mean average death-rate in S. for ten years is only 10·2 per 1000. S. is of easy access from all parts of England by railway, and steamers ply at stated intervals to and from Liverpool, Dublin, Belfast, and the Isle of Man.

SILU'RIAN ROCKS, a large division of the Palæozoic rocks between the Old Red Sandstone and the Cambrian strata. They comprise the greater portion of the rocks called by Werner 'transition,' because, as he thought, in their structure they exhibited an intermediate character between Lehman's 'primary' or metamorphic rocks, and the 'Secondary' or fossiliferous deposits. But the fossils peculiar to these beds having been found in rocks without the transition structure, the name has long ago fallen into disuse. The term 'grauwacke' or 'graywacke,' a miners' term, was also introduced from the Germans, and for some time employed to designate these rocks, because of the abundance in them of a compact argillaceous sandstone; but this awkward name has also given place to Silurian, a term introduced by Sir R. I. Murchison when he first established the system, and derived from the district where he investigated the strata; South Wales having of old been occupied by the Silures (apparently a non-Celtic, Euskarian tribe).

The Silurian system contains an enormous thickness of rocks, nearly 30,000 feet, according to some estimates, the absolute thickness being greatly increased by immense beds of interstratified igneous rocks. The upper limit, underlying the Old Red Sandstone, is universally accepted, but there has been considerable diversity of opinion in regard to the inferior boundary. Professor Sedgwick, having described the rocks of North Wales, which at first were considered to be older than the series which Murchison had illustrated, designated them Cambrian. This name has been retained for the immense mass of indurated shales and sandstones of a thickness nearly equal to that of the Silurians, which contain only faint traces of organic life, and underlie the Llandeilo formation. But Sedgwick claims also the Lower Silurian rocks as a portion of his system; the priority of name, and the uniform facies of the organic remains of the whole of the Silurian rocks, have, however, induced geologists to consider the limits as originally given by Murchison as those of the system.

The subdivisions of the rocks of the period are the following:

UPPER SILURIAN ROCKS.

	Thickness in Feet.
Upper Ludlow—	
1. Downton Sandstone and Tilestones	80 to 1000
2. Upper Ludlow Shale	800
Lower Ludlow—	
3. Aymestry Limestone	150
4. Lower Ludlow Shale	900
Upper Wenlock—	
5. Wenlock Limestone	300
Lower Wenlock—	
6. Wenlock Shale	1400
7. Woolhope Limestone and Denbighshire Grit	150

MIDDLE SILURIAN ROCKS.

Upper Llandovery—	
8. Tarannon Shale	1000
9. May-hill Sandstone and Pentamerus Limestone	800
Lower Llandovery—	
10. Llandovery Slates	1000

LOWER SILURIAN ROCKS.

Caradoc—	
11. Caradoc Sandstone	12,000
12. Bala Limestone	
Llandeilo—	
13. Upper Llandeilo	1500
14. Lower Llandeilo or Arenig Beds	
Contemporaneous Volcanic Rocks	5800

The typical Silurian strata are in Wales, and the adjoining English county, Shropshire. With the exception of the southern and south-eastern districts, where the Old Red Sandstone and Coal Measures occur, the whole of Wales is composed of Silurian and Cambrian rocks. The same deposits are found in Cumberland and the north of Lancashire. The whole of Scotland south of a line drawn from Dunbar on the east to Girvan on the west, consists of graywacke rocks, slates, and limestones of Silurian age, with the exception of one or two small patches of Old Red, Carboniferous, and Permian strata. The rocks, till recently referred to an azoic group, below the lowest fossiliferous strata in the north of Scotland, are now generally believed to be highly altered beds of this period. The southern boundary of these beds is a line drawn from Stonehaven to Helensburg. A huge trough, filled up with Old Red Sandstone and Carboniferous strata, separates the highly altered strata of the north from the less altered deposits of the south. An extensive region of Silurian rocks occurs in the south-eastern counties of Ireland and in Galway; and a great track of the same beds extends from the center of Ireland (Cavan, &c.) to the coast of Down. The metamorphic rocks of the north-west are most probably also of the same age as the corresponding strata in the north of Scotland.

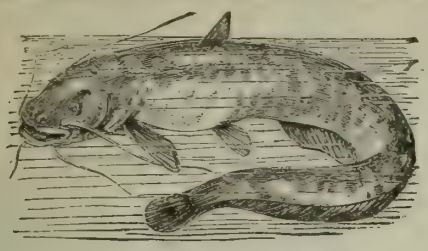
On the continent, Silurian strata have been examined and correlated with the British types, in Bohemia, by M. Barrande; in Scandinavia, by M. Angelin; and in Russia, by Murchison and others. In North America, also, extensive regions are covered with these strata. They have been wrought out and their fossils described by the Canadian and United States surveyors. Similar strata have also been detected in India, Australia, and South America.

The life of the period presents a group of very characteristic organisms, which, with the exception of the fish-remains found in the upper beds, all belong to the invertebrata. Many of them are confined to the Silurian rocks, or occur only very rarely in some of the Palæozoic formations. The Graptolites are a strictly Silurian family of Zoophytes, and most of the forms of Trilobites are found only in this period, though some members of the tribe are found in rocks of Devonian and Carboniferous age. Besides these, may also be specified such forms as Heliolites and Favosites among the Corals; Actinocrinites and the Cystidians among the Echinoderms; Orthis and Lingula among the Brachiopods; and Lituites and Maclurea among the Cephalopods.

In all the immense thickness of Silurian rocks, no deposit has been discovered containing organisms that have lived on land. Some fragments have been noticed that have a faint resemblance to the branches of Lepidodendron, and minute bodies occur in the bone-bed, which are referred to the spores of a terrestrial cryptogam. The only other indications of plants are impressions believed to have been produced by sea-weeds. The anthracitic shales of Wales and Scotland probably derived their anthracite from the algæ that must have abounded in the Silurian seas. In Shropshire, a number of shells have been found, whose nearest allies are littoral species, and these appear to indicate the existence there of an ancient shore. The Silurian rocks are, however, generally sea-deposits, and Forbes has ingeniously shown, from the small size of the conchiferæ, the paucity of spiral univalves, the great number of floating shells and of the pelagic Orthidæ, and the great rarity, or absence, except in the upper beds, of fossil fish, that it is most probable they were deposited in a sea more than 70 fathoms deep.

SILU'RIDÆ, a family of malacopterous fishes, divided into many genera, and including a great number of species, mostly inhabitants of the lakes and rivers of warm countries. The S. exhibit great diversity of form. Their skin is generally naked, but some have a row of bony plates along the lateral line, and a few are completely mailed with bony plates. The dorsal fin is single in some; others have two dorsal fins, the second being sometimes adipose, as in the salmon family. The dorsal fin is sometimes armed with a strong spinous ray, and in most of the family the first ray of the pectoral fins is very strong and serrated, so as to be capable of inflicting a severe wound, and by this these fishes are protected from alligators and other enemies. All have the mouth furnished with barbels, more or less numerous; the two principal barbels being on the upper lip, and formed by elongation of the intermaxillary bones. The barbels are believed to be organs of touch, probably of use in directing the fish to its prey. The bones of the head and other parts of the skeleton exhibit many peculiarities, into which we cannot enter. The S. are gen-

erally inhabitants of muddy rivers, lurking amongst the mud. The only European species is the SLY SILURUS, SHEAT-FISH, or SHADEN (*Silurus glanis*), the largest of European fresh-water fishes, and sometimes found in the sea near the mouths of rivers. It does not inhabit any of the rivers of Britain; its introduction has, however, recently been attempted. Neither is it found in France, Spain, or Italy, but it is plentiful in the Danube, the Elbe, and their larger tributaries, also in the rivers which fall into the Caspian Sea; and it is found in some of the rivers of North



Sly Silurus (*Silurus glanis*).

America. It attains a length of six or even eight feet, and a weight of 300 or 400 pounds. The flesh is white and fat, but soft, luscious, and not very easily digestible. In the northern countries of Europe, it is preserved by drying, and the fat is used as lard. The habits of the fish are sluggish; it seems rather to lie in wait for its prey than to go in quest of it.—Several species of this family are found in the Nile, among which is the HARMOUTH or KARMOOT (*Clarias anguillaris*), a fish in its general form and appearance much resembling that just described. It was anciently an object of superstitious regard in the Thebaïd.

SI'LVAS, or SELVAS (Span. *selva*, a forest), the name given to the western portion of the great plain of the Amazon, in the north-west of Brazil. The Silvas, which are about one-third of the whole plain, contain more than 700,000 English sq. m., and consist of low land on a dead level, densely covered with primeval forests, and annually inundated by the overflow of the mighty river or its tributaries. The forests are rendered wholly impenetrable from the denseness of the underwood, matted together as it is by creeping and climbing plants, which form myriads of festoons glowing with nature's brightest tints. The vegetation of the Silvas, under the stimulating action of the abundant irrigation, the intense tropical heat, and the inconceivable richness of the alluvium which constitutes the soil, shows an exuberance of growth far surpassing that of any other portion of the earth's surface, and from its very luxuriance, presents a bar to civilization no less effectual than do the barren deserts of Africa or the gloomy wastes of Central Asia. The few Europeans who have penetrated into this region have sailed up the Amazon and some of its tributaries, and from them we have received the little knowledge that we do possess of this immense tract of wild forest. It is the haunt of innumerable wild animals, especially monkeys and serpents, and of a few aboriginal inhabitants, who are sunk in the lowest stage of barbarism.

SILVER (symb. Ag, equiv. 108. sp. gr. 10·53) is a metal which, in its compact state, is of a brilliant white color, possesses the metallic lustre to a remarkable degree, is capable of being highly polished, and evolves a clear ringing sound when struck. It is harder than gold, but softer than copper, and is one of the most ductile of the metals. It is malleable, may be hammered into very thin leaves, and may be drawn out into very fine wire, the thinnest silver-leaf having a thickness of only $\frac{1}{100000}$th of an inch, and one grain of the metal being capable of yielding 400 feet of wire. It possesses a high degree of tenacity, a wire with a diameter of $\frac{1}{12}$th of an inch being able to support a weight of nearly 188 pounds. It requires a heat of 1873° Fahr. to fuse it, and on cooling, expands at the moment of solidification. It is an excellent conductor of heat and electricity, and is not affected by exposure even to a moist atmosphere at any temperature. When, however, it is fused, it absorbs a considerable quantity of oxygen, which it expels in the act of solidification with a peculiar sound, technically known as *spitting*.* But although it does not rust or become oxidized, it usually becomes tarnished on prolonged exposure to the air, owing to the formation of a film of sulphide (or sulphuret) of silver, and this change occurs more rapidly in towns than in the country, in consequence of sulphuretted hydrogen being more abundant in the atmosphere of the former than of the latter. This metal is unaffected by the hydrates or nitrates of the alkalies, even at a high temperature, and hence silver crucibles, &c. are highly useful in many laboratory operations.

Hydrochloric and dilute sulphuric acid have scarcely any action on silver, but nitric acid and boiling sulphuric acid oxidize it, and form salts; nitric acid being by far its best solvent. Silver has strong affinities for chlorine, bromine, iodine, and sulphur, and combines with the first three and sulphuretted hydrogen at ordinary temperatures. It is well known that common salt, especially in the melted state, when left for any time in contact with silver, corrodes that metal, soda being formed from the oxygen of the air, while the liberated chlorine attacks the silver.

Silver is frequently met with in the native state, crystallized in cubes or octahedrons, or occurring in fibrous masses. It is also found in combination with gold, mercury, lead, antimony, arsenic, sulphur, &c., and sulphide of lead is almost always accompanied with a greater or less amount of sulphide of silver; it is, however, never found as an oxide.

Silver forms three compounds with oxygen—viz., a suboxide, Ag_2O; an oxide, AgO; and a peroxide, AgO_2. All these oxides possess the common properties of being reduced by heat to the metallic state, and of being very readily decomposed by the action of light. The oxide, AgO, is the only one of these compounds requiring special notice. It is a dark-brown heavy powder, devoid of taste or smell, somewhat soluble in water, to which it communicates a metallic taste and an alkaline reaction. It acts as a powerful base, neutralizing the strongest acids, and forming normal salts with them. It is obtained by the addition of a solution of potash to a solution of the nitrate or any other soluble salt of silver, falling as a hydrated oxide, which, at a temperature above 140°, becomes anhydrous. If a concentrated solution of ammonia be digested for some hours upon freshly precipitated oxide of silver, Fulminate of Silver (q. v.), or Fulminating Silver in the form of a black powder is produced, and the same dangerous compound is formed when an ammoniacal solution of nitrate or chloride of silver is precipitated by potash.

The salts which the oxide of silver forms with acids are characterized by the readiness with which they decompose, the mere action of light blackening and partially reducing them. None of these salts occur in nature. The following are the most important of those which have been formed artificially.

Nitrate of Silver (AgO,NO_5) crystallizes, in large colorless, transparent square tablets, which blacken on exposure to light, or in contact with organic matters, owing to reduction, and dissolve in their own weight of cold water. This property of producing a permanent black color with organic matters has led to its employment as a *marking ink** for linen, &c. The black stains which it forms on the skin, on linen, &c., may be removed by the employment of a strong solution of iodide of potassium, or more readily by a solution of cyanide of potassium. The crystals fuse at a temperature of about 425°, and the molten mass, when cast into cylindrical moulds, solidifies, and forms the sticks of *lunar caustic* which are employed in surgery, medicine and Photography (q. v.). Nitrate of silver is prepared by dissolving pure silver in moderately strong nitric acid, and evaporating till the solution is sufficiently concentrated to crystallize. 'The most characteristic test for the salts of silver is the action of hydrochloric acid, or of a soluble chloride, which produces a white curdy precipitate of chloride of silver, insoluble in nitric acid, but readily soluble in ammonia; it is also soluble in hyposulphite of soda, with which it forms an intensely sweet solution; cyanide of potassium also dissolves it; the chloride of silver speedily assumes a violet tinge when exposed to light.'—Miller's *Elements of Chemistry*, 2d ed., vol. ii. p. 732.

Of the haloid salts of silver, several occur native. The most important of these compounds is *chloride of silver* (AgCl), which is found native either in cubes or in a dense semi-transparent mass, and is known as *horn silver* and may be procured as a dense white flocculent precipitate by the procedure described in the preceding paragraph. In consequence of its sensibility to light, it is employed in photography. When heated to about 500°, it fuses into a yellow fluid, which, on cooling, solidifies into a yellowish gray semi-transparent horny mass. This salt is insoluble in water and in all the diluted acids, but dissolves in a solution of ammonia from which it crystallizes in octahedra. Its solution in a solution of hyposulphite of soda is employed in silvering iron, copper, and brass goods. Traces of this salt are found in seawater, the chloride of sodium probably acting as the solvent. *Bromide of silver* (AgBr) is found in Mexico, where it is known as *Plata verte*, or green silver, in the form of small crystals or crystalline, granules of a pale olive-green tint. *Iodide of silver* (AgI) occurs native in several Mexican mines in the form of thin, flexible, pearly scales.

Sulphide (or *sulphuret*) *of silver* (AgS) is the principal ore of silver. It occurs native, sometimes crystallized in cubes or octahedra, and sometimes in masses. From its gray metallic lustre, it has received from mineralogists the name of *silver glance*. It is

* Although ordinary air has no oxidizing action on silver, ozonized air rapidly attacks it.

* Brande gives the following directions for preparing marking ink: Dissolve two drachms of nitrate of silver and one drachm of gum-arabic in seven drachms of water, and color the liquid with Indian ink. The cloth must be first prepared by moistening the spot with a few drops of a soda solution, prepared by dissolving two ounces of crystallized carbonate of soda and two drachms of gum in four ounces of water. Professor Miller recommends, as a cheap indelible marking ink, a solution of coal tar in naphtha; it resists the action of chlorine, and is used by bleachers to mark their goods.

well known that if silver spoons are allowed to remain in contact with boiled eggs for some time, they become tarnished by the action of the sulphur; a minute quantity of sulphuretted hydrogen being probably evolved. The discoloration is easily removed by washing the darkened silver with a solution of cyanide of potassium. Sulphide of silver unites with various other metallic sulphides when fused with them, especially with the sulphides of arsenic and antimony. *Red silver ore* ($3AgS,SbS_3$) is a native compound of this kind.

The alloys of silver and copper (see ALLOY and MINT), when cast into ingots, are usually found to differ in their composition in the internal and external parts, in consequence of a molecular change that takes place during the cooling and slow solidification of the molten mass. In bars containing more than 719 parts of silver in 1000, the central portions are richer in silver than the exterior; in alloys of less value, the reverse is observed, while in ingots containing 950 or more parts of silver in 1000, the composition is nearly uniform throughout. When exactly 719 parts of silver and 281 of copper are combined (corresponding to the formula Ag_2Cu_1), no separation whatever of the metals occurs. Many metals, as tin, zinc, antimony, bismuth, arsenic, &c., when mixed with silver, render it brittle and unfit for its ordinary uses; they are, however, easily removed in the process of refining. An alloy consisting of five parts of silver, six of brass, and two of zinc, is used as a solder for silver. An alloy of silver and mercury, known as *silver amalgam*, occurs native in a crystallized form. It is a mineral of a silvery white color, and its composition is represented by the formula $AgHg_2$.

Silver, like gold, has been known and prized from the earliest ages. The silver mines of Mexico were, until quite recently, by far the richest known to exist. Their estimated annual yield is about 1,600,000 lbs. troy of the pure metal. Until the remarkable discoveries of silver ore in Nevada and adjoining states in 1859 and 1860, Chili and Peru had long stood next to Mexico in their yield, each furnishing about one-sixth of the produce of that country. Bolivia is also rich in silver; but the recent extraordinary development of silver mining in the western regions of the United States, appears to have raised their produce to at least a par with that of Mexico, so that these two countries now furnish three-fourths of all the silver obtained in the world.

Of European countries, Spain is the most productive, the richest mines being those of Hiendelaencina, in the province of Guadalaxara, which were first extensively opened in 1846. These have yielded immense wealth, but their produce has much declined since 1858. Silver glance is the principal ore, although several others are found, including quantities of the formerly rare mineral freieslebenite, which contains about 23 per cent. of silver. Next to Spain, Austria, Saxony, and the Harz district in Northern Germany, yield the largest supplies. The silver mines of Kongsberg in Norway are likewise valuable, and have been long famous. Great Britain has no silver mines, properly so called, but since the introduction in 1829 of Pattinson's process for the desilverizing of lead smelted from argentiferous galena, a large quantity has been annually produced in this way. The highest yield of silver by this process was in 1868, and amounted to 841,328 ounces, but owing to the gradual decline since then in the produce of British lead, the silver obtained from it had fallen in 1880 to 295,518 ounces (see LEAD).—In the mineral veins of Cornwall, some 'bunches' of true silver ores have occasionaly been found, but of limited extent.

The forms in which silver is found in nature are numerous, but we need only notice a few of them. It is frequently found native in crystallized and amorphous masses, which are sometimes of considerable size. One fine piece found at Kongsberg is now in the Copenhagen Museum, and weighs 500 lbs. But the quantity of silver found in nature in the metallic state is comparatively small. Its principal ores are the different sulphides or sulphurets —viz., silver glance, or sulphuret of silver, containing when pure 87 parts of silver and 13 of sulphur; brittle silver ore, or sulphuret of silver and antimony, of which the composition is, silver 68·5, antimony 14·7, and sulphur 16·4; and red silver ore, called also ruby silver, of which there is a dark and a light kind, the composition of the former being similar to brittle silver ore, but it is a little less rich in silver, and the latter only differs in containing arsenic instead of antimony. The bulk of the silver obtained in Mexico and South America is got from these ores. The only other of much importance, except the mixed ores to be presently noticed, is horn silver, or chloride of silver. In a pure state, it consists of silver 75, and chlorine 25. It occurs extensively in Mexico and Peru, but is not common in European mines.

Besides the ores named above, a good deal of the silver of commerce is obtained from mixed ores, that is, the ores of other metals are frequently found to contain it. In many cases, the amount of silver falls greatly short of 1 per cent. These ores are for the most part sulphurets of lead, arsenic, copper, zinc, and iron.

In the reduction of silver ores, the processes followed are based upon the fact, that both lead and mercury have a strong affinity for silver. A more recent process depends upon the solubility of chloride of silver in a hot solution of common salt, and its separation again on cooling.

The simplest process is ordinary smelting, and is only applied to the richest ores. These are crushed, mixed with old slag, lead in some form, and a little iron ore and lime. The mixture is then heated in a furnace with charcoal, which brings down the silver

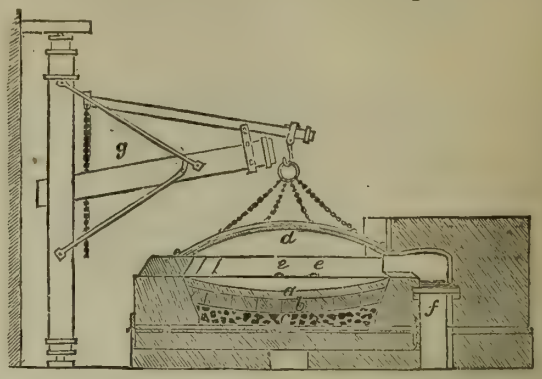


Fig. 1.—Silver Cupellation Furnace.
a, sole formed of wood ashes; *b*, bricks; *c*, bed of slag; *d*, dome of iron plate; *ee*, tuyères for bellows; *f*, fireplace; *g*, crane for lifting dome.

and lead together as an alloy. The silver is afterwards easily separated by cupellation, the principle of which is described in the article ASSAY; but on the large scale, instead of a small bone ash cupel, a cupellation furnace, say 6 feet in diameter, is used, of which fig. 1 is a section. Here the alloy is melted, bellows are used to remove the lead as litharge, or oxide of lead, and a cake of silver is left on the cupel forming the bottom of the furnace.

It happens that not many even of the richer ores are pure enough to be treated with advantage by simply roasting them with lead; accordingly, another plan, called the amalgamation process, is more commonly adopted. The following is an outline of the way in which this is practised at Freiberg in Saxony. The vein

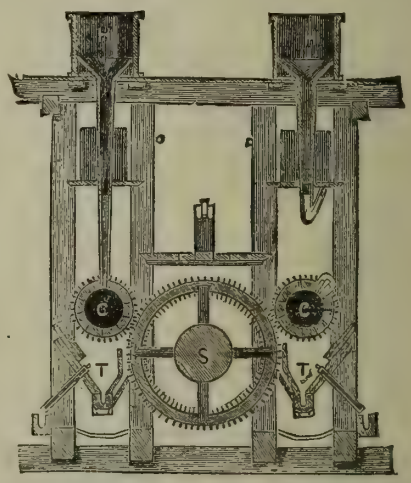


Fig. 2.—Vertical Section of Amalgamating Apparatus.
CC, oak barrels; S, toothed wheel for setting barrels in motion; H, hoppers with hose for passing the mixed ore into the barrels; TT, troughs for the reception of the charge when the amalgamation is complete.

stuff (largely silica) containing a mixed ore of lead, copper, zinc, &c. as sulphurets, and only from 3 to 3½ oz. of silver per cwt., is ground to powder, as described under METALLURGY; but some sulphuret of iron is also present, or must be added. About 10 per cent. of common salt is then mixed with the ore, and the mixture heated in a Reverberatory Furnace (q. v.) to a temperature sufficient to expel water, and in part arsenic, zinc, and antimony. After two hours, the sulphur of the sulphurets takes fire, and is burned off as sulphurous acid, or converted into sulphuric acid, so that the metals become oxides and sulphates. The temperature of the furnace is now raised, when the chlorine of the common salt forms volatile chlorides with zinc, antimony, and iron, and a fixed chloride with silver. During the roasting, the contents of the furnace are continually stirred, so that they ultimately form a coarse powder.

The product of the roasting furnace, after being ground to a fine powder, is mixed in the proportion of 10 cwt. with 3 cwt. of water and 1 cwt. of iron in fragments; the mixture being effected

in oak casks, which are then made to revolve for two hours on their axes. See figs. 2 and 3. During the operation the iron decomposes the metallic chlorides in the roasted ore, forming chloride of iron, while the copper is partly reduced to sub-chloride and partly to metallic copper. If there is not enough iron

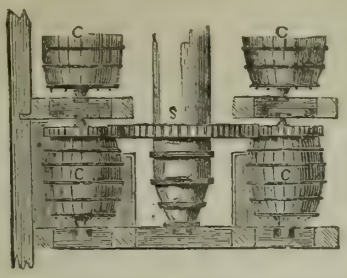


Fig. 3.—Plan of Part of Amalgamating Apparatus.

present to convert the copper into sub-chloride, then mercury will be wasted in the next stage by conversion into its sub-chloride. Quicksilver to the amount of 5 cwt. is next run into each of the casks, which are then set in motion, and continue for 22 hours at the rate of 12 revolutions per minute. The result of this is, that the silver being precipitated by the presence of metallic copper, is then dissolved by the mercury, but the amalgam so formed is usually a complex one.

In order to separate the amalgam from the earthy matters and the sulphates and chlorides, the barrels, which were hitherto only two-thirds full, are now filled with water (the dilution throwing down any chloride of silver held in solution by the sea-salt), and kept revolving for two hours; after which, by means of a stop-cock, the amalgam is allowed to flow into the amalgam chamber, and the rest of the contents, except the iron fragments, into a washtun.

The superfluous quicksilver has next to be separated from the amalgam. This is done in bags of ticking through which the mercury at first flows readily by its own weight, and is afterwards squeezed out on a flat surface. The result of this operation is, that the amalgam of mercury, silver, copper, &c., is left in the bags: its actual composition being nearly 85 per cent. of mer-

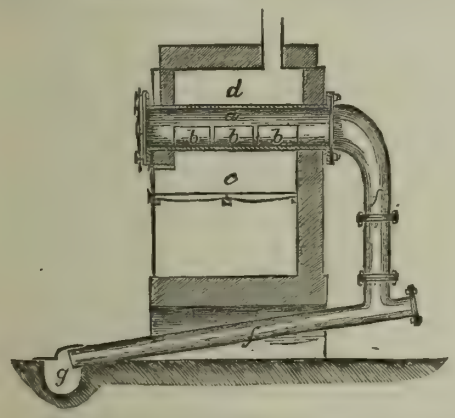


Fig. 4.—Furnace for Distilling the Amalgam.
a, iron retort; *b*, iron pots; *c*, fireplace; *d*, flue; *f*, condensing pipe; *g*, trough for collecting mercury.

cury, 10 per cent. of silver, and 5 of copper, lead, and antimony. Finally, the quicksilver of the amalgam itself is separated by heat in the distilling furnace, fig. 4. Here the amalgam is put into a row of iron pots, which go into a large retort. When heat is applied, the quicksilver volatilizes, and is condensed in a pipe attached to the retort, from which it is collected in a trough. The impure silver left in the retort is refined by fusion and subsequent cupellation.

There is another process carried on at Freiberg and elsewhere, by which the use of mercury is dispensed with. It consists in treating the ore as above described till it leaves the roasting furnace. At this stage, the roasted ore is digested in a warm concentrated solution of sea-salt, which readily dissolves the chloride of silver. The solution is then passed through wooden tubs containing metallic copper, which has the property of decomposing the chloride of silver: the chlorine unites with the copper to form chloride of copper, and the silver is precipitated.

[This process is now for the most part abandoned, and at Freiberg an argentiferous copper matt obtained in smelting mixed ores is treated with sulphuric acid, by which sulphate of copper is formed, and the silver recovered from the residue.]

In Mexico, where indeed the process was first introduced, the extraction of the silver from its ores is chiefly accomplished by amalgamation, but the plan employed differs a good deal in its details from the Saxon method described above. Of late years, the sodium-amalgam process of Mr. Crookes has been used with advantage for the extraction of silver in several American mining districts (see SODIUM-AMALGAM).

It has now become a common practice at Swansea, where the great British copper-smelting works are situated, to extract the silver which exists in an appreciable, though small quantity, in many copper ores. By one process, copper smelted from an argentiferous ore is melted with three or four times its weight of lead, and cast into ingots. When these are moderately heated, the copper does not fuse, but the lead and silver melt, and run off together, and the silver is then separated by cupellation. From the burnt pyrites of vitriol works, so recently a waste product, not only is the iron and copper, but the silver, which exists in exceedingly small proportion, is now recovered by the use of iodide of potassium.

The physical and chemical properties of silver are such as make it specially valuable for many purposes in the arts; the chief of which are noticed in the articles ALLOY, MINT, PLATING, GALVANISM, and PHOTOGRAPHY. Ordinary mirrors have their *silvering* produced by a coating of an amalgam of tin and mercury; but for some years, mirrors coated by a patent process with real silver, and backed by a layer of some composition, which protects it from the blackening action of sulphuretted hydrogen, have been made in great numbers.

MEDICINAL USES OF SILVER. *Nitrate of silver*, in small doses, constitutes an excellent tonic, and it appears to exert almost a specific influence over certain convulsive diseases. As a tonic, it is frequently prescribed in the early stages of phthisis, and in cases of irritability of the mucous membrane of the stomach; and epilepsy and chorea frequently yield to its influence, when many other remedies have been tried in vain. There is unfortunately one great drawback to its administration—viz., that when its use has been continued for some time, this salt communicates a permanent slate-like or bluish-gray hue to the skin. There is very little danger of this change of color occurring, if the medicine is not administered for a longer period than three months. In prescribing this salt, it is usual to begin with a small dose, about one-sixth of a grain, and gradually to increase it to two or three grains, three times a day. It is best administered in pills made with some vegetable extract. The surgical uses of nitrate of silver have been already noticed in the article on LUNAR CAUSTIC.

Oxide of silver is employed in the same cases as the nitrate. It is especially recommended in chronic affections of the stomach, and in menorrhagia. It may be given in the same doses as nitrate. *Chloride of silver* has been employed both in America and in Germany in the same cases as the nitrate, and in certain forms of syphilitic disease.

PRICE OF SILVER. The value of silver has recently undergone a remarkable depreciation, causing grave commercial inconvenience and loss, especially where silver is the standard, as in India. The average price for the ounce of standard silver in 1870 was 60¼d; in 1878 only 50$\frac{1}{16}$d. A chief cause of depreciation is the great recent production. The change in value has promoted the controversy on 'bimetallism;' and in 1879 the United States 'monetized' silver, or made it equally a legal tender with gold, though it was then 11 per cent. less valuable in the market.

SILVERING GLASS. See MIRROR.

SIMANCAS, a village of 900 inhabitants, 7 miles S.W. of Valladolid. S. is famous as the place where the national archives of Spain are kept. They were removed hither by Cardinal Ximenes.

SIMARUBA'CEÆ, a natural order of exogenous plants, consisting of trees and shrubs; with alternate, generally compound leaves, without stipules; regular, generally hermaphrodite flowers. The species are not numerous; they are found in the tropical parts of Asia, Africa, and America. The whole order is characterized by great bitterness, and several of the species are used as tonics in dysentery, &c. Quassia (q. v.) and Bitterwood (q. v.) belong to it.

SIMBI'RSK, a government of Russia, bounded on the E. by the Volga, and on the W. by the governments of Nijni-Novgorod and Penza. Area, 19,050 sq. m.; pop. (1880) 1,410,000. The surface is for the most part level, and the soil of remarkable fertility, and there are excellent and extensive meadows and pasture-grounds. The fisheries and the commerce on the Volga, and cattle-breeding, are important.

SIMBIRSK, a capital of the Russian government of the same name, on the right bank of the Volga, 220 miles south-east of Nijni-Novgorod. Leather, soap, and candles are manufactured, considerable trade is carried on by the Volga, and there is a famous annual fair. During the years 1864 and 1865, S. suffered severely from fires. Pop. (1880) 26,900.

SIMEON, Rev. Charles, an eminent evangelical preacher of the English Church, was born at Reading in Berkshire, September 24, 1758. Educated at Eton and Cambridge, he was ordained a priest in 1782. His first religious impressions occurred during his residence at the university, and produced a permanent change in his character. From being a somewhat vain and dressy young gentleman, he passed into an ardent and zealous preacher of the Cross, and this he remained during the fifty-four years of his public ministry. His career was not marked by many incidents. Appointed vicar of Trinity Church, Cambridge, in the year of his ordination, and vice-provost of his own college (King's) in 1790, he continued to hold these offices to the close of his life, November 13, 1836. As a preacher S. was distinguished for an impassioned evangelicalism in language, sentiment, and doctrine, that at first roused against him a bitter and protracted opposition. His earnestness, however, met with its due reward. Friends and followers sprung up; and in course of time S. became a center of evangelical influence, that began to spread itself over the whole church, and gave birth to its great missionary activity in recent years. S. may even be regarded as the founder of the 'Low-church' party, and on the whole, fairly represents their earnestness, dogmatism, mediocre intellect, and limited scholarship. For an account of S.'s life and labors, see *Memoirs of the Rev. Charles Simeon*, by the Rev. W. Carus (Lond. 1857). S.'s *Horæ Homileticæ* (21 vols., 1832) are very popular among sermon-readers and sermon-makers of evangelical tendencies.

SI'MEON STYLI'TÉS. See Pillar-saints.

SIMFERO'POL, a town of Russia, in the Crimea, capital of the government of Taurida, stands on the Salghir, 45 miles north-east of Sebastapol. The valley of the river is studded with charming villas, and the town is surrounded by gardens, and has a picturesque appearance. The older part comprises the old Tartar town of Ak-Metchet, or White Mosque—the new part, containing the government buildings, is very handsome. Fruits are largely grown in the vicinity, and exported. Pop. (1880) 52,800.

SI'MIA and SIMI'ADÆ. See Monkey.

SIMILAR FIGURES, in Geometry, are figures which exactly correspond in shape, but may or may not be of the same size. If the figures be rectilineal, then the criterion of similarity is that every pair of corresponding sides should have the same ratio to each other, and that each angle of the one figure should be equal to a corresponding angle of the other. If the figures be triangular, the proportionality of the sides carries with it the equality of the angles, and *vice versâ*, but only in this case. *Similar segments* of circles are those in which, and on whose bases, similar triangles can be inscribed; or, as it is otherwise expressed, those which contain equal angles—a satisfactory test that they are each the same part of their respective circles. *Similar solids* are those which are bounded by similar planes similarly situated to each other. All similar plane figures are to one another as the squares of any corresponding sides, and all similar solids are as the cubes of their corresponding sides. Thus, a circle which has 3 (3 : 1) times the diameter of another, has 9 ($3^2 : 1^2$) times its area, and a globe which has 3 (3 : 1) times the diameter of another has 27 ($3^3 : 1^3$) times the volume.

SI'MLA, a British sanatorium, in the north-west of India, about 170 miles in direct line north of Delhi. It consists of a number of houses irregularly scattered over a mountain-ridge, with a noble panorama expanding on all sides of it. European fruits and vegetables are successfully cultivated, and the climate is salubrious. The pop., which is very fluctuating, was given in 1871 at 7037.

SIMMS, William Gilmore, American author, was born at Charleston, South Carolina, April 17, 1806, of Irish extraction. He made verses at the age of seven; and during the war of 1812, celebrated in rhyme the exploits of the American army and navy. Left in charge of his grandmother at Charleston, he was placed with a druggist; but at 18 began the study of law; was admitted to the bar at 22; published *Early Lays* and *Lyrical and other Poems* (1827); and became (1828) editor of *The City Gazette*, and published *The Vision of Cortes, Cain, and other Poems* (1829), and *The Tri-Color*, a poetical glorification of the French revolution (1830). In 1832, his paper, opposing nullification, failed; and he lost his wife, father, and grandmother, and took refuge in New England, where, at Hingham, Massachusetts, he wrote his best poem, *Atalantis, a Story of the Sea* (1833); and the same year, *Martin Faber*, the story of a criminal. From this time, he poured out rather than wrote poems, novels, histories, and biographies in rapid succession, which may best be classed in groups. Of poems, he published *Southern Passages and Pictures* (1839); *Donna Anna* (1843); *Grouped Thoughts and Scattered Fancies* (1845); *Lays of the Palmetto*—ballads of Southern heroism in the war with Mexico (1848); *Poems Descriptive, Dramatic, and Legendary* (1854); *Areytos, or Songs and Ballads of the South* (1860). Of dramas—*Norman Maurin, or the Man of the People*; *Michael Bonham, or the Fall of the Alamo*; and a stage adaptation of *Timon of Athens*. Of prose romances of the imagination—*The Book of My Lady* (1833); *Carl Werner* (1838); *Confession, or the Blind Heart* (1842); *Castle Dismal* (1845); *The Wigwam and the Cabin*, two series (1845, 1846); *Marie de Bernière* (1853).

Of historical romances—*The Yemassee* (1835); *Pelayo* (1838); *Count Julien* (1845); *The Damsel of Darien* (1845); *The Lily and the Totem, or the Huguenots in Florida* (1845); *The Maroon and other Tales* (1855); *Vasconcelos* (1857); *Cassique of Kiawah* (1860). Of revolutionary stories—*The Partisan* (1835); *Mellichamp* (1851); *Katherine Walton* (1851); *The Scout* (1841); *The Kinsman, or the Black Riders of the Congaree* (1841); *Woodcraft* (1855); *The Foragers* (1855); *Eutaw* (1856); these five being stories of the war in the Carolinas. Of local tales—*Guy Rivers* (1834); *Richard Hurdis* (1838); *Border Beagles* (1840); *Beauchamps* (1842); *Helen Halsey* (1845); *The Golden Christmas* (1852); *Charlemont* (1856). His other works comprise a History of South Carolina; South Carolina in the Revolution; Lives of General Marion, Captain John Smith, Chevalier Bayard, General Greene; Civil War in the South; American Loyalists of the Revolution; Views and Reviews of American Literature; The Morals of Slavery, &c. Residing in South Carolina during the War of Secession, he sustained the Southern cause in a weekly newspaper, and had his house and library wrecked by Federal soldiers. Of his various and voluminous works, some are of high excellence. He died in 1870.

SIMO'DA (Lowland), a harbor of Japan, at the southern extremity of Cape Idzu, and about 80 miles from Yeddo, opened to foreign commerce by the Americans in 1854. In 1854, the town was nearly destroyed by an earthquake, while the harbor was so scoured out that hardly any holding-ground was left for ships on the granite bottom. The population was formerly estimated at 80,000, but is now reckoned at about 4000.

SIMON, Richard, a distinguished orientalist and critical scholar, was born at Dieppe, May 13, 1638. Having completed his studies, he entered the Congregation of the Oratory in 1659, but soon afterwards withdrew. He returned, however, in the latter part of 1662. For a time, he delivered lectures on Philosophy in the college of Juilly; but his studies eventually turned upon theology, oriental languages, and biblical criticism. At one time, he thought of entering the Jesuit order, but he remained in the Oratory; and it was while still a member of that congregation that he published his well-known work on the doctrine of the oriental church regarding the Eucharist, designed as a supplement to the celebrated *Defence of the Perpetuity of the Faith in the Blessed Eucharist*, by Arnauld and Nicole, but criticising that work very severely. This and other controversies to which his later writings gave rise, led to his again withdrawing from the Oratory in 1678. In that year he retired to Belleville, as cure; but in 1682, he resigned his parish, and lived in literary retirement, first at Dieppe, and afterwards in Paris. His health having given way, he returned once again to his native place Dieppe, where he died in April 1712. Few writers of his age played so prominent a part in the world of letters, and especially in its polemics. There is hardly a critical or theological scholar among his contemporaries with whom he did not break a lance—Spanheim, Le Clerc, Du Pin, Jurieu, and Jurieu's great antagonist, Bossuet. The principal work of S. is his *Histoire Critique du Vieux Testament* (Paris, 1678), in which he anticipates the most important conclusions of all the later rationalistic scholars of Germany, and also their method of investigation. For example, he conceives himself to have disproved the Mosaic authorship of the Pentateuch, and assigns its composition to the scribes of the time of Ezra.

Other writings of S.'s are *Histoire Critique du Texte du Nouveau Testament* (Rotterd. 1689); *Disquisitiones Criticæ de variis Bibliorum Editionibus* (1684); *De l'Inspiration des Livres Sacrés* (Rotterd. 1687); and *L'Histoire Critique des Principeaux Commentateurs du Nouveau Testament* (Rotterd. 1692), in which he assails the theology of the Fathers, and particularly that of Augustine, as a departure from the simple and less rigid doctrines of the primitive church. Among the fathers, his most esteemed authority was Chrysostom. Bossuet replied to this last work by his *Defense de la Tradition et des Saints Pères*. S. frequently published under assumed names—as his *Dissertation Critique* on Dupin's *Library of Ecclesiastical Writers*, under the name of Jean Reuchlin; a work, *Histoire Critique sur la Créance et des Coutumes des Nations du Levant*, under the anagram of Monis; and a *Histoire de l'Origine et du Progrès des Revenus Ecclésiastiques* under the name of Jerome Acosta. No collected edition of his works has ever appeared; in the natural progress of the science of criticism, the most famous of them have lost most of their prestige, and are displaced by recent, and often second-hand compilations upon the subjects, which, in the days of S., were comparatively new and unexplored; but still there is much to be learned even from such of his works as have been forgotten by ordinary students.

SIMO'NIDES, a celebrated Greek lyric poet, was born at Iulis, in the island of Ceos, in the year 556 B.C., and educated probably with a view to making music and poetry a profession. He left his native island on the invitation of Hipparchus, who, by means of great rewards, induced him to reside at Athens, where also lived at that time Anacreon and Lasus, the teacher of Pindar, although no intimacy seems to have sprung up between S. and his two rivals. It was probably after the expulsion of Hippias (510 B.C.) that he took up his residence in Thessaly, under the patronage of the Aleuads and Scopads, who appear to have treated him in a very niggardly fashion. Shortly before the invasion of Greece by the Persians, he returned to Athens, and employed his poetic powers in the composition of elegies, epigrams, dirges, &c., in connection with that momentous struggle, taking the prize, in regard to the battle of Marathon, out of the hands of his rival Æschylus. In the year 477 B.C., when S. was 80 years of age, he came off victor for the 56th time in a poetical contest at Athens. Shortly after this, he went to reside at the court of Hiero of Syracuse, where he died in 467 B.C., at the age of 90. S. appears to have scandalized his contemporaries by writing for hire; and Pindar, his great rival, accuses him, apparently not without good reason, of excessive avarice. His poetry is imbued with a comparatively high morality. He brought to perfection the elegy and epigram, and excelled in the dithyramb and triumphal ode; he seems also to have completed the Greek alphabet by the addition of the double letters and long vowels, and to have invented the art of artificial memory.. The characteristics of his poetry are sweetness, polish combined with simplicity, genuine pathos, and great power of expression, although in originality he is much inferior to his contemporary Pindar. The best edition of his fragments is that of Schneidewin, entitled *Simonidis Cei Carminum Reliquiæ* (Brunswick, 1835).

This S. must be carefully distinguished from the iambic poet SIMONIDES of Amorgos, who flourished about 100 years previous to S. of Ceos.

SIMONOSE'KI, a town of Japan, in 33° 56′ N. lat., and 131° E. long., at the south-west extremity of the island of Nipon, and at the entrance of the inland sea Suonada. It is surrounded by hills, and consists of one main street, containing about 20,000 inhabitants. The warehouses—the principal buildings—are built of mud and wood, coated with cement, and are said to be fireproof. S. is a depôt for receiving the European Imports from Nagasaki, to be sent into the interior of the country; also for the produce from Osaca, which is reshipped to Nagasaki and other places.

SI'MONY, in English Law, is the corrupt presentation of any one to an ecclesiastical benefice for gift-money or reward, and is so called from its resemblance to the sin of Simon Magus. In the canon law, it was considered a heinous crime, and a kind of heresy. As the canonical punishment, however, was not deemed sufficient, a statute was passed in the time of Elizabeth, defining its punishment. A simoniacal presentation was declared to be utterly void, and the person giving or taking the gift or reward forfeited double the value of one year's profit; and the person accepting the benefice was disabled from ever holding the same benefice. Presentation bonds, however, taken by a patron from a presentee to resign the benefice at a future period in favor of some one to be named by the patron, are not illegal, provided the nominee is either by blood or marriage an uncle, son, grandson, brother, nephew, or grandnephew of the patron, and provided the bond is registered for public inspection in the diocese. The result of the statutes is that it is not simony for a layman or spiritual person, not purchasing for himself, to purchase while the church is full, either an advowson or next presentation, however immediate may be the prospect of a vacancy, unless that vacancy is to be occasioned by some agreement or arrangement between the parties. Nor is it simony for a spiritual person to purchase for himself an advowson, although under similar circumstances. It is, however, simony for any person to purchase the next presentation while the church is vacant; and it is simony for a spiritual person to purchase for himself the next presentation, although the church be full.

SIMOO'M (otherwise written Simoun, Semoun, Samoun Samûn), or Sambuli, a name derived from the Arabic *samma*, signifying hot, poisonous, or generally whatever is disagreeable or dangerous, and applied to the hot suffocating winds which are peculiar to the hot sandy deserts of Africa and Western Asia. In Egypt, it is called *khamsin*, (Ar., fifty) because it generally continues to blow for 50 days, from the end of April to the time of the inundation of the Nile.

Owing to the great power of the sun's rays, the extreme dryness of the air, and the small conducting power of sand causing the accumulation of heat on the surface, the superficial layers of sand in the deserts of Africa and Arabia often become heated to 200° F. to a depth of several inches. The air resting on this hot sand becomes also highly heated, thus giving rise to ascending currents; air consequently flows towards these heated places from all sides, and these different currents meeting, cyclones or whirling masses of air are formed, which are swept onward by the wind prevailing at the time. Since the temperature, originally high, is still further raised by the heated grains of sand with which the air is loaded, it rapidly increases to a degree almost intolerable. In the shade, it was observed by Burckhardt in 1813 to have risen to 122°; and by the British Embassy to Abyssinia in 1841 to 126°. It is to the parching dryness of this wind, its glowing heat (about 200°), and its choking dust, and not to any poisonous qualities it possesses, that its destructive effects on animal life are to be ascribed.

The approach of the Simoom is first indicated by a thin haze along the horizon, which rapidly becomes denser, and quickly overspreads the whole sky. Fierce gusts of wind follow accompanied with clouds of red and burning sand, which often present the appearance of huge columns of dust whirling forward; and vast mounds of sand are transported from place to place by the terrible energy of the tempest. By these mounds of sand, large caravans are frequently destroyed; and even great armies have been overwhelmed by them, as in the case of Cambyses, who was overtaken by the Simoom on his march through the desert to pillage the temple of Jupiter Ammon, and perished with 50,000 of his troops. The destruction of Sennacherib's army is supposed to have been caused by the Simoom. The Simoom generally lasts from 6 to 12 hours, but sometimes for a longer period.

The effects of this wind are felt in neighboring regions, where it is known under different names, and it is subject to important modifications by the nature of the earth's surface over which it passes. In Italy, it is called the *Sirocco*, which blows occasionally over Sicily, South Italy, and adjoining districts. It is a hot moist wind, receiving its heat from the Sahara, and acquiring its moisture in its passage northward over the Mediterranean. It is the plague of Sicily and Naples, and while it lasts a haze obscures the atmosphere, and such is the fatigue which it occasions that the streets of Palermo become quite deserted. The Sirocco sometimes extends to the shores of the Black and Caspian Seas, and under its blighting touch, sheep and cattle die in the steppes beyond the Volga, and vegetation is withered and dried up. It is called the *Samiel* in Turkey, from its reputed poisonous qualities. The *Solano* of Spain is a south-east wind, extremely hot and loaded with fine dust, which prevails at certain seasons in the plains of Mancha and Andalusia, particularly at Seville and Cadiz. It produces giddiness, and heats the blood to an unusual degree, causing general uneasiness and irritation; hence, the Spanish proverb: 'Ask no favor during the Solano.' The Harmattan (q. v.) of Guinea and Senegambia belongs to the same class of winds.

SIMPLE CONTRACT, in English law, means any contract which is constituted by word of mouth or by a writing not under seal. See CONTRACT.

SI'MPLON (Ital. *Sempione*), a famous mountain of Switzerland, one of the Lepontine Alps, in the east of the canton of Valais, and near the Piedmontese frontier, rises to the height of 11,124 feet. The *Simplon Road*, one of the greatest engineering achievements of modern times, leads over a shoulder of the mountain from which it derives its name (the *Pass of the Simplon*, 6592 feet) from Brieg in Valais to Domo d'Ossola in the north of Piedmont. The road was commenced in 1800 under the direction of Napoleon, and was completed in 1806. It is from 25 to 30 feet broad, and has nowhere a slope greater than 1 in 13. It is carried across 611 bridges, over numerous galleries cut out of the natural rock, or built of solid masonry, and through great tunnels. Close to the highest point is the *New Hospice*, one of the 20 edifices on this route for the shelter of travelers.

SIMPSON, SIR JAMES YOUNG, was born at Bathgate, Linlithgowshire, in 1811. He early showed a peculiar talent for medical observation and research; and in the prosecution of his professional studies at the University of Edinburgh, so attracted the notice of his teachers as to inspire all of them with an active interest in his future career. He graduated as doctor in medicine in 1832, on which occasion his inaugural thesis won the highest admiration. Professor Thomson chose him as his professional assistant, and employed him in the preparation of his course of lectures on General Pathology. During the illness of the professor, Mr. S. supplied his place in the lecture-room with unusual skill and address.

He now began professional practice on his own account; and in 1840, succeeded Professor Hamilton as Professor of Midwifery in the University of Edinburgh. This position he has held with yearly enhanced distinction, and by the rigidly scientific, while popularly attractive, character of his prelections, has contributed greatly to the renown of the Edinburgh school, both at home and abroad. He was indefatigable, amid the distracting cares of an extensive practice, in promoting the scientific perfection of his art; and his two volumes of Obstetric Memoirs, edited by Drs. Priestly and Storrer, contain the fruits of much patient and ingenious research. The discovery by which he will be more par-

ticularly remembered, however, is that of the anæsthetic virtues of chloroform. The so-called sulphuric ether had been employed in America by Morton to produce anæsthesia during labor; but to S. belongs the credit of having, in 1847, first introduced to the scientific world the far safer, more certain, and now universally adopted agent of chloroform. Another innovation which surgical practice owes to Professor S. is the stoppage of hæmorrhage by Acupressure (q. v.). In his own peculiar field of obstetrics, his improvements on the old methods of practice are numerous and valuable; while his contributions to antiquarian research would of themselves create an independent reputation in that field. Besides the Obstetric Memoirs already mentioned, he published a volume on Acupressure; and many papers and notices read before the Royal and Antiquarian Societies of Edinburgh. Among these may be enumerated: Antiquarian Notices of Leprosy; On the Contagiousness of Cholera; Ancient Roman Medicine Stamps; Was the Roman Army provided with Medical Officers? On Syphilis in Scotland, &c. His scientific services were recognized by innumerable medical associations; while his professional distinction secured for him a baronetcy in 1866. He died on the 6th of May 1870. A statue of S. was erected in Edinburgh in 1877. See the Memoir by Duns (1873).

SIMROCK, KARL, a German poet and scholar, who has done more perhaps than any other man to make his countrymen familiar with their early literature, was born at Bonn, 28th August 1802. He studied at the university of his native city and afterwards at Berlin, and in 1823 entered the Prussian state service. His first work was a translation into Modern German of the *Nibelungenlied* (Berl. 1827; 9th. ed. Stuttg. and Tüb. 1854), followed by a translation of the songs admitted by Lachmann to be genuine, under the title *Zwanzig Lieder von den Nibelungen* (Bonn. 1840). Soon after the publication of his translation of Hartmann von der Aue's *Armer Heinrich* (Berl. 1830), he was compelled to leave the Prussian service on account of a revolutionary poem which he wrote. Afterwards he devoted himself exclusively to literature, and more particularly to the early literature of his own country, which he has modernized in splendid style. In 1850, he was appointed professor of German Language and Literature at Bonn, a situation which he held till his death, which occurred in July 1876. His principal works besides those already mentioned, are:

Quellen des Shakspeare in Novellen, Märchen, und Sagen ('Sources of Shakspeare in Novels, Tales, and Legends,' 3 vols. Berl. 1831), executed in conjunction with Echtermeyer and Henschel, but of which the most important part was S.'s; *Novellenschatz der Italiener* (Berl. 1832); a translation, with commentary, of the poems of Walther von der Vogelweide (2 vols. Berl. 1833), in conjunction with Wackernagel; and of *Wieland der Schmied. Deutsch Heldensage* (Bonn. 1835), one of the freshest of the German medieval epics; *Rheinsagen aus dem Munde des Volkes und Deutscher Dichter, fur Schule, Haus, und Wanderschaft* ('Legends of the Rhine, from the mouth of the people and German poets, for School, Home, and Travelling,' 4th ed. Bonn. 1850; latest ed. 1857); a collection of German *Volksbücher* ('People's Books'), comprising national proverbs, songs, and riddles, besides a vast quantity of stories (these, carried on for several years, include many vols.); a translation of Wolfram von Eschenbach's *Parzival und Titurel* (Stuttg. and Tüb. 1842); and *Das Heldenbuch*, partly translations and partly original poems (1843—1849), illustrative of the heroic traditions of the Teutonic race. A separate collection of his own poems (*Gedichte*) was published at Leipzig (1844, new ed. 1863). Later productions are a translation of the Songs of the Edda (Stuttg. and Tüb. 1851, 3d ed. 1863); a *Handbuch der Deutschen Mythologie* (2 vols. Bonn. 1853—1855, 2d ed. 1864); an *Altdeutsches Lesebuch in Neudeutscher Sprache* (Stuttg. and Tüb. 1854; *Das Deutsche Kinderbuch, Reime, Lieder &c.* (1856—1857); *Der Wartburg-Krieg, herausgegeben, geordnet, ubersetzt, und erläutert* (1858); *Die Nibelungenstrophe und ihr Ursprung; Beitrag zur Deutschen Metrik* (1858); *Lieder vom Deutschen Vaterlande* (1863); *Deutsche Märchen* (1864); *Gedichte Shakspeare's* (1867).

SIMSON, ROBERT, a celebrated Scotch mathematician, was born at Kirkton Hall in Ayrshire, October 1687. He was educated at the university of Glasgow with a view to the clerical profession, and attained great eminence in classical and mathematical knowledge. His taste for mathematics gradually gained the ascendency, and all other pursuits were abandoned. After a brief residence in London, during which he made the acquaintance of Dr. Halley, Mr. Ditton, and others, he returned to Glasgow, where in 1711 he was appointed Professor of Mathematics, and for 50 years discharged his professorial duties. S.'s reputation rests chiefly on his 'restorations,' or, as they might more properly be called, 'reconstructions,' of the Greek geometers. Some good judges are of opinion that he has corrected many errors in the original text, though his respect for the Greek mathematicians always led him to refer these to the ignorance of editors, and the negligence of copyists. His first attempt in this direction was to discover the signification of Euclid's porisms, the only datum being a most obscure and tantalizing description of them by Pappus, the indefiniteness of which had foiled both Fermat and Halley. In this difficult task, S., however, succeeded; and a similar attempt, attended with similar success, on the 'loci plani' and the 'sectio determinata' of Apollonius, stamped him as one of the most elegant geometers of modern times. With the thorough insight which he had thus obtained into the nature and processes of the Greek analysis, he set himself to the correction of Euclid's *Elements*. This last work was published in 1758, and has deservedly enjoyed a high character; it has been frequently re-edited and republished as a school-book, especially the edition by Playfair. S. also published along with his edition of 'Euclid,' a list of Euclid's 'Data,' of which he subsequently issued a second edition; but of his other works, some of which were almost ready for publication, none were printed till after his death. He retired from his professorship in 1761, and employed himself chiefly in the correction of his various works till his death, October 1, 1768. Eight years after S.'s death, Earl Stanhope caused to be published (for private circulation) at his own expense, the work on Porisms, the two restored works of Apollonius, a posthumous tract on Ratios, and another on Logarithms; and an edition of Pappus, which was discovered after S.'s death, was presented to the university of Oxford.

SIN is the name given by theologians to the evil of human nature, to the moral defect or perversion which appears as an inherent quality of the human will, and in a greater or less degree unavoidably characterizes it in this life. It is something more than evil as affirmed of the external world or of the lower creation. *Evil*, as denoting decay or corruption in nature, is admittedly a mere relative term, for in truth decay is just as normal a process of creation as renovation, and corruption is the condition of restored health and beauty. In a similar manner, evil such as it exists in the lower animal creation, in the form of *prey* and in the forms of pain, of sickness, and of death—whatever be the special view taken of such phenomena—is never reckoned evil in the sense of *Sin*. In order to constitute the special idea of sin, it is always necessary to suppose a moral element in the evil to which it is applied. Whatever form of evil is independent of the human will as its source, origin, or agent, is not sin. Theologians, indeed, speak of original sin, or the sin of human nature, as distinguished from actual sin, or the particular transgression of the individuals composing mankind. According to a common theological view, men are not only sinners individually, but they are partakers of a sinful nature, with which their will has had nothing to do—with reference to which they have had no choice of good or evil. The evil has come to them by natural descent from the original parents of the race. But even the most extreme view of original sin preserves a hypothetical relation between every individual will and the primal transgression which it considers to be sin, not merely in those who committed it, but in those who have descended from them. All mankind are supposed to have been in Adam, the first sinner, as their representative, so that 'they sinned in him and fell with him in his first transgression.' Without such a hypothesis of unity between Adam and his race, so that his will was in some measure the typical or representative will of the race, the notion of original sin could not be maintained. For the relation between sin and will as a moral power, having the choice of good and evil, is a cardinal relation without which it would seem impossible to distinguish sin as a quality from other forms of evil in the world.

SI'NAI, the mount on which, according to the Pentateuch, God announced to Moses the ten commandments and the other laws by which the Israelites were to be bound. Its exact position is matter of dispute among travelers, but it is to be sought for in the mass of granite and porphyry mountains occupying the greater part of the Arabian peninsula, lying between the Gulf of Suez and Akabah, and rising to a height of 8000 or 9000 feet above the sea. This mountain-mass is divisible into three groups, a north-western, reaching, in Mount Serbal, an elevation of 6340 feet; an eastern and central, attaining, in Jebel Katherin, a height of 8160 feet; and a south-eastern, whose highest peak, Um Shaumer, is the culminating point of the whole Sinaitic range. Serbal, with its five peaks, looks the most magnificent mountain in the peninsula, and is identified with S. by the earlier Church Fathers, Eusebius, Jerome, Cosmas, &c.; but it does not meet the requirements of the Hebrew narrative, and even as early as the time of Justinian, the opinion that Serbal was the S. of Moses had been abandoned, and to a ridge of the second or eastern range that honor had been transferred, the northern summit of which is termed Horeb; and the southern, Jebel-Mûsa, or Mount of Moses, continues to be regarded by the great majority of scholars as the true Sinai. Its height is variously estimated at from 6800 to 7100 feet above the sea.

At the eastern base of Jebel-Mûsa, in the ravine of Shouaib, stands in solitary peace the famous monastery of Mount S.; but

in earlier times the mountain had numerous other convents, chapels, and hermitages.

SINA'PIS. See MUSTARD.

SINCERE BRETHREN, or TRUE FRIENDS, is the name of a semi-religious, semi-scientific Mohammedan order, the beginnings of which are shrouded in obscurity, but which, about 970 A.D., manifested its existence by one of the boldest and most comprehensive literary undertakings—viz., an encyclopædic treatment of philosophy, theology, science, ethics, and metaphysics, in a series of no less than fifty-one treatises. Under the head of MOHAMMEDAN SECTS, and more especially under MOTAZILITES, mention has been made of that immense religious struggle that arose but a few generations after Mohammed, in the bosom of Islam, bringing forth sect after sect; and which, under whatever name and warcry, simply denoted the reaction of the thinking minds against the dead-weight of dogmas and formulas, such as the successors of the Prophet tried in his name, and often enough in direct contradiction to his explicit dicta, to impose upon the Faithful. What the Motazilites had attempted was the reconciliation of scientific speculation, as it had irresistibly grown up at the first contact of the Arabs with Greek literature, with the religious dogma of Islam. This new period of development of Arabic culture, which chiefly characterizes the epoch of the first Abbaside rulers, however, was of no long duration. The representatives of the 'orthodox' schools, who would not hear of reconciliation, but insisted all the more uncompromisingly upon the most literal interpretation, dexterously used against them those same weapons of dialectics which their adversaries themselves had first taught them how to wield.

Setting to work with proper systems and methods, they soon built up a scholastic edifice of theology, not easy to be attacked without the most direct outspokenness; and from this the new schools, the terror of the califate strong upon them, shrank. It was thus that the Motazilites soon disappeared from the arena. But their labors had not been in vain. Silently and by small degrees this new and mysterious union of the Sincere Brethren arose. Though widely spread, their schools, their houses of assembly, their rules, their doctrines—everything remained, for we do not know how long, a profound mystery; and apart from that which they themselves have thought fit to reveal of it, neither ancient nor modern investigation has been able to discover many traces of their inner organization and activity. Not even many of their names have come down to us, though the 'treatises' they have left point to a multitude of authors, and to many stages of development. The tone of these treatises is much more free, and their entire tendency more radical than that of any of the books of their predecessors. Yet, the desire not to offend the less advanced in religious matters, and above all, to reunite rather than to make the breach wider, is perceptible in their endeavor to use what Koranic quotations and traditions can be pressed into the service of free thought, by often very unnatural processes of allegory and mysticism.

Before speaking of the treatises themselves, we shall briefly summarize what can be gathered as to the mutual relations of the brethren of this secret lodge, and the aims of their association. There is special mention made of the 'secret doctrine' which the Brethren should communicate to each other in their houses of assembly at those 'stated periods,' at which no stranger was to be admitted on any condition. The principal subjects towards which their conversation was to be directed were to be the knowledge of the soul or psychology, the knowledge of the action of the senses and the things perceptible through them, the contemplation and investigation of the mysteries of the sacred books, of the prophetical revelations, and the ideas contained in the divine laws. Their attention was further to be directed towards the four 'mathematical' sciences—arithmetic, geometry, astronomy, and (musical) composition. But the chief subject of their investigations should be the knowledge of divine things, which are the end and aim of all study. The most catholic spirit was to prevail among them with regard to the various sciences, systems, or books; since 'our own system comprises all, without exception, and includes all science.' 'The speculations of our school extend simply to all things—the sensual and the intellectual—from the moment of their beginning to their end, according to their outer and inner life—that which is palpable and clear about them, and that which is hidden and secret—the Truth, in fact. For the true essence in everything is derived from one primeval origin and general cause, since there is but one world and one supreme mind, to which all the most manifold phenomena, species and kinds, and divisions, are to be traced back.' With these words, the encyclopædic tendency of the lodge and their essays is best characterized.

All their knowledge they traced back to four sources—as indeed this number seems to have played a very considerable part in all their divisions—as follows: 1. 'The books that are known by the names of the sages and philosophers, in as far as they belong to mathematics and natural history.' They do not indicate them further; but it is easy to see from the treatises themselves that they allude to the translations of Greek works bearing the names of Pythagoras, Aristotle, Euclid, Ptolemy, Porphyry, &c. 2. 'The revealed writings derived from the prophets,' such as the five Books of Moses, the Gospel, the Psalms, the Koran, and other writings of prophets who had received their contents through inspiration by the angels and the 'deep mysteries hidden in these books.' 3. 'Books treating of nature'—i. e., that describe and represent the things now in existence—the celestial circles, the motions of the stars, the transformation of matter, the individual species and kinds of animals, plants, &c. 4. 'The divine books, or the books on the divine things, written by the angels from the tablet of Fate, upon which all the divine decrees regarding the world and man are inscribed. These contain all that refers to substances, species, kinds, and orders of the different souls; their actions, destinies, metamorphoses, phase after phase, the heavenly conjunctures and periods,' &c.

The encyclopædia of treatises which this secret association has left as the monument of its existence, was first compiled at Basrah about 1000 A.D.; but has (save one often reproduced chapter, called 'The Contest between Man and Animal') never been printed. The 51 treatises are divided into four classes: 1, the 'Mathematical,' in 13 dissertations or treatises; 2, the 'Physical,' in 17; 3, the 'Origins' of mental activity, or the thinking soul, in 10; and 4th and last 'The Divine Law,' in 11 treatises, the last of which contains a general outline of the whole work. The 'Mathematical' section comprises also Arithmetic, Astronomy, Geography, Music, and an introduction to Philosophy and Logic.

Great interest attaches to this production, as the earliest Encyclopædia deserving the name, reflecting, as it does, the state of science both of the East and West at the end of the first thousand years after the introduction of Christianity. The fifty-one treatises are neither strictly systematically arranged nor methodized, nor free from repetitions, and by no means so instructive in detail as the enumeration of the contents would lead to believe; yet they belong to the most comprehensive and creditable efforts of the human mind.

One of the most attractive portions of the work, and the one which alone has been repeatedly edited and translated into many languages (not into English), is the so-called 'Contest between Man and Animal,' which forms a part of the twenty-first treatise. In this one place alone, man and animals are introduced speaking; in all other portions, rhetoric, ornamented by allegories and metaphors, mostly well chosen and artistically wrought, forms the ordinary style. These dissertations may not have fulfilled their purpose any more than did the whole lodge; but they will be all the better appreciated when that darkest period of Mohammedan history, the 10th c., is taken into consideration. Hypocrisy stood for piety at the courts of the many emirs, low cunning for wisdom, the vilest adulation for fidelity, and oppression for justice. No wonder this manly and scientific protest was not received very favorably by so corrupt a generation. Besides which, the want of strict logical arrangement—a circumstance owing probably to the voluntary suppression of the intermediate portion—and the vagueness in which many of the most important points are treated, made even the few independent and faithful minds fail to appreciate it.

The chief cause of the discontent which they excited among the contemporaries lay in their conciliatory tendencies. Theology pure and simple would not hear of philosophy. Religion, the orthodox champion said, was a revelation—divinely given, not to be understood even by human intelligence; philosophy, on the other hand, was a vain thing, treating of human things and other futile subjects. The philosophers, though they dared not be quite so outspoken on theology, felt no less keenly that there was no compromise possible under these circumstances, even if they had not repudiated any notion of being 'reconciled.'

We have treated this subject somewhat more fully than usual, both on account of its deep intrinsic interest, as forming the most striking refutation of the commonplace notion that the religion of Mohammed was a stationary, hard, fanatical, and dotard creed, never questioned or reasoned upon by the Faithful; and further, because little or no information on the subject is generally accessible. The work itself has, as we have said, with the exception of the one fairy-tale fragment, never been edited; and there are, even among the authorities on Mohammedan matters, but three or four who have paid special attention to this important subject, and what fragmentary information we possess lies scattered in Oriental 'Transactions,' in notes, and in prefaces.—See Sprenger, in *Asiatic Journal* of Bengal; Flügel, in *Deutsche Morgenl. Zeitschrift*; De Sacy, *Notices et Extraits;* Dieterici, *Mensch und Thier;* Nauwerck; &c.

SINCLAIR, THE FAMILY OF. The Scottish historical House of Sinclair or St. Clair is of Norman descent, the surname (Latinized *De Sancto Claro*) being doubtless derived from possessions in

Normandy. Two families bearing this surname, whose connection cannot now be traced, the St. Clairs of Rosslyn and of Herdmanston, appear in Mid-Lothian and East Lothian in the beginning of the 12th century. Henry St. Clair, *Vicecomes* of Richard Morville, Chancellor of Scotland, obtained, in 1162, a charter of the lands of Herdmanston, which have ever since continued in the family. His descendant rendered signal service to Robert Bruce, for which he is said to have presented him with a sword, still in the possession of the family, with the words inscribed: 'Le roy me donne, St. Clair me porte.' The ancestor of the other line was William St. Clair, who had Rosslyn confirmed to him by charter from David I. His descendant was, like his contemporary of the Herdmanston line, a companion-in-arms of Robert I., on whose death Sir William St. Clair of Rosslyn was one of the knights selected to accompany the good Sir James Douglas, with the heart of his sovereign, to Jerusalem. With the Douglas, he fell in battle against the Moors in 1330. But the fortunes and importance of the family were principally due to the marriage of the son of this Sir William with the daughter of Malise, Earl of Strathearn, Caithness, and Orkney, and heiress of the Norwegian Jarls of the Orkneys. In this way the St. Clair family acquired the Earldom of Orkney, coupled with some very stringent conditions of fealty to the king of Norway, which would have rendered it impossible for him, in the event of a war between the countries, to have retained both his Scotch and his Norse possessions.

The Orkney earldom was, however, acknowledged and confirmed to him by Robert II.; and for the next two generations the power of the family continued to be little less than princely, the St. Clair influence being further increased by intermarriages with near relatives of the royal house of Scotland, William, the third Earl, held the high offices of Lord Admiral, Lord Justice-general, Lord Chancellor, and Lord Warden of the three Marches. He was made Earl of Caithness in 1450. At his castle of Rosslyn he kept up an almost regal state and pomp. He founded and endowed a collegiate church there, bringing skilled workmen from foreign parts to build that rich and elaborate chapel, which is still among the architectural gems of Scotland, and in its style more resembles the churches of Spain than those of North Britain. His daughter was given in marriage to Alexander, Duke of Albany, son of James II. On the marriage of James III. with Princess Margaret of Denmark, the sovereignty of the Orkneys was made over by King Christiern in mortgage to the Scottish crown, a transaction which eventually led to the permanent cession of these islands. The earl soon after resigned into James's hands his earldom of Orkney, with the islands of Orkney and Shetland, and as a compensation—it has been said, a very inadequate one—obtained the lands of Dysart and Ravensheugh, and the castle of Ravenscraig in Fife. He was still Earl of Caithness and Lord Sinclair, and from the extent of his possessions one of the most powerful nobles in Scotland. Instead, however, of keeping these possessions united, he partitioned them among his three sons in such a way as contributed far more than the loss of the Orkneys to break down the family influence. On William, his eldest son, he bestowed merely the lands of Newburgh, in Aberdeenshire; on his second, Sir Oliver, he settled all his estates south of the Tay; while, with consent of the crown, he conveyed the earldom of Caithness to his youngest son, also named William.

LORD SINCLAIR.—The eldest son of this last Earl of Orkney endeavored to set aside his father's settlement, by which he had been postponed to his younger brothers, and succeeded at last in effecting an arrangement by which Sir Oliver made over to him all the Fifeshire estates, while he renounced all claim to Rosslyn, and the other lands in the county of Edinburgh. He was still Lord Sinclair, and on his death, on the field of Flodden, he was succeeded by a line of Lords Sinclair, who ranked among the more considerable of the Scottish nobility. His grandson, by a daughter, was the notorious Earl of Bothwell, third husband of Queen Mary, and whom, in memory of his maternal descent, that unhappy queen created Duke of Orkney. The seventh Lord Sinclair had no male issue, but a daughter, married to St. Clair of Herdmanston, the representative of the other House of Sinclair already alluded to. The son of this marriage, in virtue of a new patent obtained from Charles II., became eighth Lord Sinclair—this patent, singularly enough, bringing in, on failure of heirs male, his paternal relatives, the St. Clairs of Herdmanston, strangers in blood to the former Lords Sinclair. The contingency provided for occurred in the next generation. The two sons of the eighth lord having died without issue, the title went to the Sinclairs of Herdmanston, who have ever since inherited it.

EARLS OF ROSSLYN.—Rosslyn had been purchased by one of the sons of the eighth Lord Sinclair from the last of Sir Oliver's line, and while the title thus went to an entirely different line, the estates, both of Rosslyn and Dysart, were carried by destination to the issue of the eighth lord's second daughter, whose grandson, Sir James Erskine of Alva, succeeded to the earldom of Rosslyn, which had first been conferred on his maternal uncle, the Lord Chancellor Loughborough.

SINCLAIRS OF ROSSLYN.—Sir Oliver, the above-mentioned second son of the last Earl of Orkney, was progenitor of a line of barons who, for two centuries, owned the splendid domains of Rosslyn, and where buried in the vault of the chapel, in royal fashion, in their armor. Sir Oliver's second son was the noted Oliver Sinclair, the favorite of James V., whom, to the general disgust, he placed in command of the army sent to encounter the English in 1542. To the repugnance of the army to serve under him, is attributed the disgraceful rout of Solway Moss, where 10,000 Scottish troops fled at the sight of 300 English cavalry, to whom they can hardly be said to have made any resistance. Among the functions discharged by the Sinclairs of Rosslyn were those of protectors of the gipsy race, and hereditary grand-masters of the Masonic fraternity of Scotland. The last of Sir Oliver's line, impoverished by the political troubles in which his support of the Stewarts had involved him, sold Roslyn, which then became, as has been already seen, the property of the disinherited elder branch.

EARLS OF CAITHNESS.—This title was, as has been seen, conferred on William, the youngest son of the last Earl of Orkney, and has been ever since held by his descendants, passing repeatedly from one branch to another on the failure of the direct line. The third earl, ambitious enough to aspire to be an independent prince, endeavored, in 1529, by force of arms, to recover the Orkneys from the crown. He was joined by his cousin, the second Lord Sinclair, but this foolish expedition met with a signal defeat. The support of the islanders had been calculated on: but the large majority of them turned out to be steady in their loyalty, and encountered the insurgents in a naval battle, in which the earl with 500 men were slain, and Lord Sinclair and the rest made prisoners. The sixth earl, having got into difficulties, conveyed his lands to his powerful creditor, Sir John Campbell of Glenurquhy, afterwards first Earl of Breadalbane, who, in 1677, got a patent creating him Earl of Caithness, and took possession of the Caithness estates. He was dispossessed, however, by George Sinclair, the heir-male, who entered Caithness with an armed force, and was eventually found to have the sole right to the title and estates. The Sinclairs of Ulbster are sprung from a legitimated son of William Sinclair, second son to the fourth Earl of Caithness, to whom the valuable and extensive lands of Ulbster were conveyed in 1596 and 1600 by the fifth earl. See SINCLAIR, SIR JOHN.

A genealogical history of the St. Clairs of Rossyln, written by Father R. A. Hay, was printed privately at Edinburgh in 1835.

SINCLAIR, SIR JOHN, an eminent agricultural improver, and patriotic Scottish gentleman, was born at Thurso Castle in 1754. He represented the Sinclairs of Ulbster, a branch of the noble House of Caithness. After a careful education, completed at Oxford, he studied law, and was admitted a member of both the Scottish and English bars, but having, in his 16th year, succeeded to the family estate, he devoted himself to his duties as a northern landlord, and to the more engrossing pursuits of public life. In 1780, he was returned to parliament for his native county, which he represented for many years. He wrote pamphlets on public affairs—on the navy, the militia force, the national finances, &c. In 1784, he published a *History of the Revenue of the British Empire*, an elaborate work in two 4to vols.; and in 1786 he was created a baronet. He traveled over Europe, gathering information on economical and commercial questions, and on his return set about establishing a society in Scotland for improving the breeds of sheep and the quality of wool. His exertions also led to the formation of the Board of Agriculture in 1793, of which he was president for 13 years. This institution was the precursor of numerous agricultural associations, by which the country was greatly benefited. Sir John's most important undertaking was originating and carrying through the *Statistical Account of Scotland*, completed in the year 1798 in 20 large vols., and comprising a description of every parish in Scotland. The parochial clergy were the chief contributors, but the indefatigable baronet also employed statistical missionaries, and was for seven years actively engaged in prosecuting the work. Sir John wrote on all manner of topics, including even a tragedy and treatises on health and longevity; and his publications during 50 years of ceaseless exertion are said to amount in number to 367! Not one of the whole seems destined to live; their value perished in the using; but the long and active life of their author was highly beneficial to his country. The venerable baronet died at Edinburgh, December 21, 1835, in the 82d year of his age.

Sir John S. left a numerous family, some of whom have attained to distinction. CATHERINE SINCLAIR, fourth daughter of the deceased baronet, was the author of a number of tales and descriptive works—*Modern Accomplishments*, *Modern Society*, *Scotland and the Scotch*, *Shetland and the Shetlanders*, &c., which all evince literary taste and talent, combined with fine moral feeling; while her practical benevolence and social kindness greatly endeared her to her friends, and to Edinburgh society generally. Miss S. died, universally regretted, in 1864, aged 63.

SINDE, an extensive province of British India, lies in the extreme west of that territory, and is bounded on the N. by Beloochistan and the Punjab, E. by Rajputana, W. by Beloochistan, and S. by the Arabian Sea and the Great Western Runn, an extensive lacustrine inlet which separates S. from Cutch. It is 380 miles in greatest length, 280 in greatest breadth, contains 46,599 (besides a tributary area) English sq. m., with a pop. (1872) of 2,192,415. The sea-coast, which extends north-west for 150 miles, is very low and flat, with the sole exception of the small portion beyond Karatchi (Kurrachi), and is studded here and there with low mud-banks formed by the Indus, or with sand-hills the accumulated drift from the beach; it is overflowed at high tide to a considerable distance inland, and is hardly visible, according to Burnes, at a league from shore. The province is traversed through its whole length by the Indus (q. v.), which, on approaching the coast, divides and subdivides into a number of channels, forming a delta of 75 miles in length by 130 in breadth. This delta, unlike that of the Ganges, is almost wholly destitute of wood, and the soil consists of a mixture of clay, sand, and vegetable mould, which is speedily baked hard by the heat. Along each bank of the Indus is an alluvial tract of great fertility extending 2 to 12 miles from the river, and mostly irrigated by artificial canals and watercourses, which, overflowing during the inundations, cover the soil with a silt so rich as to yield two, and sometimes three, crops in a year. The soil, nevertheless, contains in the north so much saltpetre, and in the south so much salt, that after the year's crops have been obtained, these substances are extracted for home consumption and export.

Between the Indus and its most easterly branch, the Narra, is an alluvial 'doab,' averaging 75 miles in width, but which, from want of irrigation, has become almost a desert. East of this, on the other side of the Narra, is the *Thur*, a desert of shifting sand. West of the Indus the country is occupied by the desert of Shikarpur on the north, a desert not of sand, but of alluvial clay, the same as that of the delta, which only requires irrigation to render it fertile; and in the south it is traversed by the Hala Mountains. The *Thur*, or eastern desert, has numerous vestiges of former towns, in the shape of heaps of fragments of bricks and pottery. The climate of S. is remarkably sultry and dry, it being completely beyond the action of the south-west monsoon; at Haidarabad, the fall of rain in one year was 2½ inches, and the average annual fall at Karatchi does not exceed 6—8 inches, and Larkhana has been known to be destitute of rain for three years in succession; the average maximum heat for six months at Haidarabad was 98.5° in the shade, and is still greater in Upper Sinde. There are generally two harvests per annum; the first, or *rubbí* (spring) harvest, consists of wheat, barley, oil-seeds, millet, durra, opium, hemp, and tobacco; the second, or *kurîf* (autumn) harvest, of those crops whose ripening requires much heat, as rice, sugar-cane, cotton, indigo, maize. The population consists of a mixture of Juts (a Hindu race) and Beluchis, with a few Afghans in the north-west; the greater portion of them are Mohammedans, and the remainder, who profess Hinduism, have fallen far from the strictness of observance which characterizes the most of its followers. Generally, the Sindians are tall and handsome; the Beluchi portion of them warlike and independent; the Juts peaceable, and given to agricultural pursuits.

From the time (711) that S. was conquered by the calif, Abdul-Melek, it underwent numerous vicissitudes, forming at times a part of the empire of Delhi, and being latterly (1756) joined to Afghanistan. In 1779, the Beluchis rebelled, deposed their ruler, defeated the Afghans (1786), and raised their leader, the chief of the Talpûr tribe, to supreme power. This chief made large grants of territory to various of his relatives, reserving most of Lower S. for himself and his three brothers; so that there were four 'ameers' at Haidarabad, three at Khyerpûr, and one or two at Mirpur. The ameers of S. always regarded the British government with suspicion, and occasionally troubled those traders who visited their dominions; but they subsequently concluded commercial treaties, which were observed with punctuality. On the outbreak of the Afghan war in 1838, the British government intimated its intention to take temporary possession of Shikarpûr, and forced the ameers of Haidarabad and Mirpur to agree to a treaty which virtually destroyed their independence. Their expression of a natural dislike at the mode in which they had been treated, provoked fresh demands from the Calcutta government, to which the Haidarabad ameers agreed, despite the clamors and threats of their followers, who attacked the British residency on the following day. Sir Charles James Napier, the British envoy, at the head of a considerable military force, then marched against the enemy, totally routed them at Meeanee (17th February 1843), and by defeating the ameers of Mirpur, at Dubba, near Haidarabad (March 24th), completed the subjugation of Sinde. The conquered territory was divided into three collectorates—Haidarabad, Karatchi, and Shikarpûr; the ameer of Khyerpûr, by continuing faithful to the British, retaining his dominions. For two years afterwards, Napier was actively employed in reducing the marauding tribes of the west, who pillaged the province; and so successful was the 'Sheitanka bhai' (Devil's Brother), as the robber tribes named him, that they were completely rooted out of their fastnesses, and most of them transported to distant regions. The country is reported as rapidly improving under its present administration.

SINDHU (from the Sanscrit *syand*, which in its older form probably was *syandh*, to trickle or flow) is the ancient name of the river Indus and the country along the Indus or Sindh.

SI'NDIA, the name of a powerful family of Mahratta chiefs and princes, which occupies a conspicuous place in the history of India during the 18th and 19th centuries. The founder of the family was RANOJEE SINDIA, a Sudra of the Kûmbi ('cultivator') tribe, who from a menial station in the household of the Peishwa, rose to a high rank in the body-guard, and after 1743, received in hereditary fief the half of the extensive province of Malwa. His son, MADHAJEE SINDIA (1750—1794), joined the Mahratta confederation, and was present at the battle of Paniput (1761), where he was so desperately injured as to be left for dead, but he speedily recovered, and on the retirement of the Afghans and their allies, repossessed himself of his hereditary dominions. On the death of Mulhar Rao Holkar (q. v.), he became the chief of the Mahratta princes, and had the command of the Peishwa's body-guard; and in 1770, the Peishwa and his two powerful feudatories, S. and Holkar, aided the emperor of Delhi in expelling the Sikhs from his territories, of which the administration was handed over to S., who was now by far the most powerful of the Mahratta chiefs. The murder of the young Peishwa by his uncle, Ragoba, and the consequent expulsion of the murderer from the throne he had seized, brought S. for the first time into collision with the British, who had espoused Ragoba's cause; but in the war (1779—1782) which followed, fortune distributed her favors with impartiality, and by the treaty of Salbye (1782), S. was recognized as a sovereign prince, and confirmed in all his possessions. In 1784, he captured the stronghold of Gwalior, and in the following year marched on Delhi, to restore his preponderance in the councils of the puppet monarch, and subsequently seized Agra, Allyghur, and nearly the whole of the Doab (q. v.). The manifold advantages of European discipline had struck him forcibly during the war with the British, and, with the aid of an able French officer, he introduced it into his own army.

An army of 18,000 regular and 6000 irregular infantry, 2000 irregular and 600 Persian horse, with 200 cannon, was accordingly raised, and under the leadership of De Boigne, the officer above noticed, reduced Joudpore, Odeypore, and Jypore, three Rajpût states, and effectually humbled the pride of Holkar.—DOWLUT RAO SINDIA (1794—1827) continued his grand-uncle's policy, and during the troubles which convulsed Holkar's dominions at the commencement of the 19th c., he ravaged Indore and Poona, but was wholly routed in 1802 by Jeswunt Rao Holkar. Having joined Bhonsla, the rajah of Berar, in a raid on the Nizam (1803), he brought down upon himself the vengeance of the East India Company. The confederated Mahrattas were routed at Assaye and Argaum by Sir Arthur Wellesley; S.'s disciplined troops, under the command of French officers, were scattered irretrievably at Patpergunge (near Delhi) and Laswari by Lord Lake, and he only escaped total ruin by acceding to a treaty by which all his possessions in the Doab and along the right bank of the Jumna were ceded to the British. Gwalior was, however, restored in 1805, and from this time became the capital of S.'s dominions. S. had been taught by his reverses a useful lesson, and he declined to join Holkar, the Peishwa, and Bhonsla, in their attack (1817) on the British, and thus escaped the swift destruction which was visited upon his turbulent neighbors. During the reign of BHAGERUT RAO SINDIA, a minor, the Gwalior dominions were in such a state of anarchy, that the British were compelled to insist on certain guarantees for the preservation of tranquillity; and on these being rejected, a war followed, and the Mahrattas were routed at Maharajpûr (December 29, 1843) by Lord Gough, and at Puniaur by Major-general Grey on the same day. Gwalior fell into the hands of the British, 4th January 1844, and S. submitted to the conditions demanded of him, besides maintaining a contingent force of sepoys at Gwalior. In 1853, he was declared of age by the East India Company, and in 1858 he took the field at the head of his own army against the Gwalior contingent, which had joined in the great sepoy mutiny. But the most of his troops deserted him during the battle (June 1), and he narrowly escaped by fleeing to Agra. S. was subsequently reinstated by Sir Hugh Rose, and received from the British government numerous testimonials of its grateful respect. He is a Knight Grand Cross of the Order of the Bath.

SI'NECURE (Lat. *sine cura*, without care), in common language, an office which has revenue without employment. In the canon law, a sinecure is an ecclesiastical benefice, such as a chaplainry, canonry, or chantry, to which no spiritual function is attached, except reading prayers and singing, and where residence

is not required. The strictest kind of sinecure is where the benefice is a donative, and is conferred by the patron expressly without cure of souls, the cure either not existing, or being committed to a vicar. Sinecure rectories were abolished by 3 and 4 Vict. c. 113, s. 48.

SI'NEW. See TENDON.

SINGAPO'RE, one of the Straits Settlements (q. v.), belonging to Great Britain, consists of an island lying off the south extremity of the peninsula of Malacca, in lat. about 1° 17′ N., long. 103° 50′ E., and having a city of the same name on its south side. The island is 25 miles long, and from 14 to 15 broad; area, 224 sq. miles. It is separated from the mainland by a narrow but deep strait, varying from a mile to a few furlongs in width. The surface is generally low and undulating, the greatest elevation (Bukit Tima, or the Hill of Tin) being only 520 feet. According to Malay accounts, a colony was planted on the site of the present town by tribes who are inferred to have been Javanese, from the circumstance that the name Singapura, which they gave to their settlement, is most probably of Sanscrit origin (lion-town); the Javanese being the only people in these seas who have become fairly Hinduized. Be that as it may, in 1818 it was found by Sir Stamford Raffles to be an island covered with primeval forests, sheltering in its creeks and rivers only a few miserable fishermen and pirates. It seems to have been unclaimed by any power until 1811, when the Sultan of Jahore formally annexed it to his territories.

The commanding position of S., in the very center of the highway leading from British India to China, led Sir Stamford Raffles to mark it out as the site of the first free port in the Malayan seas; and in 1819, the British flag was hoisted on the new settlement; although it was not till 1824 that Mr. Crawford concluded a satisfactory treaty with the Sultan of Jahore, whereby the island of S., and all the islands within 10 miles of its shore, were given up in full sovereignty to the East India Company, on condition of a considerable yearly payment. Since then, the prosperity of S. has been almost without a parallel. Its position as an entrepôt for the trade of the Malayan Archipelago, the Eastern Peninsula, and China, and the wise policy that placed the commerce of the port on an entirely unfettered footing, rapidly established a flourishing trade. In 1823, the imports amounted to £1,200,000; the exports to £920,000. In the year ending 30th April 1865, the value of the imports was £6,610,000; the exports, £6,630,000, being fully double the amounts in 1854—1855. Notwithstanding the opening up of more direct communication with Europe of many of the markets in China, Cochin-China, and Siam, formerly largely supplied by traders from S., the commerce has increased, and in 1880 the value of imports was £16,743,620, and of exports, £15,610,347. This shows that both exports and imports had doubled within the past ten years.

The imports to the United Kingdom in 1880 amounted in value to £3,697,624, and the exports from thence to S. were £2,459,659. The local trade and the exports to the British colonies at the same time showed an increase. The chief articles of export to Europe and North America are gambir, tin, sago, tapioca, black and white pepper, tortoise-shell, nutmegs, gutta-percha, camphor, coffee, sapan-wood, and ratans. Of these, only gambir, sago, and nutmegs are produced on the island to any important extent; all the other articles being imported, chiefly by natives from other quarters. From Europe, large imports are received of cotton manufactures, woollens and linen, metals, hardware, earthenware, arms and ammunition, and treasure in the form of dollars. Large fleets of prahus are wafted by the southerly monsoon towards this great center of trade, laden with the numerous products of the Indian Archipelago, to return again laden with the manufactures of Europe. The splendid harbor of S. is well sheltered and of easy access, and lying as it does at the converging points of the great trade routes of the East, is visited by a large number of vessels. In 1880, 2120 vessels (1753 of these being steamers), of 1,693,096 tons, entered the port; and 1728 steamers, of 1,359,913 tons cleared; the coasting-trade being 4657 entered and 4694 cleared. In 1880, the local revenue of S. was £55,695; expenditure, £57,737. The total revenue of S. in 1880 was £255,482, and the expenditure, £247,905. A savings-bank was established at S. in 1877, and is now managed by a secretary immediately under the colonial treasurer. Under the new postal contract, letters can be delivered in S. twenty-eight days after the date of their leaving England. Education is being steadily advanced in S., and a zealous desire on the part of the Eurasians to learn English is now observable. One school in S. had, in 1876, an attendance of 476. It is intended to establish at S. a training school for vernacular teachers. There is already a Malay College.

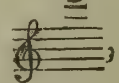
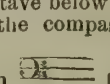
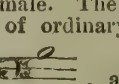
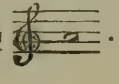
The currency of commerce is the Spanish dollar; but the official currency of government is the rupee. The Chinese pecul, of 133⅓ lbs. avoirdupois, which is divided into 100 catties, is the standard of weight. The population of S. is perhaps the most heterogeneous in the world, comprising at least 16 nationalities, speaking different tongues. The Malay, however, soft and easily acquired, is the recognized medium of communication between all classes. The population amounted, in 1881, to about 139,000; in 1871, to 97,111; of whom, 61,752 were in the town of S. and its environs, 31,235 in the country, and 4124 on board of vessels. According to the census report for that year, the various races stand to each other in the following proportion: Europeans and Americans, 1946; Chinese, upwards of 54,000; Eurasians, Armenians, and Jews, 2285; Malays, and Klings or immigrants from Southern India, 37,000. Of the aboriginal inhabitants of the island, not a trace remains; but similar tribes are still to be found in small numbers in several parts of the peninsula. Of the native population, the Chinese are the most useful part; they form almost the only body of trustworthy native merchants, in the proper sense of the word, and are freely trusted to large amounts by European importers; and it may be doubted whether, as a commercial body, they are, on the whole, more deficient in morality than many European communities. The laws are those of Great Britain, with some modifications; the court is that of a recorder. S. being a free port, the revenue is raised by inland excises on opium and spirits. S. is the seat of government for the Straits Settlements (q. v.), which, on April 1, 1867, were transferred from the control of the Indian government to that of the Secretary of State for the Colonies.

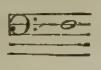
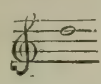
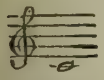
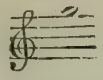
The town of S., which, as we have seen, contains ⅔ds of the whole population of the settlement, is situated at the mouth of a small river, on the S. side of the island. It is the seat of government for the whole of the Straits settlements. Its appearance is of a mixed oriental and European character; the streets are generally wide, and kept in good order, and in 1864 the town was lighted with gas. There is an efficient police, and the sanitary arrangements of the town are good. The municipal council consists of public officers and ratepayers.

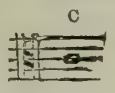
S. possesses two fine harbors; one opposite the town, which, although little more than an open roadstead, is a safe and convenient anchorage, where ships load and discharge by means of lighters; the other is about 3 miles west of the town, and is landlocked, and capable of admitting the largest vessels. Along its shores, extensive wharfs have been erected by steam-companies and individual merchants; and it is probable that when communication by railway with the town is established, the old harbor will be little used. There are several fortifications commanding the harbor and roads, but the increasing commercial and political importance of the place calls for a still stronger naval and military station. S. being within 80 miles of the equator, has little or no variety of seasons; the climate, although hot, is healthy; the temperature ranges from 71° to 92°; rain falls more or less on 200 days of the year, and the extent of the fall is about 87 inches. The soil of S. is not fertile, although the climate is such as to cover it with a rich and beautiful vegetation. The nutmeg was at one time successfully cultivated, but most of the trees having unaccountably died, this has been abandoned, and husbandry is now confined to the cultivation of the cocoa-nut, the pepper-vine and gambir plant, and to the raising of sugar-cane and vegetables for local consumption. The curse of S. is the tiger. It is estimated that 300 Chinamen and other natives are carried off yearly. Turtle are abundant on the shores, and form the cheapest animal food in the bazaars.—See Thomson's *Journal of the Indian Archipelago;* J. Crawford's *Dictionary of the Indian Islands and Adjacent Countries;* J. Cameron's *Our Tropical Possessions in Malayan India.*

SINGHARA NUT. See TRAPA.

SINGING, the art of producing music from the human voice, generally, though not necessarily, combined with speech. The mechanism of the vocal organs, as applicable to singing, has by some physiologists been likened to a reed, by others to a stringed instrument; in point of fact, the human voice is produced by an apparatus far beyond either in complexity of structure.

The extreme limits of the voice in respect of pitch may be considered to be from to  ; but the compass of any individual voice is limited to a portion of that range, and voices are classified according to their pitch. Generally speaking, male voices lie an octave below female. The former are divided into *bass* and *tenor*, the compass of ordinary bass voices being considered to be from  to  , and of tenor from to  . For tenor music, the tenor or C clef is

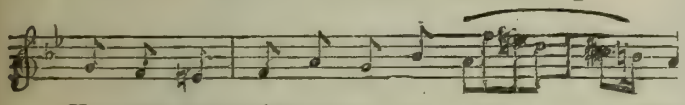
generally used , which has the advantage of having the principal tones within the staff. When the treble clef is used, the music is written an octave above its true pitch. Female voices are either *contralto* (otherwise called *alto*) or *soprano*, the former extending from  to  , the latter from  t  , or sometimes higher.

Contralto music may be noted either on the treble clef, or on the alto clef, which latter is but the tenor clef placed on the third instead of the fourth line of the staff  These are the principal divisions of voices; but there are also further subdivisions. Intermediate between bass and tenor is another male voice, called *baryton;* and intermediate between contralto and soprano, another female voice, called *mezzo soprano*. The ordinary compass of a voice is about twelve notes, but two octaves are not uncommon, and some voices have reached three. Madame Catalani is said to have possessed a voice of three and a half octaves compass.

The notes produced in singing are of two kinds, according as they proceed from the chest voice (*voce di petto*), or head voice (*voce di testa*). The chest notes, or lower register, proceed naturally and readily from the ordinary mechanism of the voice; the upper register, head voice, or falsetto, is produced by a more or less forced contraction of the cavity from which the voice proceeds, imparting to the notes a fife-like character, gentle and weak in the male voice, but often clear and sonorous in the female. It is only in the higher notes of the voice that the falsetto is used, and some notes on the borders of the two registers may be given in either. Where the two registers meet, the tones are apt to be hard and uncertain, or weak; but a cultivated singer will blend the head and chest voice at the point of junction, so as to make the break imperceptible. The notes of the bass voice are given entirely from the chest. In the tenor, the three or four upper notes belong mostly to head voice. The contralto tones are mostly chest voice, and the upper tones of the soprano are head voice. The alto, when sung, as it often is in England, by male voices, is principally falsetto.

In singing, the head should be held erect, and the chest well expanded, to allow free play to the lungs, and free emission of the voice from the throat. The tongue should be kept still, slightly pressing on the lower teeth. Proper regulation of the breath, and proper articulation of the words, are also matters of essential moment.

One particular requires to be mentioned, in which the notation of songs differs from that of instrumental music. In the latter, two or more quavers or semiquavers may be grouped together by a common line; in singing, this can only be done when the whole group are to be sung to one syllable, and notes belonging to different syllables are always written separately. When notes without hooks, or notes that are not grouped, belong to one syllable, they are bound together by a *slur* placed over them, e. g.:



Among the principal objects to be studied in cultivating the voice for singing are the improvement of its quality in respect of clearness and resources; the rendering every note in its compass equally pure; the extension of its compass, not by injudicious forcing, but by gradual practice; and the acquirement of the power to prolong any note with perfect ease. See MUSIC, VOICE, SOLFEGGIO.

SI'NGULAR SUCCE'SSOR, in the Law of Scotland, means one who succeeds in the ownership of property by purchase or any other mode than by descent.

SINIGA'GLIA, or SINIGALLIA (anc. *Sena-Gallia*), a city and seaport on the east coast of Italy, in the province of Ancona, and 17 miles west-north-west of the city of that name, at the mouth of the Misa, with 10,500 inhabitants. It is a bright, cheerful city, built after the modern style, walled round, and it has bastions and handsome gates. S. is celebrated for its annual fair, which lasts from the 20th July to the 10th August, and which sometimes puts in circulation about 60 million francs in 20 days. English, French, Swiss, Americans, Germans, &c., attend it. S. was founded by the Senonian Gauls, and colonized by the Romans 289 B.C.

SI'NISTER, in Heraldry, the left-hand side of a shield. As shields are supposed to be carried in front of the person, the sinister side is that which covers the bearer's left side, and therefore lies to the spectator's right. See POINTS OF ESCUTCHEON.

SINKING FUND. See FUND.

SINO'PÉ (Turk. *Sinub*), a town of Asiatic Turkey, province of Anatolia, on the southern side of a little promontory running eastward into the Black Sea, 80 miles north-west of Samsun. S., which is defended by some half-ruined fortifications, possesses a dock-yard, and naval arsenal; exports timber, dried fruits, tobacco, bay-leaves, and oil, and has a population of from 8000 to 10,000 souls. The bay of S., which affords the finest anchorage for ships along the whole northern coast of Asiatic Turkey, was the scene of a bloody naval engagement, or rather massacre, 30th November 1853, when a Turkish squadron of 13 ships was suddenly attacked and destroyed by the Russian fleet.—Of the ancient city of S., which was founded by a colony of Milesian Greeks, and, for 200 years after the Peloponnesian war, was almost the mistress of the Euxine, numerous ruins still exist, 'friezes, hundreds of Corinthian columns, capitals, sculptures, inscriptions, and even statues, built up into the walls of its picturesque Byzantine fortifications.' S. was the birthplace of Diogenes the cynic.

SI'NOPLE, in Heraldry (q. v.), the same as Vert.

SI'NTER, the name given by German mineralogists to those rocks which are precipitated in a crystalline form from mineral waters. They are of recent date, belonging in fact to the strata at present in course of formation. S. is of various forms, kidney-shaped, knotted, tuberous, botryoidal, tubular, stalactitic, shrub-like, or pronged, and is occasionally distinguished by its chief component, as Calcareous S., Flint or Quartz S., Iron S., &c. Calcareous S., which is a variety of carbonate of lime, composed of concentric plane parallel layers, appears under various forms; it is deposited with extraordinary rapidity by many springs, a peculiarity frequently made use of to obtain the incrustation of objects with a coating of this substance. Quartz S. is mostly found in intermittent hot springs, as in the Geysers (q. v.) of Iceland. Iron S. occurs in old mines, and in coal-beds, where it is formed from iron pyrites through the agency of the atmosphere. The tubular conglomeration of grains of sand half-melted by lightning (*blitz*) is also known as Blitz-S., or Fulgurite (q. v.).

SI'NUS (Lat. a bend or hollow) has two significations in Anatomy, and one in Surgery. The cells or cavities contained in certain bones—as the frontal, ethmoid, sphenoid, and superior maxillary—receive this designation. The frontal sinuses are two irregular cavities extending upwards and outwards, from their openings on each side of the nasal spine, between the inner and outer layers of the skull, and separated from one another by a thin bony septum. They give rise to the prominences above the root of the nose called the nasal eminences. They are not developed till after puberty, and vary considerably in size, being usually larger in men than in women and young persons, in consequence of the greater prominence of the superciliary ridges in the former. When very much developed, they give a receding appearance to the forehead.

They are larger in Europeans than in negroes, and are very imperfectly developed in the Australians, whose peculiar want of vocal resonance is apparently due to this deficiency. They communicate on each side with the upper part of the nostril by a funnel-shaped opening, which transmits a prolongation of mucous membrane to line their interior. These cells are much more highly developed in certain mammals and birds than in man. Professor Owen observes that 'they extend backwards over the top of the skull in the ruminant and some other quadrupeds, and penetrate the cores of the horns in oxen, sheep, and a few antelopes. The most remarkable development of air-cells in the mammalian class is presented by the elephant; the intellectual physiognomy of this huge quadruped being caused, as in the owl, not by the actual capacity of the brain-case, but by the enormous extent of the pneumatic cellular structure between the outer and inner plates of the skull.' The sphenoidal sinuses are two large

irregular cavities, formed, after the period of childhood, in the body of the sphenoid bone. They communicate with the upper part of the nose, from which they receive a layer of mucous membrane. Like the frontal sinuses, they serve to lessen the weight of the skull, and to add to the resonance of the voice. The ethmoid sinuses or cells lie in the lateral masses of the ethmoid bone. They open into the cavities of the nose. Their main use is to diminish the weight of the fore-part of the skull. The superior maxillary sinus commonly known as the *Antrum of Highmore* (the anatomist who first accurately described it) is the largest of the facial sinuses. Its uses are the same as those of the others, and like them, it communicates with the nasal cavities.

The *sinuses of the dura mater* are quite distinct from the above-described bony sinuses; they are irregular channels for the transmission of venous blood, and are formed in the following way. The dura mater consists of two layers—an outer, belonging to the skull; and an inner, belonging to the brain. They can be easily separated in infancy, but in the adult they are blended together for the greater part of their extent. In some places, however, as beneath the sagittal suture (formed by the two parietal bones at the top of the head, and running from before backwards), they are separated on either side of the mesial line, the outer layer being continued beneath the bone, and in contact with it; while the inner one dips inwards, and meeting with the corresponding layer of the opposite side, forms a triangular canal or sinus, which is strengthened at the sides and angles by interlacing bands of fibrous tissue. The sinus whose formation we have thus described is called the superior longitudinal sinus, and the other sinuses are formed in the same way. They are all lodged in the intervals between the great divisions of the brain, and they are so constructed 'that their shape cannot easily be altered by any external pressure; consequently, the flow of blood through them cannot be impeded by the pulsations or pressure of the brain, in the varying positions of the body. The tense, unyielding character of their walls, moreover, does not admit of either collapse or distention; hence, they must be equally full at all times, and must exert a uniform pressure on the brain.'—Humphry *On The Human Skeleton*, p. 200.

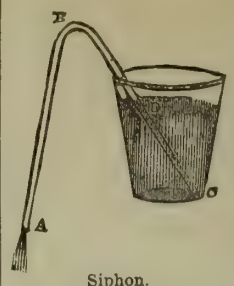
In Surgery, the term *sinus* is nearly equivalent to *Fistula* (q. v.).

SION, a small town of Switzerland, capital of the canton of Valais, in a picturesque situation on the right bank of the Rhone, 18 miles north-east of Martigny by the Simplon Railway. It is defended by walls, towers, and a ditch, and contains a large cathedral, a handsome Gothic town-house, a Jesuit's convent, and an ancient prison. On the north of the town is a lofty rock, divided into two peaks by a deeply-cut ravine. On the highest peak is the ruined castle of Tourbillon, built in 1294; on the other, the castle of Valeria, now used as a seminary. An excellent wine, called Malvoise, is made here. S. is called *Civitas Sedunorum* in a still existing inscription in honor of Augustus, to be seen in the cathedral; in the middle ages it was named *Sedunum*. Pop. (1870) 4895.

SIOU'T, also *Es-Sioût*, and *Osiût*, the chief city of Upper Egypt, stands near the western bank of the Nile, and is 200 miles in direct line south of Cairo. It has several fine mosques, bazaars almost as well furnished as those of the capital, some good baths, and one or two well-built houses. S. manufactures great quantities of the best pipe-bowls. It is the residence of the governor of Upper Egypt; the resort of the caravans from Darfur, that come by the way of the Great Oasis, and until recently was the principal seat of the Egyptian slave-trade. Pop. about 25,000. S. is built on the site of the ancient Lycopolis, but few remains of the Græco-Egyptian city are extant. From the neighboring heights of the Libyan mountains, which contain numerous rock sepulchres, the view over the valley of the Nile is, in the opinion of Lepsius, the finest in Egypt.

SIOU'X, a tribe of North American Indians, calling themselves also Dacotahs, inhabiting Dacotah territory. They are a brave and warlike people, generally at war with the Chippeways. Formerly they numbered 30,000, and counted 7000 warriors; at present their whole number is estimated at 23,250. Roman Catholic missions were established among them 200 years ago, and Presbyterian missions recently. The S. are more advanced towards civilization than any tribe of the North-west.

SI'PHON is a tube bent so that the two legs are either parallel, or incline at an acute angle, and is employed to draw off liquids from vessels which it is not convenient or desirable to move. If the end of the short leg of a siphon be plunged into the liquid, and the other leg be suffered to hang outside the vessel, then, whenever the siphon is exhausted of air (a process which can be performed by suction by the mouth or a pump, or by filling the tube with the liquid it is employed to decant, and keeping it so filled till it is placed in its proper position), the liquid will at once flow out of the vessel through the tube, and continue to do so either till it falls below the level of the outside end, or till the inside end ceases to be immersed. The principle of this simple and efficient instrument is easy of explanation: let ABC (fig.) be a siphon with one leg, BC, partially immersed in liquid, and suppose the whole siphon filled with the same liquid; then at A we have the pressure of the atmosphere acting upwards into the tube in opposition to the pressure of the liquid in the leg BA; at C we have the pressure of the atmosphere (transmitted through the liquid), and the pressure of the liquid in the vessel outside (which balances an equal height of liquid inside) the tube, acting upwards into the tube in opposition to the pressure downwards of the liquid in the leg BC.



Siphon.

The effective pressures inwards at A and C are, respectively, the atmospheric pressure less by the pressure of the liquid in BA, and the atmospheric pressure less by the pressure of the liquid in BD; and as the latter of these two is the greater, it overcomes the other, forces the liquid in the tube out at A, and that in the vessel into the tube at C, the process continuing till the liquid falls to the level of C (when air is admitted), or of A (when the two pressures become equal). It is evident from the above explanation that when A is on or above the level of D, the surface of the fluid, there can be no flow through the tube; also, that it is quite immaterial whether the longer or the shorter leg be immersed, if only A be below the level of D. If the bend of the siphon be 33 feet for water, or 30 inches for mercury, above D, the pressure at C, which produces the action of the siphon, becomes the weight of the atmosphere, diminished by an equal weight of a column of fluid, in which case the resulting pressure is zero, and there is no flow through the tube. The flow increases in rapidity and force as the difference of level between D and A increases, and as the difference of level between D and B diminishes. Many siphons have a suction-pump permanently attached to the end of the outer leg for the purpose of exhausting the air inside. Another variety is the *Wurtemberg siphon*, which has two equal legs, the extremities of which are bent upwards so that when the siphon is once filled with fluid, it remains full, and is always ready for use.

SIPHONO'STOMA. See FISH-LOUSE.

SIPHONOSTO'MATA, a large group of gasteropodous molluscs, of the order *Pectinibranchiata*, having the mantle prolonged into a siphon, by which the water enters the gill-chamber. The shell is spiral, the aperture notched or produced into a canal in front, often much produced. To this group belong the families *Cypræidæ* (cowries, &c.), *Volutidæ*, *Buccinidæ* (whelks, &c.), *Muricidæ*, and *Strombidæ*. They are almost all carnivorous, and move about with considerable activity.

SIPU'NCULUS, a genus of *Echinodermata*, giving its name to a family, *Sipunculaceæ*, and to an order, *Sipunculidæ*. The *Sipunculidæ*, although ranked among the *Radiata*, and having the essential characters of that division of the animal kingdom, resemble the *Annelida* in form, general appearance, motions, and habits, as well as in their softer covering, which is leathery and

Sipunculus Bernhardus:

1, Sipunculus alive in a periwinkle shell, with the upper part of the shell broken away to show the animal's body; 2, S. freed from its shell with the trunk retracted; 3, S. with all its parts expanded, as when preserved in spirits.—From Forbes's *British Star-fishes.*

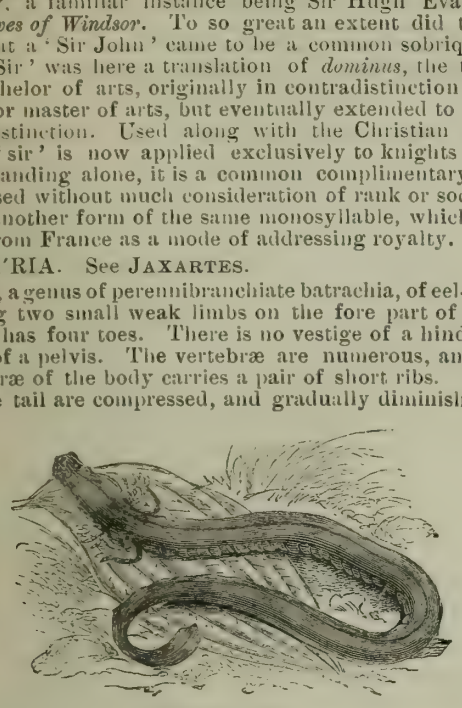
not calcareous, and in the absence of calcareous spines. The *Sipunculaceæ* have a retractile proboscis, around the extremity of which is a circle of tentacula, and at the base of it the anus. In the genus *Sipunculus* the proboscis is long and cylindrical, with a circle of tentacula near its extremity. *S. Bernhardus* is common on many parts of the British coast, living at the bottom of the sea, at a depth of from ten to thirty fathoms, and occupying as a habitation the shell of some univalve mollusc, for the protection of its soft wormlike body. It secures the entrance of the shell

by a plaster-work of sand, leaving only a hole wide enough for the protrusion of its long flexible proboscis. Other species, instead of sheltering themselves in shells, burrow in the sand. Among these is the EDIBLE S. (*S. edulis*), much esteemed by the Chinese.

SIR (Fr. *sieur* and *sire*, contracted from *seigneur;* from Lat. *senior*, elder), a term originally corresponding to *dominus* in Latin, and which has come, when appended to the Christian name and surname, to be the distinctive mark of knighthood. It was at one time the practice to use the same title in addressing the clergy, a familiar instance being Sir Hugh Evans in the *Merry Wives of Windsor*. To so great an extent did this usage obtain, that a 'Sir John' came to be a common sobriquet for a priest. 'Sir' was here a translation of *dominus*, the term used for a bachelor of arts, originally in contradistinction from the *magister*, or master of arts, but eventually extended to the clergy without distinction. Used along with the Christian name and surname 'sir' is now applied exclusively to knights and baronets. Standing alone, it is a common complimentary mode of address used without much consideration of rank or social status. 'Sire' is another form of the same monosyllable, which has been adopted from France as a mode of addressing royalty.

SIR-DA'RIA. See JAXARTES.

SI'REN, a genus of perennibranchiate batrachia, of eel-like form, but having two small weak limbs on the fore part of the body. Each foot has four toes. There is no vestige of a hinder pair of feet, nor of a pelvis. The vertebræ are numerous, and each of the vertebræ of the body carries a pair of short ribs. The vertebræ of the tail are compressed, and gradually diminish in size to



Siren Lacertinus.

its tip. The head is flattened, the mouth not deeply cleft, the muzzle blunt, the eyes very small, the ears concealed. The teeth are small; the lower jaw is furnished with them all round; there are none on the upper jaw, but two rows on each side of the palate. On each side of the neck are three gills, each consisting of a short fleshy stalk, supporting a beautiful fringe-like tuft, and water passes from the mouth to the gills through openings as in fishes. But the S. has also lungs, which are long bags, one on each side, beginning behind the heart, and extending almost the whole length of the abdomen. The blood discs are remarkable for their large size, exceeding even those of the proteus. The sirens inhabit the swamps of the Carolinas and other southern parts of North America. They live chiefly in the mud, but sometimes are to be seen swimming in the water, and even make excursions on moist ground. They feed on worms and insects. *S. lacertina* grows to the length of about three feet. Its color is blackish. The tail is compressed. The other species are smaller.

SIRÈNE, an instrument for the production of musical sounds in such a manner as to enable us to discover their ultimate nature. The simplest form of sirène is represented in section in fig. 1. A vane consisting of four equal plates, attached to a delicately supported axle, is so fixed in a metal tube as to close it almost completely (with the help of stops P, P), when either pair of plates is perpendicular to the axis of the tube. When air is forced from a bellows through the pipe A, it gives the vane a rotation in the direction indicated by the arrow, and thus produces a current which is interrupted four times in each revolution. In other words, four times in each revolution the air escapes freely, giving rise to a sound. While the vane revolves slowly, the ear distinguishes these successive puffs; but when the revolutions are more numerous than about five per second, the successive puffs cannot be distinguished, and the recurrent sounds are merged into a uniform note, whose pitch rises (i. e., it becomes more and more shrill) the faster the vane revolves. Such an instrument works well when driven by water instead of air. What it shows is, that musical sounds consist of the repetition, at equal very small intervals of time, of some definite noise. By turning the vane by means of a train of wheels, so as to give it a definite rate of rotation, the number of such repetitions per second, necessary for the production of a given musical note, may be measured.

But the sirène of Cagniard de la Tour is much more valuable for such a purpose, as it counts for itself the number of repetitions per second. In principle, it is identical with the simpler instrument just described; but the details of its construction are different. It consists essentially of two circular discs, the upper of which is free to revolve so as almost to touch the lower (fig. 2). In each a series of holes is cut, arranged at equal distances in a circle about its axis. Through the holes in the lower (fixed) plate, streams of air are admitted from a bellows, and pass through the corresponding holes in the upper (movable) plate, when the

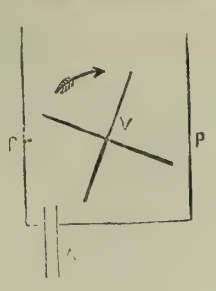


Fig. 1.

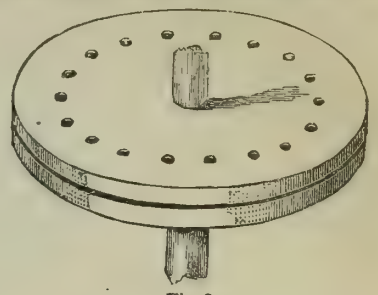


Fig. 2.

pairs of holes are superposed; but are checked when the upper plate is turned a little, readmitted when the plate turns a little further, and so on. The holes are pierced *obliquely* through the upper plate, so that the issuing stream makes it turn about its axis. The sounds given by this instrument are exceedingly pure (see SOUND) like those of the flute or tuning-fork. The axis of the upper plate carries an endless screw, which turns a light train of wheels (with dials) resembling that of a gas meter, so that when, by proper adjustment of the pressure in the bellows, the instrument gives steadily some definite note, we may observe the number of turns in any number of minutes by watch. The number of puffs is obviously to be found from this by multiplying by the number of holes in the plate, since during one turn any hole in the upper plate has been opposite each of those in the lower plate in succession. Thus we find the number of puffs per second necessary to the formation of any given musical note.

More complex forms, such as Helmholtz's double sirène, have been devised for more recondite branches of the science. See SOUND.

SI'RENS (Gr. *seirenes*, the 'entanglers,' probably from *seira*, 'a cord' or 'string') figure in Greek mythology as young maidens, who sat on the shores of a certain island or promontory near the south-western coast of Italy, and sang with bewitching sweetness songs that allured the passing sailor to draw near, but only to meet with death. Homer speaks of them in the plural, but does not specify their number; later writers mention two and three by name, and assign them various genealogies. Their tenure of life was dependent on the successful exercise of their charms. If any seaman could resist the enticements of their magic music, they were doomed, but Ulysses or the Argonauts alone succeeded in doing so. It is related by Homer, in the *Odyssey*, that when the former in the course of his wanderings approached their perilous home, he, by the advice of the sorceress Circe, stuffed the ears of his companions with wax, and lashed himself to a mast, until he had sailed out of hearing of the fatal songs. Others say that it was the Argonauts who got safely past, owing to the superior enchantment of Orpheus's singing, whereupon the S. threw themselves into the sea, and were transformed into rocks. The Latin poets give them wings, and in works of art they are often represented as birds with the faces of virgins, and are provided with musical instruments. There is obviously a close resemblance between the Mermaid (q. v.) of northern mythology, and these Græco-Mediterranean Sirens. The Loreley of the Rhine is only a river-siren, though a more exquisite enchantress than ever Greek fancy conceived.

SIRINAGUR. See SERINAGUR.

SIR-I-PUL, a town of Afghan Turkestan, 45 miles south-west from Balkh, in lat. 36° 21′ N., and long. 66° 28′ E., on a river which loses itself without reaching the Jihoon. It is the capital of an Uzbek chief. Pop. 18,000.

SI'RIUS, otherwise called *Canicula*, or the *Dogstar*, is a star of the first magnitude, the brightest in the heavens, and is situated in the constellation of *Canis Major*, or the 'Great Dog.' It is about 123 billions of miles distant from the earth. See STARS. It has long been known to possess a 'proper motion' (i. e., an independent progressive motion), which was for a time believed to be in a straight line, but has now been shown to consist of an undulatory progressive motion on each side of a middle line. This motion was investigated by Professor Peters of the Pulkowa Observatory, Russia, on the supposition that its anomalous character was produced by the attraction of some unseen neighbor, and his calculations being completed and verified (on this supposition) by Mr. Stafford of Washington, the distance of S. from the center

of gravity of both was determined to be 1495 millions of miles. In January 1862, Mr. Alvan Clark of New York, chancing to observe S. through a powerful telescope, detected a minute star (which had never before been observed) situated at an angular distance of 7″ from S., representing about 4300 millions of miles, and it is generally believed that this is the disturber in question. By photometric measurement it has been shown that, supposing the intensity of the sun's light for unit of surface to equal that of S., it would require 400 suns at the distance of S. to send us the light which that star does; and our sun at the distance of S. would appear less than a star of the sixth magnitude, and be invisible to the naked eye. The Egyptians called this star Sothis, and at one time its 'heliacal rising' (q. v.) was a sure forerunner of the rising of the Nile; while among the Romans it was considered as a star of evil omen, whose appearance above the horizon coincided with (or even caused the unhealthy and oppressive heats of summer. Hence the origin of the various superstitions regarding the Dog Days (q. v.), many of which are still current.—The term 'dog star' was also applied to Procyon, a bright star in *Canis Minor*, whose heliacal rising differs only by a few days from that of Sirius.

SIRO'CCO. See SIMOOM.

SISMONDI, JEAN CHARLES LEONARD DE, a distinguished historian of Italian descent, was born at Geneva on 9th May 1773. He received his education as a boy at the 'College' or high school of his native town. At the due age, he was removed to the Auditoire, or university. Before he had completed his education, the pecuniary reverses of his father made it necessary for S. to do something for his own maintenance, for which purpose he entered the counting-house of the eminent firm of Eynard and Co. of Lyon. Hateful as mercantile pursuits seem to have been to him, he applied himself to his drudgery with all diligence. He became a thoroughly good clerk, and in after life he acknowledged that the practical training had been of incalculable benefit to him. The French revolution sent S. back to Geneva, but the storm following, he took refuge in England, along with his family. Homesickness soon sent them back to Geneva, but the continuance of political trouble made it impossible to remain there long. In 1795, they bought a small farm near Pescia, in Tuscany, where their narrow circumstances rendered it necessary for S. almost literally to put his hand to the plough. He had now, however, leisure for literature. In 1798, he began to collect materials for his *History of the Italian Republics*. In 1803, appeared a work on political economy, *De la Richesse Commerciale*, in which he writes like a decided follower of Adam Smith, though at a later period, in his *Nouveaux Principes d'Economie Politique* (1819), he abandoned the wiser views of his youth. In consequence, a professorship in this science was in the same year offered to him in the university of Wilna, which he declined. It was in history, however, that his literary forte lay. The 16 vols. of his *Histoire des Républiques Italiennes*, published between 1807 and 1818, placed him in the first rank among contemporary historians, and brought him praise from the most distinguished men in France and Germany.

The events of the Hundred Days occasioned one of the most memorable passages in the life of S.—his interview with Napoleon. In 1813 appeared his *Littérature du Midi de l'Europe* ('Literature of the South of Europe,' Eng. by Roscoe, frequently reprinted). In 1819, he began his best and greatest work, the *Histoire des Français*, with which he was occupied until his death. On the 19th April of the same year he married Miss Allen, an English lady, whom he had previously met in Italy. This marriage was followed by many happy years during which S. resided at Geneva, making frequent visits to Pescia and England. His latter days were, however, darkened by the troubles of his native city, in whose politics he took a keen interest. He died 25th June 1842. S. has contributed more to historical literature than any other writer of his time, and the labor which he bestowed on his works has never been surpassed. 'Nine times,' he says, 'have I traversed Italy, and I have visited every place which has been the scene of any great historical event.' For twenty years he worked habitually eight hours a day. Both as a worker and as a thinker, he was thoroughly conscientious. His mind was to the last open to truth; neither fettered by prejudice nor blinded by self-conceit. At the same time, no one has surpassed him in tenacity of purpose, nor in energy in following it out. His feelings on religious questions were especially intense. Having on one occasion heard a sermon in an English church on eternal punishment, he vowed never again to enter another church holding the same creed; and 'never to contribute to spread what the English call their Reformation; for, by its side Romanism is a religion of mercy and peace.' His private character was singularly amiable and benevolent. His whole career is a noble one, full of interest and instruction.—See *Quarterly Review*, September 1843; *Vie et Travaux de Sismondi* (Paris, 1845); see also his Correspondence with Mademoiselle de St. Aulaire (Paris, 1863); and his *Letters Inédites à Madame d'Albany* (1864).

SISTERS OF CHARITY. See BROTHERS AND SISTERS OF CHARITY.

SI'STOVA, an important commercial town of the principality of Bulgaria, on the south bank of the Danube, about 35 miles up the river from Rustchuk. It has several mosques, an ancient and strong castle, where the 'peace of Sistova' between Austria and Turkey was concluded in 1791; manufactures cottons and leather, and carries on an active river-trade. Pop. (1881) 11,438.

S'ISUPALA is in Hindu legend the sovereign of Chedi, a country situated in Central India, who was the enemy of Krishn'a (q. v.), and ultimately was slain by him. The history of this enmity, and the death of S., are the subject of the *S'is'upâlabadha* of Mâgha. See SANSCRIT LITERATURE.

SI'SYPHUS, a personage of Greek mythology, whom later accounts make to be the father of Odysseus. He is said to have been founder and king of Ephyra—afterwards Corinth—and both he and his whole house were notorious for their wickedness. He is, however, best known for the punishment which he suffered in the lower world, either for treachery towards the gods, or for his wholesale robbery of travelers, whom, at the same time, he murdered with a huge block of stone. He was condemned to roll an immense boulder from the bottom to the summit of a hill, which, whenever it reached the top, rolled down again, and the task of S. had to be begun anew.

SITA is, in Hindu Mythology, the daughter of Janaka, a king of Mithilâ, and the wife of Râma. See VISHN'U. The word means literally 'furrow,' as she was not born in the usual sense of this word, but arose from a furrow when her father was ploughing the ground, whence she is also called *Pârthivî* (from *pr'thivî*, the earth). Her history is related in the RAMAYAN'A (q. v.).

SI''TKA, or NEW ARCHANGEL, the principal settlement in the territory of Alaska, is a small place of about 2000 inhabitants, on the west coast of the island of Sitka or Baranov, the largest island in the group known as George III.'s Archipelago. Lat. 57° 3′ N., long. 135° 18′ W. S. was the residence of the governor of Russian America, and has a magnetic observatory. Here the chief establishments of the Russian-American Company, incorporated 1799, for fishing and hunting fur-bearing animals, were situated. The Company employed 50 ships, and about 850 men, but their privileges expired in 1863.

SITOPHO'BIA, or SITOMA'NIA. The repugnance to or refusal of food may range from mere impairment or loss of appetite, or hysterical antipathy to particular viands, to total and prolonged abstinence, as a symptom of delusion or delirium. In the insane, food has been consistently refused for years. During this time, the system was, of course (see FASTING), sustained by compulsory alimentation. The causes of such a course are generally local disease in the organs of digestion, creating disgust and loathing towards food, and associating suffering with the process of nourishment; the fear of death, or the desire for death. The motives assigned for such feelings or resolution vary, of course, as the morbid condition may affect the stomach or the brain; and, according to the mental state predominating, suicide may be courted, or poisoning, drugging, or pollution of aliment may be dreaded. The throat or bowels may be imagined to be hermetically sealed; God or Satan may have imposed abstinence; the body is dead, inanimate, or belongs to another.

Absurd as such principles of action may be, they prove inexpugnable to persuasion, or to the pangs of hunger and exhaustion, and require a special course of treatment. The determination may be exorcised by medicine; it may be overcome by commands, threats, bribes; it may be evaded by giving eggs, cocoanuts, milk from the cow, and other substances, into which mercury, arsenic, &c., cannot well be introduced; or it may be defeated by placing food in the stomach through the instrumentality of the stomach-pump. There have been epidemics of maniacal abstinence.—Chipley, *American Journal of Insanity*, July 1859; Browne, *Report Crichton Institution*, 1854.

SI''TTA. See NUT-HATCH.

S'IVA (a Sanscrit word, literally meaning happy, auspicious) is the name of the third god of the Hindu Trimûrti (q. v.) or triad, in which he represents the principle of destruction. The name S., as that of a deity, is unknown in the Vedic hymns, but established as such in the epic poems, *Purân'as* and *Tantras*. The worshipers of S. (see S'AIVAS) assigned to him the first place in the Trimûrti; and to them he is not only the chief deity but the deity which comprises in itself all other deities. Thus, in the *S'iva-Purân'a* (see PURAN'A), he is addressed as Brahma, Vishn'u, Indra, Varun'a, as the sun and the moon, as earth, fire, water, wind, &c.; but even in the Purân'as relating to Vishn'u, his power is exalted in praise, and he is addressed with the utmost awe. The symbol of S. is the *Linga* (q. v.), emblematic of creation, which follows destruction. From each of his numerous attributes or characteristics he derives a name or epithet. He has five heads (hence his name *Panchânana*, &c., the five-faced);

three eyes (hence his name, *Trinetra*, &c., the three-eyed), one of which is on his forehead, and indicates his power of contemplation; and in the middle of his forehead he wears a crescent.

His hair is clotted together, and brought over the head so as to project like a horn from the forehead. On his head he carries the Ganges, whose course he intercepted by his hair, when this river descended from heaven, so as to enable the earth to bear its fall (hence his name, *Gangâdhara*, &c., the Ganges-bearer). Round his neck he carries a garland of human skulls; and his throat is dark blue, from the poison which he swallowed when it emerged from the ocean, churned by the gods for the attainment of the beverage of immortality, and threatened to destroy the world. In his hands he holds the trident, a club or pole, armed at the upper end with transverse pieces, representing the breastbone and ribs adjoining, and surmounted by a skull and one or two human heads. His weapons are the *Khinkhira*, which is not described, a bow called *Ajakava*, or *Ajagava*, a thunderbolt, and an axe. As the destroyer of the world, he is also called *Kâla* (Time or Death), and represented as of black color. One of his representations is also half-male and half-female, emblematic of the indissoluble unity of the creative principle (hence his name, *Ardhanârîs'a*, the half-female-lord). He is clothed in a deer-skin; or he also holds a deer in one of his hands; or he sits on a tiger-skin, or is clothed in it. When riding, his vehicle is the bull Nandi, whom he also carries as an emblem in his banner. He resides on the wonderful mount Kailâsa, the northern peak of the Himalaya, where he also rules over the north-east quarter. His principal wife is *Durgâ* or *Umâ* (q. v.); his sons are GANES'A and KARTTIKEYA (q. v.). One of his principal attendants is *Tan'du*, who is one of the original teachers of the arts of dancing and mimicry, whence S. is the patron of the dancers, and is called *Nat'es'wara* (lord of the dancers). Besides Tan'du, a host of other attendants and companions, together with demons and other beings surrounding him, are named by the Purân'as.

Amongst the principal achievements of this god is his conflict with the god Brahma, who was originally possessed of five heads, but lost one through exciting the anger of S.; for the fifth head of Brahma once disrespectfully addressing S., and even challenging his power, S. immediately cut off the offending member with the nail of his left thumb. A similar penalty he inflicted on *Daksha*, his father-in-law, who once performed a great sacrifice, but neither invited his daughter Satî nor her husband Si'va. S., nevertheless, appeared at the sacrifice; but when Satî, offended at the reception she met with, threw herself into the sacrificial flames, S. cut off the head of Daksha; and Daksha would have remained headless, had not the gods interfered in his favor with S., who, out of compassion, replaced his head by that of a ram. Besides these feats, he killed several demons.—*Ruru, Andhaka, Tripura;* and he also reduced to ashes *Kâma* (the god of love), who, at the instigation of the gods, undertook to excite the desire of S. to procreate a son, but was indiscreet enough to choose for this purpose a time when S. was engaged in fierce austerities (see KAMA). S. is especially worshiped under the symbol of the Linga; but there are periods at which homage is paid to him also, under other forms, corresponding with the description given above. Hindu mythology knows, properly speaking, no incarnations of S. like those of Vishn'u; in some writings, however, some of his forms, especially that called Bhairava, and that called Virabhadra, are considered to be his sons or incarnations. S., like Vishn'u (q. v.), has a thousand names by which he is addressed; some derived from his exterior attributes have been mentioned before; among the rest, the principal are *Îsa* or *Is'wara* (lord); *Mahes'a* or *Mahes'wara* (the great lord); *S'ankara* (the conferrer of happiness); *Rudra* (the terrible), or *Mahârudra* (the very terrible); and *Mahâdeva* (the great god). For his worshipers, see S'AIVAS.

SI'VAS, a city of Asiatic Turkey, capital of the pashalic of the same name, is situated on the Kizil Irmak (anc. *Halys*), 60 miles south-south-east of Tokat. S. covers a large extent of ground, is well built, has numerous old mosques, khans, gardens, and excellent bazaars, manufactures coarse woollens, and carries on a considerable transit trade. Pop. 25,000, of whom about 5000 are Armenians, the rest Turks. S. is built on the site of the ancient *Sebasteia*, from which it derives its name.

SIVA'SH, or PUTRID SEA. See CRIMEA.

SIVATHE'RIUM (*Siva*, an Indian god; and Gr. *therion*, a wild beast), a remarkable genus of extinct mammals, found in the Miocene strata of the Sewalik Hills in Northern India. It had a large skull, nearly as long as that of an elephant, supported on a neck little short of that of a giraffe, but much stronger. The face was short, and the nasal bones were prolonged into a pointed arch above the external nostrils, indicating the existence of a trunk or proboscis, an organ unknown among the Ruminantia to which it belonged. Like the existing 4-horned antelope of India, it had two small diverging horns, rising from the brow between the orbits, and two large, probably palmated horns, further back. In general appearance, it resembled a huge antelope. The remains of two species have been described by Falconer and Cautley.

SIX ARTICLES, STATUTE OF, an enactment of the 33d year of Henry VIII., passed January 7, 1541, and commonly called the Bloody Statute. The object of this statute was to compel, from all the subjects of the crown, the uniform profession of certain doctrines, six in number, which are carefully recited in the act. These doctrines are (1), the Real Presence of Christ in the Eucharist, and Transubstantiation; (2), the sufficiency of communion in one kind only; (3), the unlawfulness of the marriage of priests; (4), the obligation of vows of chastity; (5), the propriety of retaining private masses; (6), the expediency and necessity of auricular confession. The penalties of this act exceeded in severity almost every precedent, at least in England, and they are specially severe against impugners of the first article, all of whom, whether they dispute, write, or preach against it, are to suffer death as heretics, with forfeiture of all their goods to the crown, and without being allowed to abjure the error. With regard to the remaining four articles; the usual penalty of felony is attached to the crime of publicly preaching against them; private impugners are liable for the first offence to imprisonment at the king's pleasure, for the second, to death; and the same, or nearly the same penalties are enacted against priests or nuns marrying or cohabiting, and against persons contemptuously refusing to confess at the prescribed times, or to receive the sacraments. The act at first was enforced with great severity, but it was somewhat mitigated in 1544, and was finally repealed in 1549.

SIXTUS, the name of five popes, of whom two call for particular notice, Sixtus IV. and Sixtus V. The former (originally named Francesco della Rovere), born July 22, 1414, was a native of a small village near Savona, and a member of a very humble family. He was a scholar of the celebrated Cardinal Bessarion, and became a member of the Franciscan order, in which capacity he obtained the highest reputation throughout Italy as a preacher. On the death of Paul II. in 1471, Rovere was elected to the Roman see. The domestic government of S. has been strongly condemned. His inordinate partiality to his relatives exhausted the papal treasury, and led to many questionable exactions, and to gross abuses in the dispensation of church patronage. His excessive facility, too, in dispensing favors, led to his not unfrequently conferring the same benefice on more than one individual. But the worst imputation upon the memory of his pontificate arises in connection with the political affairs of Florence, and especially with the conspiracy against the Medici family, known in history as the Pazzi conspiracy. In the last act of this nefarious plot, the murder of Giuliano in the church at Florence, S.'s nephew, Riasio, was present, and when, after its failure, the leaders, including the Archbishop of Pisa, were executed, S. excommunicated the Duke Lorenzo and all the magistrates of the city. Although this censure was passed professedly for the violation of the immunities of the church in putting an ecclesiastic to death, yet it has drawn upon S. the suspicion of complicity, or at least of connivance after the fact; and has led to much controversy among historians.

The necessities of defence against the Turkish invasion embarrassed still further the finances of the pope, and even the Catholic historians deplore the lengths to which ecclesiastical exactions and the simoniacal distribution of benefices were carried in the latter years of Sixtus. In many respects, nevertheless, his administration was liberal and public spirited. He did much to foster learning and to encourage art. Under him, the Vatican library continued to increase, and he contributed notably to the improvement and decoration of the city. In 1482 he entered into an alliance with the Venetians against the Duke of Ferrara, which led to a general Italian war, and ended in a dissolution of the Venetian alliance, so mortifying to the pope, that his death is said to have been caused by chagrin and mortification, August 13, 1484. —SIXTUS V., in many respects, one of the most remarkable of the modern occupants of the Roman see, originally named Felice Peretti, was born (December 13, 1521) near Montalto, of parents so poor, that his boyhood was spent in the humble occupation of a swineherd. While thus engaged, the boy attracted the notice of a conventual Franciscan father, who procured his admission into the order. He was ordained priest in 1545, and became professor of theology at Siena. His reputation as a preacher led to his being transferred to Rome, where he rose to its first dignities. He accompanied Cardinal Buoncompagno as theologian in his legative mission to Spain (1565); and on the accession of Pius V. to the pontificate, was named cardinal (1570). On the accession of his former patron, Buoncompagno, under the name of Gregory XIII., Cardinal Montalto might have exercised the highest influence, but he lived a retired and mortified life, and was believed to have fallen almost into the decrepitude of age and infirmity.

This appearance was afterwards ascribed by his enemies to the design of concealing his ambitious views; and there is a well-known but apocryphal story of his having, when elected pope on

the death of Gregory in 1585 (April 24), flung aside his crutch, and revealed himself to the astonished cardinals in the full vigor of his physical strength and his moral character. His pontificate, however, was a most active and energetic one, and was marked by vigorous measures of improvement in every department of administration, ecclesiastical as well as civil. His first care was to repress the prevailing license and disorder of the city of Rome, and of the papal states generally, by effectually breaking up and exterminating the lawless bands of outlaws by which both were infested. His administration, both in this matter and in the repression of immorality, was rigorous perhaps to the extreme of cruelty; but the evil was one which seemed to call for extreme remedies. He reformed the administration of the law, and the disposal of public patronage; and he entered upon numerous and most comprehensive projects for the moral and material improvement of Rome. Many of his great works are still recognizable at Rome under his name, and are popularly remembered as his; among which are the library buildings of the Vatican. A distinguishing characteristic of his administration, too, was its disinterestedness. He steadfastly refused to use his position for the purpose of advancing any of his relatives, or to bestow upon them property or money derived from the public; and by judicious retrenchment he secured within the first years of his short pontificate a surplus of above 5,000,000 of crowns.

It is of course impossible to enter into the details of his foreign policy; it will be enough to say that its great aim was, in the strongest sense of the words, to advance the cause of the Roman Catholic Church in every portion of Christendom, against the Huguenots in France, against the Lutherans in Germany, and against Queen Elizabeth in England. At the same time, he entertained a deep jealousy and apprehension of the designs of Spain; and he resisted persistently the excessively rigorous measures of the Spanish Inquisition as organized under Philip II. His church administration was equally vigorous and energetic. He fixed the number of the Sacred College of Cardinals at 70; and it was under him that the present organization of separate congregations of cardinals for the several departments received some of its most important developments. He published a new edition of the Septuagint, and an edition of the Vulgate, which has become famous from the multiplicity of its errors, subsequently corrected in the edition of Clement VIII. Many of the popular stories regarding him are derived from Gregorio Lete's *Vita di Sisto V.* (2 vols., Lausanne, 1669), a work of no authority. See also Tempesti, *Storia della Vita e Gesti de Sisto V.* (2 vols., Rome, 1754); Lorentz, *Sixtus V. und seine Zeit* (Mainz, 1852); Ranke, *Fürste und Völker von Süd-Europa,* and Von Hübner, *Sixtus V.* (1874).

SI'ZAR (from *size*, in university slang, an allowance of victuals from the buttery—or the smallest quantity of anything which can be bought, a word derived from *assize*, formerly the same as *assess*, to apportion), a name given to an order of students at Cambridge and Dublin universities, who are admitted on easier terms than others. Duties of a somewhat menial kind were originally required to be performed by the sizars, but these have long since gone into disuse. Sizars are not on the foundation, and therefore so long as they remain such, are not eligible for fellowships; but they may at any time become pensioners, and generally sit for scholarships immediately before taking their first degree. If successful, they are on the foundation, and may become candidates for fellowships when they have taken their degree.—At Oxford, there is a similar order of students, denominated Servitors.

SIZE. See GLUE and GELATINE.

SKA'GEN, CAPE, or THE SKAW, the most northerly point of Jutland, Denmark. On it is built a light-house of stone, 67 feet high, the lat. of which is 57° 43′ 8″ N., long. 10° 36′ 5″ E.; and near it is a small town of 1400 inhabitants.

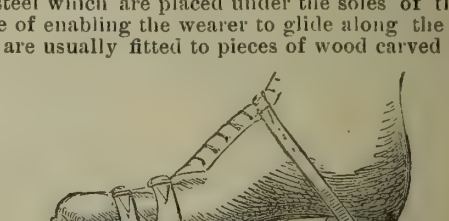
SKA'GER-RACK (' Crooked Strait of Skagen; ' *rack* is probably from the same root as A.-S. *raca*, Ger. *rachen*, throat; thus being equivalent to the Celtic *Kyle* [in Kyles of Bute], Lat. *gula*, English *gully*—is the *Race* of Alderney allied to *Rack?*), an arm of the North Sea (q. v.) lying between Denmark and Norway, and communicating with the Cattegat, is about 150 miles long from west-south-west to east-north-east, and 80 miles broad. The depth is much greater on the Norwegian than on the Danish coast, being on the former about 200 fathoms, while on the latter it varies from 30 to 40 fathoms, increasing towards the center to about 60. When free from violent storms—to which, however, it is very subject—the current runs east on the side next Denmark, and west on that next Norway, the harbors being all on the latter coast.

SKALD (allied to *skill;* the radical sense is, to separate, and hence to discern) signifies, in old Norse, a poet. The name was given specially to that class of poets who exercised their art (*Skálldskapr*) as a vocation requiring a learned education; that is, a knowledge of the construction of verse, and of the enigmatical imagery, roughly shaped out of obscure tradition, to which Scandinavian poets were prone. The great, if not the only aim of the Skaldic poetry was to celebrate the deeds of living warriors or of their ancestors. For this reason, princes attached Skalds to their courts, and competed with each other, by magnificent presents, for the possession of the most skilful minstrels. Very few complete Skaldic poems are extant; but, on the other hand, the multitude of fragments preserved, partly in the younger Edda (q. v.), partly in the Sagas (q. v.), and the Heimskringla (q. v.), is very great. A manuscript of the younger Edda, belonging to the university of Upsala (which has been printed in the *Historia Literaria Islandica* of Einarsen), contains a list of the most celebrated Icelandic and Norwegian Skalds of the 13th c., under the name of *Skálldatal.* The songs relating to the religious and heroic traditions of the North, which are found in the Edda, go back to an earlier time, in which the class or school of ' Skalds,' properly so called, did not yet exist. The authorship of these primitive Eddaic songs is unknown; but they are the sources from which the ' Skalds ' of later times drew much of their inspiration.

SKA'LITZ, or SZAKO'LCZA, a town in the north-west of Hungary, near the borders of Moravia, 47 miles N. of Presburg, on the left bank of the March, with a pop. (1880) of 5715. It is nearly in the form of a square, is surrounded by walls, has several Protestant and Roman Catholic churches, a Franciscan monastery, town-hall, &c., besides large manufactures of cloth. Good wine is produced in the vicinity, and hemp is largely grown.

SKATE, the popular name of several species of Ray (q. v.).—The COMMON S. (*Raia batis*), known in Scotland as the *Blue S.* or *Gray S.*, and in the south of England as the *Tinker*, is plentiful on most parts of the British coasts; the breadth of the body is to its length in the proportion of about four to three; the snout sharp; a slight concavity in the outline between the snout and the extreme lateral angle of the pectoral fin; a short hard tubercle in front of each eye, and another on the inner side of each; a single row of spines commencing on the dorsal ridge near the origin of the ventral fins, and reaching along the tail as far as the first of the two small fins which it bears; the upper parts grayish brown, the belly dusky white with darker lines. It attains a large size, having been known to weigh 200 lbs.—The LONG-NOSED S. (*R. rostrata* or *mucronata*) is remarkable for the elongation and sharpness of the snout. The upper surface is of a light lead color, the lower grayish white. The tail has a row of crooked spines. This species is not uncommon on the British coasts, and attains a large size.—The SHARP-NOSED S. (*R. oxyrhynchus*) has also a very sharp snout, but less elongated. It is thicker in proportion to its other dimensions than any of the other British species, and attains a very great weight. The line of the body from the snout to the extreme lateral expansion is waved. The tail is armed with three rows of spines. The upper surface is of a brown color; the color being lighter than in the other species, this is generally known in Scotland as the *White Skate.*—The FLAPPER S. (*R. intermedia*) is very thin and broad; it has only a line of pointed tubercles on the tail; the upper surface is dark olive green, with numerous white spots. Skates are very voracious. They are often caught by lines, but the greater number of those brought to market are caught by trawl-nets. They are much esteemed for food in most countries, yet on some parts of the British coast they were until recently rejected as worthless.

SKATES AND SKATING. Skates are small keels or blades of iron or steel which are placed under the soles of the feet for the purpose of enabling the wearer to glide along the surface of ice. They are usually fitted to pieces of wood carved into some-



Skate attached to the Foot.

what of a boat-like form, to which straps of leather are adjusted, to enable the skater to attach them firmly to his feet. Of late, in some improved skates, the wood has given way to metallic fittings, which are neater and perhaps preferable; they are, however, liable to rust, and consequently to get out of order. In Britain, skating is a favorite pastime in winter; and in England, and Scotland especially, is carried to a degree of excellence not known in other countries: the skaters study the most graceful curves, and the nicest possible balancing of the body, when going

at great speed. In such countries as Holland and the more northern parts of Europe, skating is used merely as a necessary means of locomotion among the laboring classes.—The name of *roller-skate* has been adopted for a frame for the foot, fitted on small wheels or rollers. On a specially prepared surface, such as an asphalted floor, these roller-skates permit a smooth, gliding motion somewhat analogous to that of skating. Places for this amusement (called *rinking*) have of late years sprung up all over the country, and are known as *skating-rinks*.

SKE'LETON (Gr. *skeletos*, dry) is the term applied in anatomy to designate the hard parts or framework of animals. In the invertebrate animals, the skeleton, except in the case of certain corals, is tegumentary or dermal, forming the outer hard and protective covering, as in the *Echinodermata*, *Mollusca*, and *Crustacea;* and like the epirdermis and its appendages, is non-vascular, and can only be increased by additions to its edges. This hard insensible covering serves to protect the animal from hurtful external influences, and to afford fixed points of attachment to the muscles which move the body and limbs; the muscles, however, always lying interior to the skeleton, and not clothing it, as we see in the vertebrata. We scarcely ever observe, amongst the invertebrata, that the skeleton bears any definite relation to the nervous system, which is merely protected by it to the same extent as the other soft tissues. Moreover, in none of these animals are the hard parts composed of true bone.

In the vertebrate animals, although we find occasional cases of bone being deposited in various parts of the body, its most constant position is around the central masses of the nervous and vascular systems, with rays extending thence into the middle of chief muscular masses, forming the bases of the limbs. 'Portions of bone are also developed, to protect and otherwise subserve the organs of the senses, and in some species are found encasing mucus-ducts, and buried in the substance of certain viscera—as, e. g., the heart in the bullock and some other large quadrupeds. Strong membranes, called "aponeurotic," and certain leaders or tendons, become bony in some animals—as, e. g., the "tentorium" in the cat, the temporal fascia in the turtle, the leaders in the leg-muscles in the turkey, the nuchal ligament in the mole, and certain tendons in the abdominal muscles of the kangaroo, which, so ossified, are called the marsupial bones.'—Owen's *Structure of the Skeleton*, p. 163. In some animals (e. g., the sturgeon, the crocodile, the armadillo), bony matter accumulates upon or near to the surface of the body, rendering the skin in some cases absolutely ball-proof.

The following is Owen's theory of the vertebrate skeleton (which, however, is not supported by embryological research—see end of article). The superficial or skin bones constitute the 'dermo-skeleton' (Gr. *derma*, skin); the deep-seated bones in relation to the nervous axis and locomotion, form the 'neuro-skeleton' (Gr. *neuron*, nerve); the bones connected with the sense-organs and viscera form the 'splanchno-skeleton' (Gr. *splanchnon*, a viscus or inward part); while those developed in tendons, ligaments, and aponeuroses are termed the 'sclero-skeleton' (Gr. *skleros*, hard). In the arrangement of the various parts of the dermo-, splanchno-, and sclero-skeletons, no definite plan or law can be detected. The definite end or purpose gained by the position of the bony plates, cases, or rods, belonging to these skeletons, is usually easily seen to be connected with the habits and well-being of the animals in which they occur, but the parts cannot be referred to one general type, as in the case of the neuro-skeleton. We will follow Professor Owen in taking the sturgeon and armadillo as examples of a dermo-skeleton, and shall condense the remarks which he makes on their outer covering. The head of the sturgeon is defended by a case of superficial bony plates, and the body by five longitudinal rows of similar plates, one extending along the mid-line of the back, one along each side of the body, and two along the belly, between the ventral and pectoral fins. These fishes habitually swim low and grovel along the bottom, turning up the mud and sand with their pig-like snout, and feeding on the decomposing organic substances carried down by strong and rapid currents. The heavy dermal osseous plates, regularly arranged in orderly rows along the middle and sides of the body, act as well-arranged ballast. The protection which their plate-armor affords them against the logs and stones hurried along their feeding-grounds, renders needless the ossification of the immediate case of the brain and spinal marrow, and, consequently, all the parts of the neuro-skeleton remain in the flexible, elastic, gristly state common to all the so-called cartilaginous fishes; the weight of the dermo-skeleton requiring that the neuro-skeleton shall be as light as possible, consistently with the defensive and sustaining functions which it is called to perform.

The coat of mail in which the ganoid fishes of an early period were clothed, was probably subservient to the same ends as the dermal plates of the sturgeon; and in most of these fishes, as in the sturgeon, the dermal bones are coated externally with a very hard material resembling enamel. In these extinct fishes, the plates are more close-set than in the sturgeon, overlapping each other, and being fastened together like tiles by a peg of one entering a socket in the next, and conversely.

In the armadillo, the dermal bones are small, usually five or six sided, smooth internally, and variously sculptured externally—the pattern, however, being constant in, and characteristic of, each species. They are united together at their margins by rough surfaces, and collectively resemble a tesselated pavement. To allow of the requisite movements of the trunk of the armadillos, which have the power of rolling themselves into a ball, a certain number

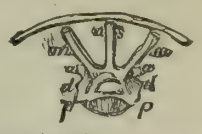


Fig. 1.—Transverse section, showing portions of Dermo- and Neuro-skeleton of Armadillo.
(The signification of the letters is subsequently given.)

of transverse rows, marked in the figure, are interposed, having an elastic yielding attachment with one another, and with the anterior and posterior fixed parts of the trunk-armor; and by this arrangement, the head and limbs can be withdrawn beneath the central case, by the action of strong subcutaneous muscles. In the colossal extinct armadillo (the *Glyptodon*), the trunk-armor was not divided by bands, but was composed of one immovable piece, covering the back and sides—an arrangement by which the dermo-skeleton would afford increased protection against falling timber, the attacks of other animals, &c.

The splanchno-skeleton is at first sight less apparent than the dermo-skeleton. In most air breathing vertebrates, the larynx, trachea, and bronchial tubes contain a cartilaginous framework, which sometimes becomes ossified; in fishes, and in the batrachians in the tadpole state, the gills are supported upon a cartilaginous or osseous framework, developed independently of the vertebral skeleton; and in mammals, the heart contains a bone that serves as a support for its muscular and ligamentous fibres. If to these parts we add the so-called 'sense-capsules'—the bony cap which is found in the outer coat of the eye in many birds and most fishes; the hard bony envelope which surrounds the internal ear, and which subsequently, as the petrous portion of the temporal bone, becomes incorporated in most vertebrates with the neuro-skeleton; and the turbinate bones of the nose—and the teeth, we have the principal parts of the splanchno-skeleton. The sclero-skeleton requires no further explanation than that which has been already given; and we therefore proceed to what may be called the skeleton proper—the neuro-skeleton.

From the nature of the subject, it is impossible to avoid the introduction of a considerable number of technical terms, which will probably be new, and will sound somewhat harshly to many of our readers; and as few writers can popularize a difficult subject more successfully than Professor Owen himself (unquestionably the greatest osteologist of the present age) we shall for the most part follow the history of the neuro-skeleton which he drew up for the benefit of general readers in *The Circle of the Sciences*. A thoughtful examination of the skeleton of any vertebrate shows that it is arranged in a series of segments, following and articulating with each other in the direction of the axis of the body, from before backwards in brutes, from above downwards in man.

Each complete segment, called a 'vertebra,' consists of a series of osseous pieces arranged according to the plan shown in figs. 2 and 3, so as to form a bony hoop or arch above a central piece, for the protection of a segment of the nervous axis; and a bony hoop or arch beneath the central piece, for the protection of a segment of the vascular system. The upper hoop, N, is called the 'neural arch' (Gr. *neuron*, a nerve), and the lower hoop, H, the 'hæmal arch' (Gr. *hæma*, blood); while their common center, C, is termed the centrum. The neural arch is formed by a pair of bones, *n*, *n*, called 'neurapophyses' (Gr. *apophysis*, a projecting part or process), and by a bone, *ns*, sometimes cleft or bifid, called the 'neural spine;' it also sometimes includes a pair of bones, *d*, *d*, called 'diapophyses' (Gr. *dia*, across). The hæmal arch is formed by a pair of bones, *pl*, called 'pleurapophyses' (Gr. *pleuron*, a rib); by a second pair, *h*, called 'hæmapophyses;' and by a bone, *hs*, sometimes bifid, called the 'hæmal spine.' It also sometimes includes parts or bones called 'parapophyses' (Gr. *para*, transverse). Bones, moreover, are developed, which diverge as rays from one or more parts of a vertebra. Professor Owen divides the various parts of a vertebra into (1) the autogenous and (2) the exogenous parts. The autogenous parts are those which are developed from independent centers of Ossification (q. v.), and are termed the elements of the vertebra; while the exogenous parts are those that grow from parts previously ossified, and are termed processes. The line between these two sets of parts cannot be strictly drawn, since parts which are usually exogenous are sometimes autogenous, and *vice versâ*.

The autogenous parts or elements are the centrum, C; the neurapophyses, *n, n;* the neural spine, *ns;* the pleurapophyses, *pl, pl;* the hæmapophyses, *h, h,* and the hæmal spine, *hs;* while the exogenous parts or processes are the diapophyses (fig. 3), *d, d;* the parapophyses (fig. 5), *p, p;* the zygapophyses (fig. 3), *z, z* (Gr. *zygos*, a junction); the anapophyses (fig. 1), *a, a* (Gr. *ana*, backwards); the metapophyses (fig. 1), *m, m* (Gr. *meta*, between); the hypapophysis (fig. 5), *y* (Gr. *hypo*, below); and the epapophysis (fig. 2), *e* (Gr. *epi*, upon). These individual parts may be united with each other in various ways, and may occur in various degrees of development; sometimes they (or some of them) remain entirely disjoined even in the adult animal, while in other cases they are united into a single piece, so that their real distinctness can only be recognized by tracing the history of their development. In most instances, some one or more of these parts will be found to be altogether deficient, while in other cases one set of parts is exaggerated to a great degree.

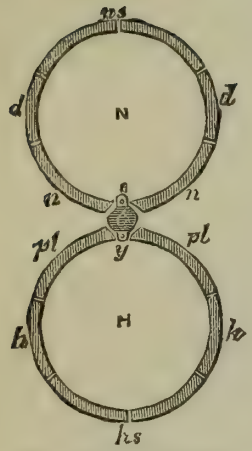


Fig. 2.—Typical Vertebra (ideal.)
(The signification of the letters is fully given in the text.)

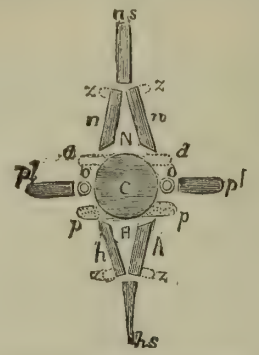


Fig. 3.—Another Modification of a Typical Vertebra:
C, the centrum, giving off *d, d,* the diapophyses, and *p, p,* the parapophyses; the neural arch N, enclosing the spinal cord, is formed by *n, n,* the neurapophyses, and *ns,* the neural spine; the hæmal arch H, enclosing the great centers of the circulation is formed by *h, h,* the hæmapophyses, and *hs,* the hæmal spine. From both the neurapophyses and the hæmapophyses may be given off the zygapophyses, *z, z.* The lateral arches which may enclose the vertebral arteries, O, O, are completed by the pleurapophyses, *pl.*

Thus, in fig. 4, which exhibits the third or parietal segment of the human skeleton, the neural arch, N, is much expanded, while the hæmal one, H, is contracted; while more commonly, as is shown in fig. 5, which represents a thoracic segment or vertebra of a raven, the hæmal arch, H, is much expanded, and the neural one, N, contracted; while sometimes, again, as in the tail of the crocodile and of many other animals, both neural and hæmal arches are simultaneously contracted. The segments are commonly simplified, and made smaller as they approach the end of the vertebral column or axis, one element or process after another being removed until the vertebra is reduced to its centrum, as in the diagram of the archetype vertebral skeleton. If we glance at the typical vertebra represented in fig. 3, we observe the diapophyses projecting above a canal that serves for the passage of a blood-vessel, and parapophyses which form the lower boundaries of this canal. These elements never attain any high development in mammals, birds, or reptiles; thus, in the human cervical vertebra, they form the two roots of the transverse process surrounding the foramen for the passage of the vertebral artery, while in the thoracic vertebra of the bird (see fig. 5) the diapophyses, *d, d,* form the transverse processes, and the parapophyses, *p, p,* reduced to mere rudiments, form the articular surfaces with which the heads of the ribs come in contact.

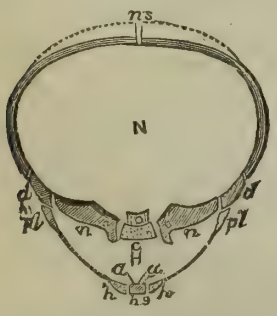


Fig. 4.—Parietal, or Third Segment or Vertebra of the Human Skeleton.
(Letters as in preceding diagrams.)

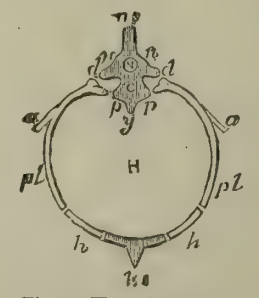


Fig. 5.—Thoracic Segment or Vertebra of a Raven.
(In this and the preceding figure, *a, a,* are diverging appendages.)

In fishes, however, they are much developed, and in the cod tribe are even larger and broader than the pleurapophyses or true ribs. The ordinary function of these lateral processes is to afford attachment to muscles, to protect the lateral vascular trunks (as in the case of the vertebral artery), and to give support to the pleurapophyses, *pl, pl,* whose development varies extremely in different parts of the same vertebral column, as well as in different animals. Then, in the human cervical vertebra (fig. 6), they form the short bifid transverse processes which are anchylosed at their base to the diapophyses and parapophyses which surround the vertebral canal. In the thoracic segments (fig. 5), they are developed separately, and constitute the ribs which form the greater part of the circumference of the hæmal arch. Proceeding to the consideration of the parts below the centrum, we often find the entire hæmal arch wanting, as in the cervical and lumbar vertebræ of man and mammals; but in the tail of some mammals and of reptiles, a hæmal arch, protecting the caudal artery and vein, and closely resembling a neural arch, is found. It is in the thoracic region of mammals, birds, and reptiles that we find the greatest expansion of the hæmal arch (see fig. 5); the hæmapophyses here articulating with the extremities of the ribs instead of with the centrum, and the arch surrounding the entire visceral cavity. In man and mammals, the hæmapophyses remain unossified, and are known as the cartilages of the ribs; but in birds and reptiles, they are ossified, and constitute the sternal ribs. The hæmal spine, *hs,* presents great variety of form, and is often altogether absent. In the mammalian thorax, it occurs as a flat sternum; in birds, the flatness is replaced by a prominent keel on the mesial line, so that a transverse section almost resembles a neural spine; while in reptiles, again, the hæmal spine or sternum is flattened laterally, as in mammals.

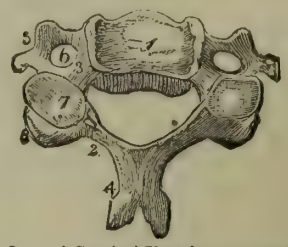


Fig. 6.—A Central Cervical Vertebra as seen from above:
1, the body; 2, the lamina; 3, the pedicle; 4, the bifid spinous process; 6, the vertebral foramen; 7, the superior articular process. This figure, as compared with the preceding ones, must be regarded as inverted, the neural arch being here below the centrum.

The hæmapophyses and hæmal spine are absent in the abdominal region of mammals and birds, but are continued backwards in the saurians or lizard like reptiles, whose hæmal arch is, notwithstanding, incomplete, from the absence of pleurapophyses. In serpents, the hæmal arches are wanting through the whole trunk, the ends of the ribs being free; and in fishes generally, the hæmapophyses and hæmal spine are absent, or unossified.

Having noticed, as fully as our space permits, the modifications which the typical vertebra undergoes in various animals, and in different parts of the same animal, we now come to the more difficult subject of 'the archetype vertebrate skeleton,' which is made up of a series of vertebræ arranged in a continuous row. The accompanying scheme or diagram represents Professor Owen's conception of the common pattern or archetype of the vertebrate skeleton. It is difficult at first sight to see any resemblance between this figure and the human skeleton; but, in fact, the human skeleton, of all others, recedes the furthest from the common pattern; and if we turn to fishes, which were the first form of vertebrate life introduced into this planet, we find that they deviate the least from the archetypal idea. If proof be demanded that a given bone in the human skull is an element of a particular vertebra, it is afforded by tracing the same bone through its various modifications in mammals, birds, reptiles, and fishes, till the simple archetypal form is arrived at. The skull is found to be but a continuation of the backbone, and to consist of four vertebræ or segments, corresponding to the four consecutive enlargements of the nervous system which we call the brain. These segments, reckoning them from behind forwards, are termed the occipital, the parietal, the frontal, and the nasal segment. Each segment consists of a neural and a hæmal arch.

The Neural Arches are :

N. I. Epencephalic Arch (bones Nos. 1, 2, 3, 4 in figure). N. II. Mesencephalic Arch (bones Nos. 5, 6, 7, 8 in figure). N. III. Prosencephalic Arch (bones Nos. 9, 10, 11, 12 in figure). N. IV. Rhinencephalic Arch (bones Nos. 13, 14, 15 in figure).

The Hæmal Arches are :

H. I. Scapular Arch (Nos. 50—52). H. II. Hyoidean Arch (Nos. 38—43). H. III. Mandibular Arch (Nos. 28—32). H. IV. Maxillary Arch (Nos. 20—22).

The special names given by Owen to the various elements of that hæmal arch, from above downwards, are 'suprascapular,' No. 50; 'scapula,' No. 51; 'coracoid,' No. 52. The scapular arch thus formed supports and protects the heart or center of the hæmal system, and in most fishes supports the pectoral fin, while in other animals the appendage that here becomes a fin is modified into a fore-leg, a wing, an arm, and a hand. Some of the special names originally employed in human anatomy are retained and applied to like parts in the pectoral fin of the fish; but it will be

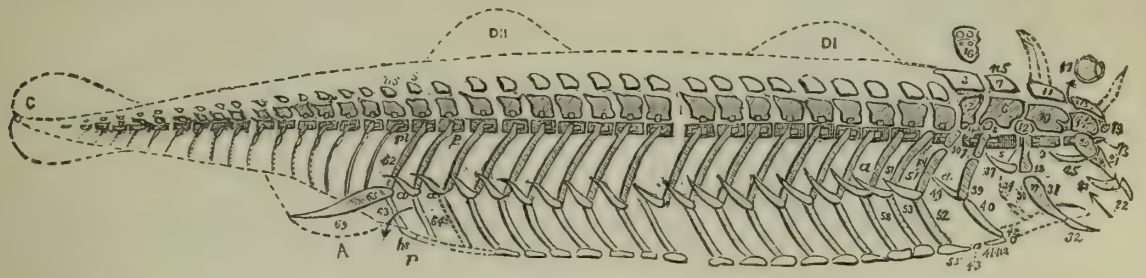


Fig. 7.—Diagram of Archetype Vertebrate Skeleton, composed of the following parts:

1, Basioccipital; 2, Exoccipital; 3, Supraoccipital; 4, Paroccipital, constituting the neural arch of the first or occipital vertebra of the head (the epencephalic arch); 5, Basisphenoid; 6, Alisphenoid; 7, Parietal; 8, Mastoid, constituting the neural arch of the second or parietal vertebra (the mesencephalic arch); 9, Presphenoid; 10, Orbitosphenoid; 11, Frontal; 12, Post-frontal, constituting the neural arch of the third or frontal vertebra (the prosencephalic arch); 13, Vomer; 14, Prefontals; 15, Nasal, constituting the neural arch of the fourth or nasal vertebra (the rhinencephalic arch); 16, Petrosal or acoustic sense-capsule; 17, Sclerotic, or ophthalmic sense-capsule; 19, Ethmoturbinal or olfactive sense-capsule;—20, Palatine; 21, Maxillary; 22, Premaxillary, constituting the maxillary hæmal arch; 25, 27, being its diverging appendages;—28, Tympanic; 29—32, Mandibular, or lower jaw, constituting the mandibular hæmal arch; 34, 37, Operculars, being the diverging appendages of this arch;—38, Stylohyal; 39, Epihyal; 40, Ceratohyal; 41, Basihyal; 42, Glossohyal; 43, Urohyal, constituting the hyoidean hæmal arch; 44, Branchiostegal, being its diverging appendages; 50, Supra-scapula; 51, Scapula; 52, Coracoid; 52', Episternum; 53, Anterior member, constituting the scapular hæmal arch, with its diverging appendages; 58, Clavicle;—62, Ilium; 63, Ischium; 64, Pubis, th : hæmapophysis of one of the lumbar vertebræ; 65, 69, Posterior extremity, constituting the hæmal arch of the sacral vertebra skeleton, with its diverging appendages.

The jaws are the modified hæmal arches of the first two segments; and the mouth opens at the interspace between these arches. The position of the vent varies (in fishes), but always opens behind the pelvic arch, S 62, 63, *p*, where this is ossified. Outlines of the chief ossified developments of the dermo-skeleton, in different vertebrates, are added by Professor Owen to the neuro-skeletal archetype; as, for example, the median horn, supported by the nasal spine, 15, in the rhinoceros; the pair of lateral horns developed from the frontal spine, 11, in most ruminants; the median folds, DI, DII, above the neural spines, one or more in number, constituting the dorsal fin or fins in fishes and cetaceans, and the dorsal hump or humps in the buffaloes and camels; similar folds are sometimes developed at the end of the tail, constituting the caudal fin, C, and the anal fin or fins, A, of fishes.

It has been already remarked, that bones which diverge as rays are formed from one or more parts of a vertebra. These 'diverging appendages' are mainly connected with the hæmal arches, and those which especially concern us are the pectoral appendages of the scapular arch, which become developed into fore-limbs or arms (54—57, fig. 9), and the pelvic appendages which are attached to their supporting hæmal arch, 63, *hs*. If we examine the skull

Fig. 8.

1, neural spines	A, nasal vertebra.
2, diapophyses of the three posterior vertebræ.	B, frontal vertebra.
	C, parietal vertebra.
3, neurapophyses.	D, occipital vertebra.
4, pleurapophyses.	E, supra-scapula.
5, hæmapophyses.	F, scapula.
6, hæmal spine.	G, ulna.
7, appendage proceeding from the pleurapophysis of the first arch to that of the second, and corresponding to internal pterygoid plate in man.	H, carpus.
	I, radius.
	K, metacarpus.
	L, phalanges.
	M, scapular arch.
8, centra.	N, hyoidean arch.
	O, inferior maxillary arch.
	P, superior maxillary arch.

of a cod-fish, in which the bones have been arranged according to the segments or vertebræ to which they belong, we observe that the occipital vertebra has a widely expanded hæmal arch, consisting of three pairs of bones with diverging appendages.

observed that Professor Owen designates each bone not only by a name but by a numeral. Of the two flat bones connecting the fin with the coracoid, the upper one is the 'ulna,' No. 54; the lower one, the 'radius,' No. 55; the row of short bones joined with these are the 'carpals,' No. 56; beyond which are the metacarpals and phalanges. Ascending from fishes to reptiles, we find that, in the lower batrachia (as the *amphiuma*), the scapulæ are detached from the occiput, and that other important modifications have occurred. The coracoids, *h* 52, are well expanded, three segments of the diverging appendage, *a*, are ossified, and two of these segments are bifid, showing a simple beginning of the radiating multiplication of parts. The first segment is the seat of these modifications, which have acquired for it the special name of 'humerus,' 53; the two divisions of the next segment of the appendage are called 'ulnar,' 54, and 'radius,' 55; the gristly mass, 56, is the carpus, and the two bony divisions are the digits or fingers, 57.

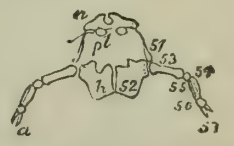


Fig. 9.—Posterior View of the Occipital Vertebra of *Amphiuma*:

n, neurapophyses; *pl*, 51, pleurapophyses of occipital vertebra or scapula; *h*, 52, hæmapophyses of occipital vertebra, or caracoid bone; *a*, 53—57, diverging appendages of occipital vertebra, or anterior limbs.

We have here got so distinct a rudimentary arm, separated from the head, although, according to the views propounded in this article, an appendage of the occipital segment of the cranium, that it is unnecessary to trace the further modifications that ensue, which lead finally to the arm and hand of man. It is only necessary to remark, that in mammals, except amongst the non-placental orders, the coracoid bone is reduced to a mere rudiment, being known as a process of the scapula, and that its function—namely, that of keeping the shoulders apart—is performed by the clavicle, which, according to Owen, is the hæmapophysis (58) of the first cervical vertebra (see fig. 7). With regard to the pelvic arch, we have only space to add that it must be regarded as the hæmal arch of one or more of the pelvic vertebræ; and there is undoubted evidence to show that the pelvic and scapular arches are constructed on the same plan; the 'ileum' answering to the scapula.

The elaborate and ingenious morphological theory of the skeleton here outlined was founded entirely upon the comparison of adult structures, and has of late years been entirely disproved, in principle and detail, by actual observation of the phenomena of development. For some account of the embryological theory of the skeleton, which is now securely founded, chiefly through the labors of Huxley, Parker, and Gegenbaur, see the article SKULL.

or Huxley's *Anat. of Verteb. Animals;* Balfour's *Embryology*, vol. ii.; or Parker's *Morphology of the Skull.*

SKE'LLIGS, THE, three rocky islands on the west coast of Ireland, about 8 miles west of Bolus Head, county Kerry, in long. 10° 32′ W. The lights on the Great Skellig are the first visible to ships crossing the Atlantic.

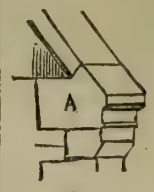
SKELTON, JOHN, an early English satirical poet, is supposed to have been born about the year 1460, but whether in Norfolk or Cumberland, is uncertain. He studied at both Cambridge and Oxford, and received from each the academical honor of laureate. His sovereign, Henry VII., appointed him tutor to the young Prince Henry, afterwards King Henry VIII.; and Erasmus, in allusion to his learning, styled him the light and grace of British scholars. At this time, S. had produced some translations, written elegies on Edward IV. (1483) and the Duke of Northumberland (1489), and was author of some stiff court masques and allegorical poems of little or no merit. He entered the church in 1498, and became rector of Diss in Norfolk, shortly after which he seems to have struck into that vein of original vernacular poetry, addressed to the multitude, for which he is unique among our elder bards, and which helped to fix our language. It consists in a flow of rattling voluble verse, unrestrained satire and jocularity, and a profusion of grotesque imagery mixed up with Latin and slang phrases. At times, S. has gleams of bright fancy and snatches of pleasant description. Of this higher class is his *Philip Sparrow*, being a poetical lamentation made by a young maiden (whose charms the poet describes with great gusto and minuteness) over the loss of a pet bird slain in a convent of black nuns at Carowe near Norwich.

The most humorous of his pictures of low life—often coarse enough—are found in the piece entitled *The Tunning* [or Brewing] *of Elynor Rummyng*, an alewife at Leatherhead in Surrey. This poem was highly popular, and was often reprinted in black-letter, garnished with a rude woodcut representation of the fat hostess. His best satires are *Colin Clout*, and *Why come ye not to Court?* The former is a general satire on the clergy; and the latter, a virulent attack on Cardinal Wolsey, whom the unscrupulous poet had previously flattered, but who had disappointed him of a prebend which he coveted. In this scurrilous lampoon, Wolsey is not only charged with arrogance, avariciousness, and incontinence, but is reminded of his 'base original' and 'greasy genealogy,' having been 'cast out of a butcher's stall.' The enraged cardinal ordered his libeller to be arrested, but S. took refuge in the sanctuary at Westminster, and received the protection of Abbot Islip. From this retreat he did not dare to emerge, but continued silent under its sacred shelter till his death in 1529. The 'pithy, pleasaunt, and profitable workes of Maister Skelton, Poete Laureate,' were collected and published in 1568, and reprinted in 1736. An edition, carefully edited by the Rev. A. Dyce, was issued in 1843, in 2 vols. 8vo.

SKE'RRIES, THE (Skerry is a term for any isolated sea-grit rock), small islands about 2 miles off the north-west coast of Anglesey, having a light-house 117 feet high. See also PENTLAND FIRTH.

SKE'RRYVORE is the chief rock of a reef which lies about 10 miles south-south-west of the south-west point of the island of Tiree (q. v.), and 24 miles west of Iona. This reef, which stretches from 8 to 10 miles in a west-south-west direction, is composed of compact gneiss, worn smooth by the constant action of the waves, and was long a terror to mariners, having caused the loss of one ship annually for forty years previous to 1844. The Northern Light-house Commission had long intended the erection of a light-house on S., the only point of this dangerous reef which could afford the needful foundation; but the difficulty of landing on the rock, from the immense force (three tons to the superficial foot) with which the Atlantic waves beat upon it, caused the delay of the scheme till 1834, when preparations were made in earnest. The design and superintendence of the construction of the building were intrusted to Mr. Alan Stevenson, who commenced operations on the rock in 1838, following generally the mode adopted by his father, Mr. Robert Stevenson (q. v.), in the construction of the Bell Rock (q. v.) Light-house, and in spite of occasional disasters from tempests, completed his work in 1844. The light-house is 138½ feet high; at the base 42 feet, and at the top 16 feet in diameter. The light, a revolving one, is produced by the revolution of eight large annular lenses round a lamp of four wicks, according to Fresnel's first dioptric system, and can be seen at a distance of 18 miles. The cost of erection was close upon £87.000. S. Light-house is nearly ⅛ths higher than that on the Bell Rock, and more than twice as high as the Eddystone. A small group of rocks belonging to this reef, and situated three miles westward of the light-house, is known as Stevenson's rocks.

SKEW, a sloping water-table—as on the set-off of a buttress, the cope of a gable, &c. This term is more generally used in Scotland than in England. The large stone (A) at bottom is called the skew-putt.



Skew.

SKEW-BRIDGE, a bridge placed obliquely so as to cross a road or river at an angle not a right angle. Such bridges, built of stone, are not easy of construction, owing to the peculiar twisted forms which the voussoirs assume, and were scarcely ever used till the necessities of railway curves compelled their introduction. They are evidently a great improvement on the old-fashioned mode of twisting a road, first to the right, and then to the left, in order to get the bridge at right angles to the place to be crossed. Since the introduction of iron girders as the supports of bridges, skew-bridges have become easy of construction, and are now quite generally used.

SKIBBEREE'N, a market-town of the county of Cork, Ireland, and situated in lat. 51° 34′ N., long. 9° 16′ W., distant from Cork 52 miles south-west. It is a place of little commerce, and almost entirely without manufactures. The pop. in 1881 was 3631, of whom 3209 were Roman Catholics.

SKID, in Military and Naval Language, is any timber which is used as a base to keep one object from resting on another. Thus, a row of cannon in store will be kept from the ground by skids. The term is also applied to the drag which is put on the wheels of carriages in going up hills, to prevent rolling backwards.

SKI'DDAW, a mountain in Cumberland, near the center of the county; height, 3054 feet. A few miles to the south lie Derwent Water and the town of Keswick.

SKIN. Considered in its general physiological and histological (or textural) relations, the skin is merely a part of the great mucous system to which the mucous membrane and secreting glands also belong, and which consists of two essential elements—a *basement tissue*, composed of simple cutaneous membrane, and an *epithelium* of nucleated particles resting on it—while beneath the basement membrane are vessels, nerves, and connective tissue. See EPITHELIUM and MUCOUS MEMBRANES. In the skin, the hard and thick epithelium is termed *cuticle* or *epidermis*, and the true skin below it is termed the *derma* or *cutis vera*, and is chiefly formed of modified and very dense connective (or areola or cellular) tissue.

The external surface of the skin formed by the cuticle is marked by furrows of different kinds. Some (termed furrows of motion) occur transversely in the neighborhood of joints, on the side of flexion; others correspond to the insertion of cutaneous muscles; while others, of quite another kind, are seen in aged and emaciated persons, and after the subsidence of any great distention of the integument; and besides these coarse lines, most parts of the skin are grooved with very minute furrows, which assume various courses in relation to one another. These minute furrows are most distinctly seen on the palmar aspect of the hand and fingers, and on the sole of the foot. The outer surface of the skin also presents innumerable pores for the discharge of the contents of the sudoriparous and sebaceous follicles, or the sweat and fat glands; and the modifications of epidermis known as hair and nails occur on the same surface.

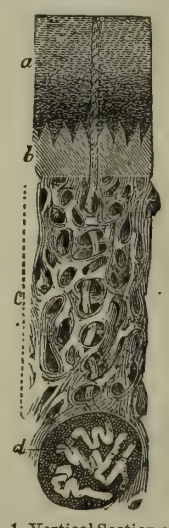


Fig. 1. Vertical Section of the Skin of the Sole:
a, Cuticle; *b*, Papillary structure; *c*, *Cutis vera*, or true skin; *d*, Sweat-gland lying in a cavity on the deep surface of the skin, and imbedded in globules of fat. Its duct is seen passing to the surface. Magnified about 30 diameters.

The deep layer of the skin consists of connective tissue, in which both the white and yellow fibrous elements are considerably modified as to the proportions in which they occur, and smooth muscles are present in no inconsiderable quantity in some parts of the skin. Where great extensiblity, with elasticity, is required, the yellow (elastic) element predominates; and where strength and resistance are specially required, as in the sole of the foot, the *cutis* is chiefly composed of a dense interweaving of the white (inelastic) element. The thickness and strength of this layer differ greatly in different parts, according to the amount of resistance required against pressure. The skin is thicker on the hinder surface of the body than in front, and on the outer than on the inner, sides of the limbs. 'It is unusually thin over the flexures of the joints. It is particularly delicate in the eyelids, and proportionably so in some other situations where great mobility is demanded. In regions which are most subject to external pressure, as the soles of the feet,

it is firmly united by very dense laminæ to the subcutaneous fascia; and the intervals between these are provided with pellets of fat, forming a cushion, as an additional means of protection to the delicate organs it encloses and covers. Amongst the lower animals, we may notice numberless examples of an analogous kind.'—Todd and Bowman's *Physiological Anatomy and Physiology of Man*, vol. i. p. 407. The blubber of the whale merely represents, in a very exaggerated form, the layer of fat which generally occurs in the subcutaneous areolar tissue of man and most animals, serving as a soft bed on which the skin may rest, and gives the appearance of plumpness and symmetry to the outline of the body. It is on the external surface of the cutis that the *tactile papillæ*, or true organs of touch, are developed.

Kölliker divides the true cutis into the 'reticular' and 'papillary' portions, the latter being the reddish-gray external superficial layer which contains the upper portion of the hair follicles and cutaneous glands, and whose most important element is these tactile papillæ. They are most abundant and largest in the palm of the hand* and the sole of the foot, while in the back and in the outer sides of the limbs, they are almost entirely absent. They occur as small, semi-transparent, flexible elevations (see *b*, in fig. 1), which are usually conical or club-shaped in form; but in certain parts, as the palm of the hand, present numerous points (in which case they are termed compound papillæ).

The thickness of the true skin varies, according to Kölliker, from $\frac{1}{4}$th of a line to a line and a half. In its chemical characters,

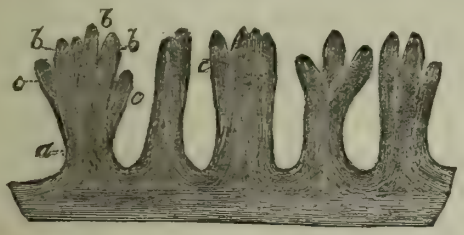


Fig. 2.—Compound Papillæ of the Surface of the Hand, with Two, Three, and Four Points:

a, Base of a papilla; *bb*, their separate processes; *cc*, Processes of papillæ when base is not visible. Magnified 60 diameters.

it agrees with those of the connective tissue, of which it is principally composed. The gelatine which it yields on boiling is de-

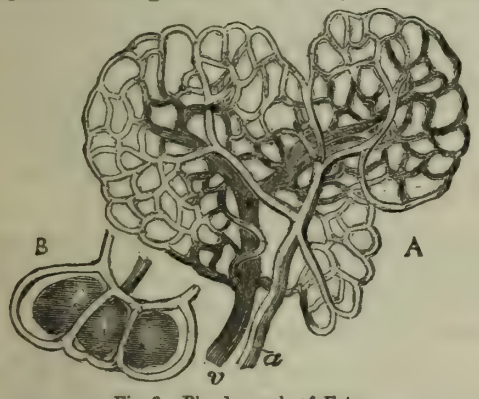


Fig. 3.—Blood-vessels of Fat:

A, Minute flattened fat lobule, in which the vessels only are represented; *a*, Terminal artery; *v*, Primitive vein. Magnified 100 diameters. B, Plan of arrangement of the capillaries on the exterior of the vesicles, more highly magnified.

rived mainly from the white fibrous tissue, and it is probably this element which is principally concerned in the changes which skin undergoes in the process of tanning. Arteries from the subcutaneous connective tissue freely enter into the structure of the skin, and are distributed to the fat-lobules, the sudoriparous and sebaceous glands (presently to be described), the hair follicles, the papillæ, &c. In these several parts, they terminate in a close network of capillaries. The two accompanying diagrams illustrate the mode in which these capillaries are distributed over the fat-cells and in the papillæ. Those parts of the skin which border upon the epidermis are for the most part very freely provided with nerves, while in the deeper parts the nervous filaments are comparatively scanty. How they terminate, is still a subject of dispute; but the view most generally adopted is that they end in loops.

The glands occurring in the skin next claim our consideration. They are the *sudoriparous* or *sweat glands*, the *sebaceous* or *fat glands*, and the *ceruminous glands*. The *sweat-glands* exist in almost every part of the human skin. They lie in small pits in the deepest parts of the true skin, and sometimes entirely below the skin. Their orifices can be seen in the middle of the cross grooves that intersect the ridges of the papillæ on the hands and

Fig. 4.—Arrangement of the Capillary Loops in the Skin.

feet, their arrangement being here necessarily regular, while in other parts they are irregularly scattered. Their size and number in different regions of the skin correspond with the amount of perspiration yielded by each part; thus they are nowhere so much developed as in the axilla, or armpit. In that part of this region, which in the adult is more or less covered with hair, they form a layer of a reddish color, of about an eighth of an inch thick. They are soft, and more or less flattened by their pressure on one

Fig. 5.—Vertical Section of the Skin and Sweat-glands of the Axilla.

a, Layer of glands with their ducts traversing *b*, the cutis and cuticle; *c*, a small hair; *d*, *d*, Portions of larger hairs. Magnified one and a half diameter.

Fig. 6.—A Sweat-gland and the beginning of its Duct:

a, Venous radicles on the wall of the gland; *b*, Capillaries. The vessels are all outside. Magnified 35 diameters.

another, being imbedded in delicate connective tissue, and covered and permeated with a network of capillaries. On isolating one of these glands, and highly magnifying it, it is found to consist of a solitary tube, intricately ravelled, one end of which is closed, and hidden within the glandular mass, while the other emerges from the gland. The wall of the tube consists of an outer or *basement membrane*, with which the blood-vessels are in contact, and an *epithelium*, lining the interior, the former disappearing when the tube reaches the surface of the papillæ. The duct, on leaving the gland, follows a meandering and rather spiral direction through the reticular portion of the cutis to the interval between the papillæ, when it becomes straight; and it again assumes a spiral course in perforating the cuticle (see fig. 1). It is not easy to explain how or why so beautifully regular a spiral form should be given to the cuticular portion of the duct, which is rather wider than the rest, the average diameter of the duct being $\frac{1}{1700}$th of an inch.

The *sebaceous glands* are small whitish glands, which exist in almost every part of the skin, except the palms and soles, and are especially abundant in the scalp, face (the nose being particularly rich in them), and about the anus. They are usually connected with the hairs, as shown in fig. 7, and consist of a duct terminating in a blind pouch-like or pear-shaped extremity. The *basement membrane* of these glands is lined by an epithelium, in the particles of which are included granules of fatty or sebaceous matter, which, having become detached, constitutes the secretion. These glands are the seat of the parasite known as *Acarus folliculorum*.

The *ceruminous glands* are brown simple glands, in external appearance like the sudoriparous glands, occurring in the cartilaginous portion of the external meatus of the ear. They yield an adhesive bitter secretion, which protects the membrane of the tympanum from the access of dust, insects, &c.

We shall conclude by taking a brief survey of the functions of the skin, omitting, however, its most important function, TOUCH (q. v.). Regarded as a protective covering, the skin possesses the combined advantages of toughness, resistance, flexibility, and

* In one square line of the palm of the hand, E. H. Weber reckons that there are 21 compound, and from 150 to 200 smaller papillæ, arranged in tolerably regular rows.

elasticity; the connective framework being the part which mainly confers these properties, although the epidermis co-operates with it. The subcutaneous layer of fat, and the modifications of epidermis in various forms, as hairs, wool, feathers, scales, &c.,

Fig. 7.—Sebaceous Glands, showing their Size and relation to the Hair Follicles.
A and B, From the nose; C, From the Beard. Magnified 18 diameters.
(With two exceptions, the diagrams in this article are borrowed from Todd and Bowman.)

serve for the preservation of warmth, and occasionally (when they occur as claws, talons, &c.) as means of offence or defence.

The skin is the seat of a twofold excretion—viz., of that formed by the sudoriparous glands, and that formed by the sebaceous glands. The fluid secreted by the sudoriparous glands is usually formed so gradually that the watery portions of it escape by evaporation as soon as it reaches the surface; but in certain conditions, as during strong exercise, or when the external heat is excessive, or in certain diseases, or when the evaporation is prevented by the application of a texture impermeable to air, as, for example, oiled silk, or the material known as mackintosh, or india-rubber cloth, the secretion, instead of evaporating, collects on the skin in the form of drops of fluid. When it is stated that the sweat contains urea, lactates, extractive matters, &c., and that the amount of watery vapor exhaled from the skin is, on an average, 2½ lbs. daily (according to Valentine's observation), the importance of the sudoriparous glands as organs of excretion will be at once manifest. Moreover, there is reason to believe, from the experiments of Scharling, Gerlach, and others, that the importance of the skin as a *respiratory* organ is far from inconsiderable, very appreciable quantities of carbonic acid being exhaled hourly by the external surface of the body. In the amphibia, in which the skin is thin and moist, the cutaneous respiration is extremely active; and that the respiratory function of the skin in the higher animals is also considerable, is proved not only by measuring the excreted carbonic acid, but by the fact, that if the skin is covered with an impermeable varnish, or if the body be enclosed, all but the head, in a caoutchouc dress, animals soon die, as if asphyxiated, their heart and lungs being gorged with blood, and their temperature before death gradually falling many degrees. The secretion of the sebaceous glands is a semi-fluid oily mass, which often solidifies into a white viscid tallow-like matter on the surface or in the glandular ducts, from which it can be removed by pressure, in a form resembling that of a small whitish worm or maggot. Under the microscope, cells containing fat, free fat mixed with epidermic scales, and sometimes chrystals of cholesterin, are observed. Its chemical constituents, in addition to water, are a peculiar nitrogenous matter resembling casein, fat (consisting of palmitin and olein, soaps composed of palmitic and oleic acids), cholesterin, earthy phosphates, and chlorides and phosphates of the alkalies. Its purpose seems to be that of keeping the skin moist and supple, and by its oily nature, of hindering too rapid evaporation. Moreover, considered as an excretion, it must take a share in the purification of the blood.

The skin is, moreover, an organ of absorption: mercurial preparations, when rubbed into the skin, have the same action as when given internally, Potassio-tartrate of antimony, when rubbed into the skin in the form of ointment or solution, may excite vomiting, or an eruption extending over the whole body; and many other illustrations might be given. The effect of rubbing is probably to force the particles of the matter into the orifices of the glands, where they are more easily absorbed than they would be through the epidermis. It has been proved by the experiments of Madden, Berthold, and others, that the skin has the power of absorbing water, although to a less extent than occurs in thin-skinned animals, such as frogs and lizards. This fact has a practical application. In severe cases of dysphagia—difficult swallowing—when not even fluids can be taken into the stomach, immersion in a bath of warm water, or of milk and water, may assuage the thirst. Sailors, also, when destitute of fresh water, find their urgent thirst allayed by soaking their clothes in salt water.

The *diseases* of the skin and their classification into genera and species, have occupied much attention; but none of the proposed classifications is very satisfactory. The more important affections are noticed in special articles. See ECZEMA, and ECTHYMA; also Quain's *Anatomy*.

SKINK. See SCINK.

SKIPS, large square baskets, lined with leather or skin, used in spinning-mills for carying the bobbins of yarn; sometimes they are made entirely of thick hides. Wood or basket work would be apt to catch and break the delicate threads.

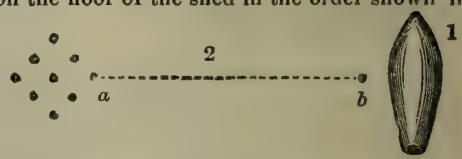
SKI'PTON, a market-town of England, County of York, is finely situated in a broad and fertile valley, near the river Aire, about 38 miles west of York, and 16 north-north-west of Bradford. S. carries on manufactures of cotton and woollen goods, and is a station on the Leeds and East Lancashire Railway and on the Midland line. Pop. (1881) 9091.

SKI'RMISHERS are soldiers operating in loose array, two together i. e., front and rear, with a lateral distance of about six paces between the files. When the army advances, the ground in front, and for some distance on each flank, is usually covered by skirmishers, to prevent surprise. If cavalry come suddenly on them, they rush together, and form small squares, called rallying squares. Skirmishers fire independently at their own discretion; but the rule is, that one of the two men composing a file should always have his rifle loaded. Orders are communicated by the sound of bugle.

SKI'RRET (*Sium Sisarum*), a perennial plant of the natural order *Umbelliferæ*, a native of China and Japan, but which has long been cultivated in gardens in Europe for the sake of its roots, which are tuberous and clustered, sometimes 6 inches long, and of the thickness of the finger. They are sweet, succulent and nutritious, with a somewhat aromatic flavor, and when boiled, are a very agreeable article of food. A kind of spirituous liquor is sometimes made from them. Good sugar can also be extracted. S. was at one time more cultivated in Britain than it is at present, although there seems to be no good reason for its having fallen into disrepute. It is propagated either by seed or by very small offsets from the roots. It has a stem of 2—3 feet high; the lower leaves pinnate, with oblong serrated leaflets, and a heart-shaped terminal leaf, the upper ones ternate with lanceolate leaflets.

SKI'RTING, the board round the bottom of the walls of rooms. When large, it is called a base-plinth.

SKI''TTLES, a game very popular in England amongst the frequenters of public houses. It is usually played in a covered shed, called a skittle alley, about 60 feet in length. The skittles are made of hard wood of the shape shown in fig. 1, and they are placed upon the floor of the shed in the order shown in fig. 2, *a*.



Skittles.

The player, standing at *b*, throws a wooden ball, and tries to knock down the whole of the skittles in a given number of throws. The rules of the game vary in different places. It is sometimes called 'Ninepins,' from the number of skittles used.

SKOPI'N, a town of Russia, government of Riazan, and 160 miles south-east of Moscow, is situated on the Verda, a tributary of the Oka, which is itself a tributary of the Volga. It has manufactures of Russian leather, and a trade in corn and cattle. Pop. (1880) 9500.

SKU'A, or SKUA GULL (*Lestris*), a genus of birds of the family *Laridæ*, also known by the name JAGER (Ger. hunter), and differing from the gulls in having the upper mandible more hooked at the tip, and the nostrils larger and further forward in the bill, the base of which is covered with a cere. The skuas are bold and powerful birds, and generally obtain their food by pursuing gulls or terns, and causing them to disgorge the fish which

they have captured, which they dart upon and seize in the air. They also eat eggs and small birds. The COMMON S. (*L. cataractes*) is fully two feet in length, of a brown color, with lighter streaks

Common Skua (*Lestris cataractes*), in pursuit of a Gull.

on the head and neck. It inhabits the northern seas, and breeds in some of the Shetland isles.

SKULL. The skull is divided into two parts, the cranium and the face. In human anatomy, it is customary to describe the former as consisting of eight, and the latter of fourteen bones; the eight cranial bones, which constitute the brain-case, being the *occipital, two parietal, frontal, two temporal, sphenoid,* and *ethmoid;* while the fourteen facial bones are the *two nasal, two superior maxillary, two lachrymal, two malar, two palate, two inferior turbinated, vomer,* and *inferior maxillary.* The bones of the ear, the teeth, and the Wormian bones are not included in this enumeration. The morphologist, however, who wishes to trace out the fundamental similarity of type in the structure of the various modifications of the vertebrate skull will not be content with this arrangement, in which, as, for example, in the occipital, temporal, and sphenoid bones, the human anatomist considers as a single bone an osseous mass consisting primarily in man, and persistently in some of the lower vertebrates, of several distinct pieces

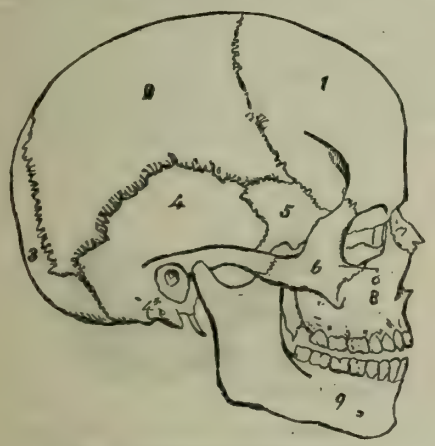


Fig. 1.—Side-view of Human Skull:

1, Frontal bone; 2, Parietal bone; 3, Occipital bone; 4, Temporal bone (squamous portion); 4*, Do (mastoid portion); 5, Sphenoid bone; 6, Malar bone; 7, Nasal bone; 8, Superior maxillary or jaw bone; 9, Inferior maxillary or jaw bone.

or elements. Postponing to the close of this article any remarks on the structure of the vertebrate skull generally, we shall proceed to notice the ordinary anatomical relations of the human skull. The development of the skull is a subject of great interest not only in itself, but as throwing light on many points which the study of the adult skull would fail to explain. At a very early period of fœtal existence, the cerebrum is enclosed in a membranous capsule external to the dura mater, and in close contact with it. This is the first rudiment of the skull, the cerebral portion of which is consequently formed before there is any indication of a facial part. Soon, however, four or five processes jut from it on either side of the mesial line, which grow downwards, incline towards each other, and unite to form a series of inverted arches, from which the face is ultimately developed. Imperfect development or ossification of these rudimentary parts of the face gives rise to the peculiarities known as 'hare-lip' and 'cleft-palate,' or in very extreme cases to the form of monstrosity termed 'Cyclopean,' in which, from absence of the frontal processes, the two orbits form a single cavity, and the eyes are more or less blended in the mesial line.

The following is a brief summary of the succession of events that occur in the ordinary or normal development of the skull. Cartilage is formed at the base of the membranous capsule, which has been already described as thrown around the brain, and capable of enlarging with it. This is speedily followed by the deposition of ossific matter at various points of the capsule, which soon becomes converted into flakes of bone, which afford protection for the brain, while the intervening portions, which remain membranous, permit the skull to expand as its contents enlarge. The formation of these bony flakes on the convexity of the cranium is soon followed by the appearance of osseous nuclei in the cartilage at the base, corresponding to the future occipital and sphenoid bones. Lastly, the various bones, some originating in membrane, and some in cartilage (as described in the article OSSIFICATION), approach one another by gradual enlargement, and become united in various ways, so as to form a continuous, and ultimately an unyielding bony case, which, in the words of of Dr. Humphry, 'is admirably adapted for the defence of the brain, for the accommodation of the organs of special sense, and for the attachment of the ligaments and muscles by which the skull is supported and moved on the spine.'—*The Human Skeleton,* p. 185. At the period of birth, most of the principal bones have grown into apposition with their neighbors, forming the *Sutures* (q. v.), but one large vacuity remains at the meeting-point of the parietal and frontal bones, which is termed the anterior fonta-

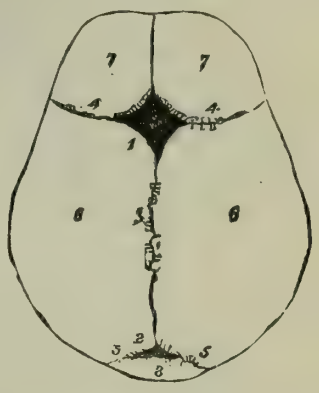


Fig. 2.

1, Anterior fontanelle; 2, Posterior fontanelle; 3, Sagittal suture; 4, 4, Coronal suture; 5, Lambdoidal suture; 6, 6, Parietal bones; 7, 7, Two halves of the frontal bone, still ununited; 8, Occipital bone.

nelle,* which does not close till the second year after birth, and sometimes remains open much longer.

The deficiency of the osseous brain-case at this position not only facilitates the act of delivery, but also acts, according to Humphry, 'to some extent like a safety-valve during the first months of infantile life, at which time the brain bears an unusually large proportion to the rest of the body, and is liable to sudden variations of size from temporary congestion, sudden wasting of its

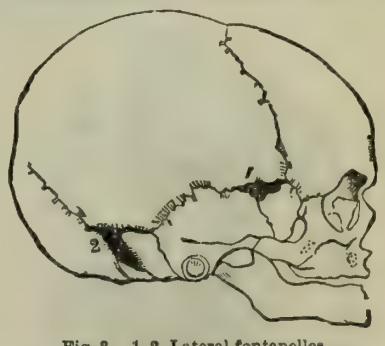


Fig. 3.—1, 2, Lateral fontanelles.

substance, and other causes. The sutures remain distinct long after the closure of the fontanelles, and probably serve a purpose both in permitting an increase of the size of the cranium by the growth of the bones at their edges (although the enlargement of the cranial cavity does not entirely depend upon this growth at the edges), and in diminishing and disbursing vibrations from blows, and thus contributing to the security of the brain.

The number of centers of ossification in the skull is tolerably constant; each bone having a certain number. (Thus, the occipital has 7 centers, the temporal 5, the sphenoid 12, &c.; the total number being about 59.) In addition to these, centers frequently occur in the course of the sutures, giving rise to independent pieces, which are called the *ossa triquetra,* or the *Wormian bones.* They are regarded by Humphry as stop-gaps, developed in the membranous

* So called from the pulsations of the brain, which may be here seen resembling the rising of water at a spring or fountain. There are two fontanelles in the mesial line, as shown in fig. 2, and two lateral fontanelles on either side, as shown in fig. 3.

covering of the brain, when the extension of the regular osseous nuclei is likely, for some reason, to be insufficient to cover in the cranial cavity; and this view is supported by the observation that, in cases of rickets and hydrocephalus, the Wormian bones are especially abundant.

After the sutures have been formed, and the skull has acquired a certain thickness, a process of resorption commences in the interior of the bones, and reduces the originally dense structure to a more or less cellular or cancellated state. The interior thus altered is called the *Diplöe*, and by this change the weight of the skull is much diminished, while its strength is scarcely affected.

The diplöe usually begins to be apparent about the tenth year, and is most developed in those skulls which are thickest. Dr. Humphry has observed it to be especially thick in idiots, and where the brain is small. 'Hence,' he observes, 'the propriety of the term *thick-headed*, as a synonym for *stupid*, derives some confirmation from anatomy.' A continuation of the same process of resorption, which causes the diplöe, gives rise to the formation of the cavities known as the frontal and sphenoid sinuses. The formation of the diplöe divides the walls of the cranium into three layers, viz., an outer tough layer; an inner dense, brittle, and somewhat glass-like layer, known as the vitreous table or layer; and the intervening cancellous diplöe. The vitreous table being more brittle than the outer layer, is apt to be fissured to a greater extent in fracture of the skull; and is even sometimes broken while the outer layer, which received the blow, has remained entire; although the diplöe must have great power in lessening the concussions transmitted from the outer to the inner layer of the skull. The growth of the skull after the seventh year proceeds slowly, but a slight increase goes on to about the age of twenty. The skull-bones are freely supplied with blood from arteries which pass from the dura mater internally and the pericranium externally, through the numerous foramina observed on both surfaces; the blood being returned by veins which take various directions.

The fact that concussion of the brain scarcely ever proves fatal, unless there is also fracture of the skull, affords the most distinct evidence that the skull is constructed in such a manner that so long as it maintains its integrity, it is able to protect its contents from serious lesion. This marvelous protective power is due to its rounded shape, whereby its strength is increased, and in consequence of which blows tend to glide off it, without doing material damage. Moreover, the curved lines or ridges which may be traced round the skull tend to strengthen it. The weakest part of the skull is at the base. Hence, notwithstanding its removal from exposure to direct injury and the protection afforded by the soft parts, fracture takes place more frequently at the base than at any other part of the skull, fracture often taking place here even when the skull was not broken at the part struck. There are two points in the architecture of the bones of the face which deserve especial notice, viz. (1), the great strength of the nasal arch, and (2) the immobility of the upper jaw, which is fixed by three buttresses, the nasal, the zygomatic, and the pterygoid.

The base of the skull, whether seen from within or from below,

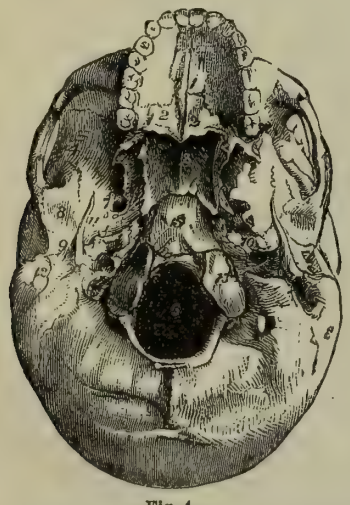


Fig. 4.

1, 1. Hard palate, formed by the palate processes of the superior maxillary bone; 2, 2, Palate bones; 3, Vomer, dividing the openings of the posterior nostrils; 4, Zygomatic fossa; 5, Basilar process of the occipital bone; 6, Foramen magnum, through which the spinal cord passes; 7, Foramen ovale; 8, Glenoid fossa, in which the head of the lower jaw-bone lies: 9, External auditory foramen; 10, Carotid foramen of the left side; 11, Styloid process; 12, Mastoid process; 13, One of the condyles of the occipital bone.

presents many objects of physiological interest, in relation to the nervous system. As seen from within, the base presents on each side three fossæ, corresponding to the anterior and middle lobes of the cerebrum and to the cerebellum. These fossæ are marked, as is the whole skull-cap, by the cerebral convolutions, and they contain numerous 'foramina' and 'fissures' which give passage to various sets of nerves and blood-vessels. The external or outer surface of the base of the skull, if we consider it from before backwards, is formed by the palate processes of the superior maxillary and palate bones; the vomer; the pterygoid and spinous processes of the sphenoid and part of its body; the under surface of the temporal bones, and by the occipital bone. The most important of the parts which it presents are named in the description of fig. 4.

The anterior region of the skull, which forms the face, is of an irregularly oval form, and the bones are so arranged as to enclose the cavities for the eyes, the nose, and the mouth, and to give strength to the apparatus for masticating the food. The size of the face and the capacity of the cranial cavity stand in an inverse ratio to one another, as may be readily seen by comparing vertical sections (through the mesial line) of human and other mammalian skulls; and if, in place of mammalian skulls, we take skulls of lower vertebrates (the crocodile, for example), this ratio is far more striking. In man, the face is at its *minimum* as compared with the cranial cavity; chiefly in consequence of the facial bones being arranged in a nearly vertical manner beneath the cranium, instead of projecting in front of it. The human face is also remarkable for its relatively great breadth, which allows the orbits for the reception of the eyes to be placed in front instead of on the sides of the head, and renders their inner walls nearly parallel. 'This parallelism,' says Dr. Humphry, 'in man is associated with the parallelism of the optic axes, and contributes to that clear, accurate, and steady vision which results from the ready convergence of the eyes upon every object.' Each orbit is of a pyramidal form, with the apex behind, and is composed of seven bones—viz., the frontal, ethmoid, lachrymal, sphenoid, superior maxillary, malar, and palate, which last contributes very slightly to the human orbit, but is an important constituent in the orbit of many animals. The nasal cavities have been sufficiently described in the article NOSE.

The different varieties of mankind present certain well-marked and characteristic peculiarities in the form of the skull. There are *three typical forms* of the skull which seem to be well established from the examination and comparison of a large number of crania, viz., the *prognathous*, the *pyramidal*, and the *oval* or *elliptical* cranium. When the upper jaw slopes forward, the insertion of the teeth, instead of being perpendicular, is oblique. A skull with

Fig. 5.—Prognathous Skull of a Native Australian.

this peculiarity is *prognathous* or *prognathic* (Gr. *pro*, forwards, and *gnathos*, a jaw); the opposite condition being termed *orthognathous* or *orthognathic* (Gr. *orthos*, upright). The Negro of the Guinea Coast and the Negrito of Australia present the prognathous character in its most marked form. The pyramidal form is characterized by the breadth and flatness of the face, which with the narrowness of the forehead, gives this shape to the head. The Mongolian and Esquimaux skulls belong to this type. The oval or elliptical type is that which is presented by the natives of Western or Southern Europe, and which is not distinguished by any particular feature so much as by the absence of the longitudinal projection of the first type, or the lateral projection of the second, and by a general symmetry of the whole configuration. The length of the skull, which to a great degree corresponds to the degree of development of the posterior cerebral lobes, has been taken by the late Professor Retzius as a basis of classification. He arranges all the varieties of mankind into two great classes—the *Dolicocephalæ*, or *long-heads*, whose cerebral lobes completely cover the cerebellum; and the *Brachycephalæ*, or *shortheads*, in whom the cerebral lobes do not extend so far. Each of these classes contains *orthognathous* and *prognathous* varieties. See ETHNOLOGY.

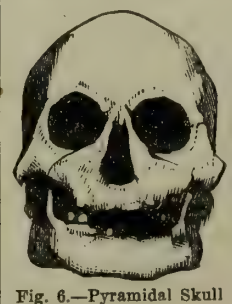


Fig. 6.—Pyramidal Skull of Mongolian Race.

The *Morphology of the Skull* is the highest and most difficult problem of comparative anatomy, and has cost the most extraordinary labor for its solution. Goethe and Oken independently suggested that the skull was to be regarded as the modification of a series of four vertebræ, and this 'vertebral theory' was worked out in the most elaborate detail by Owen and other anatomists (see SKELETON). Huxley, however, in a celebrated Croonian Lecture (1858), revised and extended the hitherto neglected embryological observations of Rathke, proposed an unanswerable destructive criticism of the archetypal theory, and may be said to have thus definitely placed the newer view in the way of general acceptance. An enormous amount of detailed research, for which we are indebted chiefly to Parker in England, and Gegenbaur in Germany, and which is still in progress, has established the newer theory on sure grounds of actual observation.

Taking first the simple unsegmented cartilaginous cranium of a skate or dog-fish, with its appended jaws and branchial arches, we find that in development, though the notochord extends into the region of the head, the vertebræ stop altogether short of it; but that on each side of the cranium there arise a pair of cartilaginous bars—the *trabeculæ* or 'rafters' of the future skull—three pairs of cartilaginous capsules, nasal, ocular, and auditory, form round the developing sense organs; the nasal capsules immediately unite with the ends of the trabeculæ, which are meanwhile uniting below, and growing up at the sides to form the brain-case. The auditory capsules become united with the trabeculæ by the appearance of two new masses of cartilage—the parachordals—the eyes of course remaining free. At first there are no jaws, but a series of seven or more similar vertical cartilaginous bars or arches, considerably resembling the trabeculæ, between which slits open into the pharyngeal cavity. The first pair of these arches develops an ascending process, which passes above the developing mouth, and becomes the 'palato-pterygoid' arch or upper jaw, the original portion remaining as the mandible. The second pair of arches—the 'hyoid'—becomes more or less modified usually to aid in supporting the jaws and floor of the mouth, while the remaining pairs become little modified, and serve throughout life to support the gills.

The more complex bony skulls of higher vertebrates are now in principle readily understood. The chondro-cranium and subjacent arches in all cases develop in the same way, although reduction and even atrophy of the gill arches subsequently takes place. The bones, although similar in the adult, originate in two utterly distinct ways, either by actual ossifications in the substance of the chondro-cranium and jaws, or by the ossification of overlying dermis, and are hence known as cartilage bones and membrane bones respectively—the latter corresponding to the dermal bones and teeth of ganoid and elasmobranch fishes. In mammals, a further extraordinary specialization takes place: the ends of the mandibular and hyoid arches lose their suspensory function, are taken up during development into the interior of the ear capsule, and are metamorphosed into the auditory ossicles.

See article on SKELETON; Huxley's *Croonian Lecture* 1858; Huxley's *Anat. of Verteb. Animals*, 1871; Parker's *Morphology of the Skull*, 1877; and for summary, Balfour's *Embryology*, vol. ii.

Fracture of the skull may take place either in the vault or at the base of the skull. We shall first consider *fractures of the vault*. Here the fracture is usually direct, the bone giving way at the point at which it was struck, and the result being either a simple fissure, or a breaking of the bone into several fragments (a comminuted fracture). Although fractures may be limited to the outer or to the inner surface of the skull, they most commonly extend through the whole thickness, and the broken bone is generally driven inwards; and the most ordinary form of fracture with depression is that in which several fragments of a somewhat triangular form have their points driven down and wedged into each other, while their bases remain on a level with the surrounding bone. There are no signs by which we can in all cases recognize the existence of fracture of the vault.

Fissures constantly exist without ever having been suspected during life. When, however, the fracture is accompanied by a wound leading down to the bone, it may, in general, be easily detected. With regard to treatment, it is now an established rule, that 'simple fractures of the skull with depression, and without symptoms, are to be left alone. The depression may be so marked as to be easily detected; and yet so long as there are no symptoms, all operative interference, of whatsoever form, is carefully to be avoided.'—Prescott Hewett, *op. cit.* If, however, there be a wound leading down to the bone in a depressed fracture without symptoms, immediate operative interference is called for. When a depressed fracture is accompanied by primary brain-symptoms, an operation for the purpose of raising or removing the depressed fragments is usually necessary. If, however, the fracture is a simple one, and the symptoms are not urgent, milder remedial agents, as bleeding, purging, and low diet, may be first tried.

Fractures of the base may be direct or indirect, but in most cases are indirect, that is to say, the bones give way at a point remote from the seat of the blow, as has been already shown. At certain parts, however, the bones of the base are so thin, that if direct pressure be brought to bear upon them, they readily give way. Thus scissors, slate-pencils, tobacco-pipes, &c., have often been thrust into the skull through the orbits of the nostrils, and these wounds are very serious, from the readiness with which the brain may be thus injured. The only symptoms that can be depended upon as indicating a fracture of the base of the skull, are connected either with an escape of the substance of the brain, or blood, or watery fluid, or with an injury done to the nerves as they emerge at the base. Out of 32 cases of fractured base observed by Hewett, bleeding from the mouth or nose occurred in 14 and bleeding from the ear in 15 cases.

SKUNK (*Mephitis*), a genus of quadrupeds of the weasel family (*Mustelidæ*), but departing very considerably from the typical characters of that family, and approaching to the badgers and gluttons in general appearance, in habits, in the lengthened claws of the fore-feet, in the plantigrade hind-feet, and in some of the teeth. There are six incisors and two canine teeth in each jaw, eight molars in the upper, and ten in the lower; the teeth

Common Skunk (*Mephitis varians*).

generally resemble those of the polecat. Skunks depend very much for defence against enemies on an excessively fetid fluid, which is secreted by glands near the anus; and when assailed, they turn the rump towards the assailant, elevate the tail, and discharge this fluid with considerable force. The odor proceeding from it, even when a dead S. had been flung into an enclosure has been known to cause nausea to the inmates of an apartment with closed windows at the distance of 100 yards. So confident does the S. seem of the efficacy of its peculiar mode of defence, that it permits itself to be approached till it is just on the point of being seized, which, however, is only attempted by the inexperienced, when the battery is discharged. It is almost impossible to remove the odor from clothes. Dogs flee at once, and rub their noses on the ground till they bleed. Dogs that are aware of the S.'s powers, however, kill it by leaping upon it suddenly, and in such a way that they are not exposed to danger. There is much uncertainty concerning the species of S., as the colors vary considerably even in the same species; but there is no doubt of the existence of a number of species. They are found only in America, where they are very widely distributed from Hudson's Bay, to the Strait of Magellan. The COMMON S. (*M. Americana* or *varians*) is about the size of a cat, generally black or blackish brown, with white streaks along the back. It inhabits burrows which it makes in the earth, feeds on mice, frogs, &c., and also on insects and fruits; and sometimes enters houses to plunder storerooms, where, if it is suddenly alarmed, everything is tainted with an intolerable odor. White streaks on the back, one or more, are very characteristic of this genus.

SKYE, the largest of the Scottish islands after Lewis, and the most northerly of the group known as the Inner Hebrides, forms part of the county of Inverness, from the mainland of which it is separated by a channel scarcely half a mile in breadth at its narrowest point, Kyle Rhea. Its extreme length, from south-east to north-west, is 47 miles; breadth, from 7 to 25 miles; but on account of the extraordinary number of inlets at all parts of the island, no point is above 4 miles from the sea. Area, 547 sq. m.; pop. (1871) 17,330; (1881) 16,099. S. is for the most part mountainous and moory, but it contains some pleasant tracts of arable and pasture land, and one considerable plain, formerly the bed of a lake, in the parish of Kilmuir, where some ruins of a religious house called after St. Columba were found. The principal mountains are the Coolin Hills (not Cuchullin), which stretch irregularly chiefly from south-west to north-east, terminating in the sharp peak of Scoor-nan-Gillean (3167 feet) above Sligachan. Another peak, Scoor Dearg, has been found to be the highest of the range (3233 feet), but Scoor-nan-Gillean will still be regarded as the chief of the Coolin Hills. The jagged outline of these remarkable hills arrests the eye at a great distance, and forms the dominant feature in the view at almost every point round the island, and far out at sea. The rock of which they are composed, hypersthene, is not found in any other part of Britain. The most

famous scene in this region is Loch Coiruisg, a small lake near the head of the bay of Scavaig, all but encircled by frowning ridges of rock, shooting up at several points to heights above 3000 feet. It has been powerfully depicted by Sir W. Scott in *The Lord of the Isles*. Glen Sligachan, extending from the head of the loch of that name about 9 miles to Camusunary, is by many considered the grandest glen in the Highlands. The scenery of Cuiraing, near the north of the island, has been truly styled 'unique.' The same may be said of Storr. The coast-scenery is for the most part highly picturesque. Between Rhunam-Brarin and Loch Staffin, on the east side, it presents columnar trap formations on a grand scale.

On the west side, at Galtrigill and Vaterstein, the cliffs reach a height of 1000 feet. Over these cliffs descend many remarkable waterfalls, and their bases are frequently worn into deep caves, some of which are of historical interest. One, near Portree, afforded a refuge to Prince Charles; another, on the west coast, was the temporary prison of Lady Grange. The largest arms of the sea are Loch Bracadale, Loch Dunvegan, and Loch Snizort; and the chief harbors are those of Portree, Uig, Grishernish, Lochbay, Dunvegan, Pooltiel, and Harport.

The coasts abound in fish, the most important being herring, salmon, cod, and ling. Good oysters are found in several places. The herring-fishery is prosecuted in the season in all the bays; the cod and ling-fishery is chiefly confined to Loch Dunvegan and Loch Snizort; and the salmon-fishery to Portree and the east coast. Lobster-fishing is also carried on to a considerable extent. There are no rivers of any magnitude; but salmon and sea-trout are got in some of the principal streams, at Skeabost, Portree, Ose, Hammer, &c., and trout in most of the fresh-water lochs. Deer are not numerous, nor are grouse. West Highland cattle are reared to a considerable extent, but sheep-farming on a large scale predominates. The climate is exceedingly rainy, but mild and healthy. Agriculture in S. being comparatively unprofitable, owing to the moisture of the climate, is falling into entire neglect on some of the chief sheep-farms. The soil, however, is in many places excellent, and capable, in dry seasons, of yielding good cereal crops, while for turnips it is peculiarly suited.

The inhabitants are for the most part poor and ill-housed, but well-behaved and intelligent. At one time they contributed largely to the British army; not less than 10,000 private soldiers, it has been calculated, during the long war with France. The number of soldiers now sent from Skye is very small. In the districts where the men practise fishing, nearly the whole of the adult males go to the east coast fisheries in summer, while from all parts of the island young men and women go to the south in search of field-labor. Potatoes and fish are the general diet, meat being a rare luxury. The population is chiefly Celtic, with, however, a considerable mixture of the Norse element. Gaelic is still universally spoken, but is gradually giving place to English. The chief proprietors are still, as of old, Lord Macdonald, whose seat, Armadale Castle in Sleat, is one of the most beautiful in all its surroundings to be seen on the Scottish coasts, and Macleod of Macleod, whose ancient castle of Dunvegan, picturesquely seated on a rock, has been pleasantly commemorated by Dr. Johnson and Sir Walter Scott. The principal port of S. is Portree, a picturesquely situated village of (1881) 758 inhabitants, to which steamers regularly ply from Glasgow, and also from Strome Ferry, in connection with the Skye Railway thence to Inverness. Other villages, also calling-points of the steamers, are Kyleakin (Hakon's Strait), Broadford, and Dunvegan. The celebrated whiskey generally known as 'Tallisker,' is made at the distillery of Carabost, at the head of Loch Bracadale. The inhabitants are nearly all Presbyterians, and chiefly adherents of the Free Church.

Of books about S. the most interesting are, Boswell's *Tour in the Hebrides*, and Alexander Smith's *Summer in Skye*.

SKY'ROS, or SCYRO, an island of the Grecian Archipelago, the largest of the northern Sporades, 25 miles north-east of Eubœa. Length 19 miles; area 60 sq. miles. S. is very mountainous and uncultivated in the south; but the northern part, though also hilly, has several fertile plains, which produce as fine wheat as any grown in the archipelago. The only town in the island is Skyro, or St. George, which is built on a high peak on the eastern coast, the broad summit of which is occupied by the ruins of a castle, and was the site of 'the lofty Scyros' of Homer. There are several relics of antiquity in the island. Pop. 3250.

SLAGS, called otherwise Scoriæ or Cinders, are fused compounds of silica in combination with lime, alumina, or other bases; and result as secondary products from the reduction of metallic ores. More or less of the metal always remains in a slag; in the early days of iron-smelting, the proportion of metal thus wasted was so great, that some old slags have been profitably smelted in recent times. Slags being silicates, are of the nature of glass, and externally have a glassy, crystallized, or stone-like character. Beautifully crystallized specimens are occasionally to be met with at smelting-works. They vary very much in color, and are sometimes so prettily veined and marbled, that attempts have been made to apply them to ornamental purposes. Millions of tons of slag are annually produced at the iron-smelting works of Great Britain, but almost the only use to which it has yet been successfully applied is in the making of square blocks or bricks for building purposes. The slag is run into moulds, either as it issues from the blast-furnace, or after being remelted; and it is found to be a very durable material. Broken slag is also used as a covering for roads, but its brittleness and sharpness are objectionable qualities for this purpose. Several patents, beginning so far back as 1728, have been taken out for casting slag into articles of a more ornamental kind, but hitherto they have not been commercially successful.

In an archæological point of view, slags are interesting as pointing out the sites of ancient smelting-works, and as affording a clue to the primitive methods of obtaining the metals from their ores.

SLANDER is an injury to a person's character and reputation caused by spoken words. It is difficult to define what kind of injuries of this nature are actionable, but in general whatever imputes disgraceful, fraudulent, or dishonest conduct, or even tends to make a man contemptible, in his private relations, and shunned by his friends and neighbors, is a slander. Thus, whatever imputes a crime or indictable offence, or a contagious disease, is a slander. There are some epithets, however, which are not actionable unless some special damage is directly caused thereby, as calling a man a scoundrel, swindler, rogue, gambler, liar, &c. To call a woman a whore is also not actionable, unless she can show that she has lost offers of marriage, &c. thereby. Words imputing gross ignorance or misconduct affecting one's trade or profession, are, however, actionable, as calling a man a bankrupt grocer, a quack doctor, &c. See also LIBEL. The remedy for slander is an action at law for damages. Though certain words when spoken will not amount to slander, yet, if printed or written, they will sometimes become so, as calling one a rogue, swindler, rascal, &c.

SLANG, once assumed to have been borrowed from the gipsy tongue, but derived by Skeat from a Scandinavian source (see his *Etymological Dictionary*). In its usual signification, it denotes a burlesque style of conversational language, originally found only among the vulgar, but now more or less in use in this country among persons in a variety of walks in life. It is somewhat allied to, though not indentical with *cant* (in French *argot*), the language used for purposes of concealment by thieves and vagrants of all descriptions.

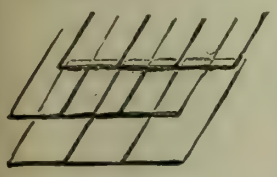
Slang is not exclusively of modern date. It was known in the classic ages of Greece and Rome, and abounds in the writings of Aristophanes, Plautus, Terence, and Martial. Every modern European language has its slang. In our country, the 'Rump,' the 'Barebones Parliament,' the terms 'Roundheads,' 'Puritans,' 'Quakers,' all belonged to the slang of the 17th century. *Hudibras* and the dramatic works of last century abound in slang. Old English slang was coarser than that now in use, but the greater portion of its phraseology had a somewhat restricted circulation, not permeating every species of conversation to the extent that modern slang does. Towards the close of last century, the slang vocabulary received large additions from pugilism, racing, and 'fast life;' and its fashionable vulgarisms came into great favor during the minority of the Prince Regent. In the present century, the growth of refinement in manners and ideas has not banished slang, but given it a more familiar and utilitarian character, while it has been introduced in some measure into circles where it was formerly unknown.

Slang consists in part of new words, and in part of words of the legitimate language invested with new meanings, such as are assigned to the verbs to *cut* to *do*. Many slang expressions are derived from thieves' cant, and some from the gypsy tongue. Their derivations are often indirect, arising out of fanciful allusions and metaphors, which soon pass out of the public mind, the word remaining, while its origin is forgotten. The origin of much of the current slang may be traced to the universities of Oxford and Cambridge, and the great public schools of England. There is not an institution connected with the university which has not its slang equivalent (e. g., 'plucked,' 'little go').

There is a slang attached to various professions, occupations, and classes of society. The slang of English fashionable life and fashionable novels comprises a number of French words and phrases, whose application is often very different from what is current in France. The *beau monde*, a *chaperon*, a marriage being on the *tapis*, are expressions which, in their English sense, are utterly unknown in Paris. To the slang of military life, Hindustani has contributed its quota of words, imported by officers who have resided long in India. We have also parliamentary slang, religious slang, literary slang, civic slang, and shopkeepers' slang.—Many curious details regarding slang in all its departments are to be found in Hotten's *Slang Dictionary* (Lond. 1865).

SLATE, or CLAY-SLATE (Fr. *esclat*, a shiver or splinter), is a highly metamorphosed argillaceous rock, fine-grained and fissile, and of a dull blue, gray, green, or black color. It splits into thin laminæ or plates, that are altogether independent of the layers of deposit; though sometimes coinciding with them, they more frequently cross them at different angles. See CLEAVAGE. Some rocks that split into the thin plates of the original stratification, are popularly but erroneously named slate, as the thin bedded sandstones properly called flagstones or tilestones, the fissile shales of Cambrian and Silurian age, and the metamorphic gneiss, and mica schist, whose planes of division correspond to their stratification. True slate is a very compact rock, little liable to be acted upon by atmospheric agencies. It is chiefly obtained from Palæozoic strata, but it is found also among more recent rocks. It is used for various purposes, being split into thin slabs of small size for the roofing of houses, and into larger slabs for fitting up dairies, &c., and even for making billiard-tables, and split and polished by means of pumice for writing-slates. There are extensive quarries of roofing-slate in Wales and in the Western Highlands of Scotland, and in the Ardennes in France, some of which have been wrought for a long time, and give employment to a great number of workmen. A hard compact slate is best for roofing; that which is porous imbibes water, the freezing of which splits it in winter, whilst it affords also a soil for mosses, which soon injure the roof.

In roofing with slates, it is necessary to put on the slates in two thicknesses, so that the sloping joints may be covered by the overlap of the course above. Besides this, the third course must also cover the first by an inch or two, to prevent rain from penetrating. Slates are generally laid upon boarding, and bedded in lime, and nailed with malleable-iron nails, japanned, so as to prevent them from rusting. When large strong slates are used, they may be nailed to strong laths in place of boarding. Welsh slates are the cheapest and most generally used; but Easdale or Ballachulish slates, from the west of Scotland, are stronger and better when the roofs are liable to be injured.



SLATE-PENCILS are either cut or turned sticks of slate, or they are made by pressing moistened slate-powder until it is firm enough to be made into pencils.

SLAVE-COAST, a division of the coast of Upper Guinea Africa, lying between the rivers Volta and Lagos. See GUINEA.

SLAVERY. A slave is an individual who is the property, or at the disposal of another, who has a right to employ or treat him as he pleases. Such is the state of the slave in the most absolute sense of the term; but slavery has been subjected to innumerable limitations and modifications.

Slavery probably arose at an early period of the world's history out of the accident of capture in war. Savages, in place of massacring their captives, found it more profitable to keep them in servitude. All the ancient oriental nations of whom we have any records, including the Jews, had their slaves. The Hebrews were authorized by their law to possess slaves, not only of other races, but of their own nation. The latter were generally insolvent debtors, who had sold themselves through poverty, or thieves who lacked the means of making restitution; and the law dealt with them far more leniently than with stranger slaves. They might be redeemed; and if not redeemed, became free in the space of seven years from the beginning of their servitude; besides which, there was, every fiftieth year, a general emancipation of native slaves.

Slavery existed in ancient Greece: in the Homeric poems, it is the ordinary destiny of prisoners of war; and the practice of kidnapping slaves is also recognized—Ulysses himself narrowly escaping a fate of this kind. None of the Greek philosophers considered the condition of slavery objectionable on the score of morals. Aristotle defends its justice on the ground of a diversity of race, dividing mankind into the free and the slaves by nature; while Plato only desires that no Greeks should be made slaves. One class of Greek slaves were the descendants of an earlier and conquered race of inhabitants, who cultivated the land which their masters had appropriated, paid rent for it, and attended their masters in war. Such were the Helots in Sparta, the Penestæ in Thessaly, the Bithynians at Byzantium, &c., who were more favorably dealt with than other slaves, their condition somewhat resembling that of the serfs of the middle ages. They could not be sold out of the country, or separated from their families, and were even capable of acquiring property. Domestic slaves obtained by purchase were the unrestricted property of their owners, who could dispose of them at pleasure. In Athens, Corinth, and the other commercial states, they were very numerous, and mostly barbarians. They were employed partly in domestic service, but more as bakers, cooks, tailors, or in other trades, and in mines and manufactories; and their labor was the means by which the owner obtained profit for his outlay in their purchase. These slaves were, for the most part, purchased; but few were born in their master's family, partly from the general discouragement of the cohabitation of slaves, and partly from the small number of the female in comparison with the male slaves. An extensive traffic in slaves was carried on by the Greek colonists in Asia Minor with the interior of Asia; and another source of supply arose from the practice common among Thracian parents of selling their children. In Greece in general, and especially at Athens, slaves were mildly treated, and enjoyed a large share of legal protection. According to Demosthenes, a slave at Athens was better off than a free citizen in many other countries.

The Roman condition of slavery differed in some particulars from that of Greece. All men were considered by the Roman jurists to be free by natural law; while slavery was regarded as a state contrary to natural law, but agreeable to the law of nations, when a captive was preserved, instead of being slain (hence the name *servus*, quasi *servatus*); or agreeable to the civil law, when a free man sold himself. In earlier times, there was no restriction on the master's power of punishing or putting to death his slave; and even at a later period, when the law on this head was much modified, slaves were used with considerable rigor. The estimation in which their lives were held is illustrated by the practice of gladiatorial combats, as also by the conduct of Vedius Pollio, who, in the polite age of Augustus, flung such slaves as displeased him into his fishponds, to feed his lampreys, and on the matter being brought under the emperor's notice, was visited with no severer punishment than the destruction of his ponds. Old and useless slaves were often exposed to starve in an island of the Tiber. Under the Empire, the cruelty of masters was in some degree restrained by law. It was enacted that a man who put to death his own slave without cause should be dealt with as if the slave had been the property of another; and that if the cruelty of the master was intolerable, he might be compelled to sell the slave. A constitution of Claudius declared the killing of a slave to be murder, and it was also enacted, that in sales of slaves, parents and children, brothers and sisters, should not be separated. A slave could not contract marriage, and no legal relation between him and his children was recognized. The children of a female slave followed the status of their mother. There were various ways in which a slave might be manumitted, but the power of manumission was restricted by law. The harboring of a runaway slave was illegal. The number of slaves in Rome, originally small, was increased much by war and commerce; and the cultivation of the soil came, in the course of time, to be entirely given up to them.

During the later republic and empire, persons in good circumstances kept an immense number of slaves as personal attendants; and the possession of a numerous retinue of domestic slaves was matter of ostentation—200 being no uncommon number for one person. A multitude of slaves were also occupied in the mechanical arts and the games of the amphitheater. Originally, a slave was incapable of acquiring property, all his acquisitions belonging to his master; but when slaves came to be employed in trade, this condition was mitigated, and it became the practice to allow a slave to consider part of his gains, called his *peculium*, as his own, a stipulation being sometimes made that he should purchase his freedom with his peculium, when it amounted to a specific sum.

Though the introduction of Christianity did not do away with slavery, it tended to ameliorate the condition of the slave. Justinian did much to promote the eventual extinction of slavery; and the church excommunicated slave-owners who put their slaves to death without warrant from the judge. But the number of slaves again increased; multitudes being brought with them by the barbarian invaders, who were mostly Slavonian captives (whence our word *slave*); and in the countries which had been provinces of the empire, slavery continued long after the empire had fallen to pieces, and eventually merged into the mitigated condition known as serfdom, which prevailed all over Europe in the middle ages, and has been gradually abolished in modern times. See SERF. But though the practice of selling captives taken in war as slaves ceased in the Christian countries of Europe, a large traffic in slaves continued among Mohammedan nations, by whom Christian captives were sold in Asia and Africa; and in the early middle ages, the Venetian merchants traded largely in slaves, whom they purchased on the coast of Slavonia, to supply the slave-markets of the Saracens.

The negro slavery of modern times was a sequel to the discovery of America. Prior, however, to that event, the negroes, like other savage races, enslaved those captives in war whom they did not put to death, and a considerable trade in slaves from the coast of Guinea was carried on by the Arabs. The deportation of the Africans to the plantations and mines of the New World doubtless raised the value of the captive negro, and made slavery rather than death his common fate; while it may also have tempted the petty princes to make war on each other, for the pur-

pose of acquiring captives, and selling them. The aborigines of America having proved too weak for the work required of them, the Portuguese, who possessed a large part of the African coast, began the importation of negroes, in which they were followed by the other colonizers of the New World. The first part of the New World in which negroes were extensively used was Hayti, in St. Domingo. The aboriginal population had at first been employed in the mines; but this sort of labor was found so fatal to their constitutions that Las Casas, bishop of Chiapa, the celebrated protector of the Indians, interceded with Charles for the substitution of African slaves as a stronger race; the emperor accordingly, in 1517, authorized a large importation of negroes from the establishments of the Portuguese on the coast of Guinea. Sir John Hawkins was the first Englishman who engaged in the traffic, in which his countrymen soon largely participated, England having exported no fewer than 300,000 slaves from Africa between the years 1680 and 1700; and between 1700 and 1786, imported 610,000 into Jamaica alone. The slave-trade was attended with extreme inhumanity; the ships which transported the negroes from Africa to America were over-crowded to such an extent that a large proportion died in the passage; and the treatment of the slave after his arrival in the New World depended much on the character of his master. Legal restraints were, however, imposed in the various European settlements, to protect the slaves from injury; in the British colonies courts were instituted to hear their complaints; their condition was to a certain extent ameliorated, and the flogging of women was prohibited. But while slavery was thus legalized in the British colonies, it was at the same time the law of England (as decided in 1772 in the case of the negro Somerset), that as soon as a slave set his foot on English soil he became free; though, if he returned to his master's country, he could be reclaimed.

Before the idea of emancipation was contemplated, the efforts of the more humane portion of the public were directed towards the abolition of the traffic in slaves. In 1787, a society for the suppression of the slave-trade was formed in London, numbering Messrs. W. Dellwyn, Thomas Clarkson, and Granville Sharp among its original members. The most active parliamentary leader in the cause was Mr. William Wilberforce, whose views were seconded by Mr. Pitt. In February 1788, an order of the crown directed that an inquiry should be made by a committee of the Privy Council into the state of the slave-trade; and an act was passed to regulate the burden of slave-ships, and otherwise diminish the horrors of the middle-passage. A bill introduced by Mr. Wilberforce for putting an end to the further importation of slaves was lost in 1791. Meanwhile, our conquest of the Dutch colonies having led to a great increase in the British slave-trade, an order in council, in 1805, prohibited that traffic in the conquered colonies; and in the following year, an act was passed forbidding British subjects to take part in it, either for the supply of the conquered colonies or of foreign possessions. In the same year, a resolution moved by Mr. Fox for a total abolition next session, was carried in the Commons, and on Lord Granville's motion, adopted in the Lords; and the following year, the general abolition bill, making all slave-trade illegal after 1st January 1808, was introduced by Lord Howick (afterwards Earl Grey) in the House of Commons, was carried in both Houses, and received the royal assent on 25th March 1807.

British subjects, however, continued to carry on the trade under cover of the Spanish and Portuguese flags; the slave-ships were more crowded than ever, from the necessity of avoiding capture, and the negroes were not unfrequently thrown overboard on a pursuit. The pecuniary penalties of the act were discovered to be inadequate to put down a traffic so lucrative as to cover all losses by capture. Mr. Brougham therefore, in 1811, introduced a bill, which was carried unanimously, making the slave-trade felony, punishable with 14 years' transportation, or from three to five years' imprisonment with hard labor. An act of 1824 declared it piracy, and as such, a capital crime, if committed within the Admiralty jurisdiction; and the statute of 1837, mitigating the criminal code, left it punishable with transportation for life. Among the philanthropic projects due to the exertions of the Anti-slavery Society was the establishment of the colony of Sierra Leone, on the coast of Africa, which had been formed by the British government in 1787, in order to show the possibility of obtaining colonial produce without slave-labor, and after the abolition of the slave-trade, became a settlement for the negroes captured by British cruisers.

The United States of America abolished the slave-trade immediately after Great Britain, and the same was in the course of time done by the South American republics of Venezuela, Chili, and Buenos Ayres, by Sweden, Denmark, Holland, and during the Hundred Days after Napoleon's return from Elba, by France. Great Britain, at the peace, exerted her influence to induce other foreign powers to adopt a similar policy; and eventually nearly all the states of Europe have passed laws or entered into treaties prohibiting the traffic. The accession of Portugal and Spain to the principle of abolition was obtained by treaties of date 1815 and 1817; and by a convention concluded with Brazil in 1826, it was declared piratical for the subjects of that country to be engaged in the slave-trade after 1830. By the conventions with France of 1831 and 1833, to which nearly all the maritime powers of Europe have since acceded, a mutual right of search was stipulated within certain seas, for the purpose of suppressing this traffic. The provisions of these treaties were further extended in 1841 by the Quintuple Treaty between the five great European powers, subsequently ratified by all of them except France. The Ashburton treaty of 1842 with the United States provided for the maintenance by each country of a squadron on the African coast; and in 1845, a joint co-operation of the naval forces of England and France was substituted for the mutual right of search.

The limitation of the supply of negroes naturally led, among other good results, to a greater attention on the part of the masters to the condition of their slaves. But the attention of British philanthropists was next directed towards doing away with slavery altogether in our colonies. Societies were formed with this end, an agitation was set on foot, and attempts were made, for some time without success, to press the subject of emancipation on the House of Commons. At length, in 1833, a ministerial proposition for emancipation was introduced by Mr. Stanley, then Colonial Secretary, and an emancipation bill passed both Houses, and obtained the royal assent, 28th August 1833. This act, while it gave freedom to the slaves throughout all the British colonies, at the same time awarded an indemnification to the slave-owners of £20,000,000. Slavery was to cease on 1st August 1834; but the slaves were for a certain duration of time, to be apprenticed laborers to their former owners. Objections being raised to the apprenticeship, its duration was shortened, and the complete enfranchisement took place in 1838.

The French emancipated their negroes in 1848; as did most of the new republics of South America at the time of the revolution; while the Dutch slaves had freedom conferred on them in 1863. In Hayti, slavery ceased as far back as 1791, its abolition having been one of the results of the negro insurrection of that year. Slavery still exists in the Spanish and Portuguese colonies, but recent acts have been passed for its abolition. In Brazil, a law for the gradual emancipation of slaves was passed in 1871. It enacts that from that date children born of slave women shall be free; while, at the same time, they are bound to serve the owners of their mothers as apprentices for twenty-one years. A recent treaty between Great Britain and the Sultan of Zanzibar secures, in promise, the speedy abolition of the slave-trade on the opposite eastern coast of Africa. The expedition of Sir Samuel Baker, in 1873, was announced as having put an end to the slave-trade to the south of Egypt, as far as the equator. How far the Khedive was sincere in coupling this object with the conquest of the Nile regions is doubtful; and it is certain that most of his officers, and an army of slave-hunters, are bent on defeating the attempt. In 1874, the British governor at the Gold Coast, where domestic slavery still existed, announced that thenceforth no person could be sold as a slave in the protectorate, or removed from it for that purpose.

In presence of the statement in the 'Declaration of Independence,' that 'all men are born free and equal, and possess equal and inalienable rights to life, liberty, and the pursuit of happiness,' the colonies which threw off the British yoke numbered several hundred thousand negro slaves, whose condition of slavery was expressly recognized in the constitution of the United States, as ratified in 1788, provision being there made for the rendition of fugitive slaves, a subject the regulation of which was delegated to the federal government, slavery being otherwise left to be governed by the laws of the states where it existed. Slavery established itself firmly in the southern states, where negro labor was required for the cultivation of sugar and cotton; and after the limitation of the supply from Africa, the breeding of slaves went on to a large extent in Maryland and Virginia for the supply of the other states of the south. The different position of the northern and southern states regarding slavery, combined with other causes to engender that diversity of feeling and interest between north and south, out of which arose the civil war. The politicians of the north, however, except a small section, by no means advocated the abolition of slavery where it already existed; they only objected to its extension to new territories. The increased consumption of cotton led to an increased demand for slave-labor; and in 1820, when Missouri was admitted to the Union as a slave state, a compromise was entered into by which slavery was legalized to the south, but prohibited to the north of 36° 30′ N. lat. (see MASON AND DIXON'S LINE).

California, though partly lying south of that geographical line, was admitted as a free state, the southern party obtaining in compensation the boon of an amendment of the fugitive Slave Law, making it penal to harbor runaway slaves or aid in their escape. A reaction against the policy of the south, and Mr. Lincoln's elec-

tion as President, were the signals for a long contemplated secession of the southern states, and the bloody war which ended in the overthrow of the principle of state-sovereignty and the consolidation of the Union. In the course of the war, many negroes were emancipated; and on 22d September 1862, Mr. Lincoln issued a proclamation declaring all the negroes of secession masters who should not have returned to the Union before 1st January 1863, to be free. In January 1865, congress finally voted for an amendment to the constitution, abolishing slavery; and by the end of the year this had been approved by an overwhelming majority of the state legislatures.

SLAVES, or SLAVONIANS (native name *Slowene* or *Slowane*, derived by some from *Slawa*, fame, but better from *Slowo*, a word; thus meaning 'speaking' or 'articulate,' as distinguished from other nations, whom they called Niemetz, or 'Mutes'), the general name of a group of nations belonging to the Aryan family, whose settlements extend from the Elbe to Kamtchatka, and from the Frozen Sea to Ragusa on the Adriatic, the whole of Eastern Europe being almost exclusively occupied by them. They were settled in these regions before the dawn of history, and are comprehended by ancient writers under the designations of Sarmatians and Scythians. The original names of the Slavic tribes seem to have been Winds or Wends (*Venedi*) and Serbs. The former of these names occurs among the Roman writers, and later, in Jornandes, in connection with the commercial peoples of the Baltic Sea; the latter is spoken of by Procopius as the ancient name common to the whole Slavic stock.

The earliest historical notices extant represent the S. as having their chief settlements about the Carpathians, from which they spread northward to the Baltic, westward as far as the Elbe and the Saal, and later after the overthrow of the kingdom of the Huns, southward beyond the Danube, and over the whole peninsula between the Adriatic and the Black Sea. These migrations ceased in the 7th c.; the division of the Slavic stock into separate branches became now more complete, and gradually they began to form into independent states. The various sections of the stock may be divided into two groups, the south-eastern and the western; the first comprehends—(1), Russians; (2), Bulgarians; (3), Illyrians (Serbs, Croats, Winds): the second—(1), Lechs (Poles, Silesians, Pomeranians); (2), Czechs or Bohemians (Czechs, Moravians, Slovaks); (3), Polabians, comprising the Slavic tribes of N. Germany, who are fast disappearing, by being absorbed in the Teutonic population. With the exception of Russia and, since the Berlin Congress of 1878, of Servia and Montenegro, the once numerous Slavic kingdoms (Bohemia, Bulgaria, Moravia, Poland, &c.) have lost their independent sovereignty, and been incorporated in other states, chiefly Turkey, Austria, Prussia, and Saxony. The Polabians never attained any distinct political footing. The whole of the Slavic populations are estimated at upwards of 80 millions.

The S. are represented by ancient writers as an industrious race, living by agriculture and the rearing of flocks and herds; as hospitable and peaceful, and making war only in defence. The feeling of nationality was strong among them. The government had a patriarchal basis, and chiefs or princes were chosen by assemblies. But contact with the feudal institutions of the Roman-German empire gradually altered this primitive constitution; the Slavic princes strove after unlimited power, like that of the emperors; and the chiefs sought to dominate over the people, like the feudal nobility. In the course of the 11th, 12th, and 13th centuries, nobility became a hereditary privilege throughout the Slavic states. The worst kind of feudalism fairly took root, and the people sank into the condition of serfs. Between them and the nobles there was no third or middle class, as the peculiar privileges of the nobility prevented the growth of cities. See SERF, RUSSIA.

The *religion* of the ancient S., like that of the Teutonic nations, seems to have been, in many of its features at least, a kind of nature-worship; not, however, without the idea of a One supreme power, to whom the other agencies were subordinate. From this, some authorities infer that the system was originally a monotheism, which in process of time had become obscured and confused by the infusion of foreign elements, and thus degenerated into polytheism, and finally pantheism. The chief deity, whose worship seems to have been common to all the Slavic tribes, was Swiatowit, with whom were associated on a nearer footing of equality than the other gods, Perun and Radegast—if, indeed, these three names do not merely denote different personations or manifestations of the same power. In this trinity, Swiatowit is considered as most analogous to Mars and Zeus, Perun to Jupiter and Thor, and Radegast to Mercury and Odin.

Of the numerous gods of an inferior order, we may name Prowe, god of justice; Prija (= Freya), Venus; Bjelbog, the White god, and Cernobog, the Black god; together with multitudes of demons and spirits good and bad. The images of the Slavic divinities (a stone statue of Swiatowit was in recent times discovered in Eastern Galicia) had a striking resemblance to those of India. Swiatowit had four heads, Rugewit (the god of war) had seven faces, and Perun four, and so on. The S. seem to have been not without some crude notion of existence and retribution after death. Worship was performed in groves and temples, cattle and fruits being offered by the priests, whose office must have been originally performed by the head of the family or chieftain, as the common name for priest and prince (*kniez*) shows.—The eastern S. received Christianity from Byzantium in the 9th c., through the instrumentality of Cyril (q. v.) and Methodeus; the western, from Rome and Germany.—PANSLAVISM is the subject of an article (q. v.). See Schafarik, *Slaw. Alterthümer*.

SLA'VIC LANGUAGE AND LITERATURE. The term Slavic, as applied to language or race, is a generic name (like Celtic or Teutonic) for a group of kindred languages and peoples belonging to the great Indo-Germanic or Aryan family. In its roots and structure, the Slavic language exhibits a remarkable similarity to Sanscrit, but has become European, so to speak, in the course of a long literary development, begun *before* that of any of the other European families. Its peculiarities are quite marked. The leading characteristics of the Slavic tongues are the completeness of their system of declensions, the want of articles, the absence of pronouns in the conjugation of the verb, pure vowel-endings, the fixed quantity of the syllables, the free construction of sentences, and the richness of their vocabulary. The earliest dialect of Slavic that received a literary culture was the 'Old Bulgarian,' better known as the 'Church Slavic,' which, however, failed to become the literary vehicle for all the Slavic peoples, inasmuch as the special dialect of each gradually acquired a literature of its own. Altogether, writers reckon eight distinct extant dialects of Slavic: 1. The 'New Bulgarian;' 2. The Russian; 3. The Servian or Illyrian; 4. The Polish; 5. The Bohemian; 6. The Slovak; 7. The Wendic; 8. The Polabic. Such of these as merit special treatment have received it.—See BOHEMIAN LANGUAGE AND LITERATURE, POLISH LANGUAGE AND LITERATURE, RUSSIAN LANGUAGE AND LITERATURE, SERVIAN LANGUAGE AND LITERATURE.—In regard to Slavic literature, considering the articles just mentioned, it is only necessary to state that at present the Russian branch of the Slavic is the richest in the number of its published works; but as regards literary merit, the Polish ranks first, having cultivated with great success almost all sorts of literature, and possessing in particular a very exquisite poetry. The Bohemian and Servian literatures both contain many fine and distinctively original productions, worthy of being more widely known than they are.—See the works of Schafarik, Eichhoff (in French), Mickiewicz, Talvi (Eng. transl.), Krek and Miklosich (*Vergl. Grammatik*, new ed. 1876).

SLAVO'NIA, a province of Austria, lying east of Croatia (q. v.), with which it is now politically united. It is bounded on the N. by the Drave, on the E. by the Danube, on the S. by the long strip of marsh-land known as the Slavonian Military Frontier, which stretches between it and the Save. Area of the kingdom of Croatia (q. v.) and Slavonia, 8840 sq. m.; pop. (1880) 1,191,845. The greater part of the surface of S. consists partly of eminences clothed with vines and fruit-trees, and partly of fertile and swampy plains. The mountains are rich in coal, marble, and mineral springs. The principal products are all sorts of grain, particularly maize and wheat, leguminous plants, and fruit in abundance, apples, pears, plums, walnuts, chestnuts, melons, wine, &c. There is little manufacturing industry in Slavonia.—The inhabitants of S. belong to the Slavic family (see SLAVES), and call their land Slavonska; themselves Slavonaz. They speak the so-called Illyrian or Servian tongue. See SERVIAN LANGUAGE AND LITERATURE. The Slavonians proper are a handsome, tall, and slender race. The prevailing form of religion is the Roman Catholic, but the non-united Greek Church also numbers many adherents. Education is still in a backward state. Capital of the country, Eszék (q. v.).

SLEA'FORD, a town of Lincolnshire, England, on the right bank of the Slea, a branch of the Witham, 17 miles south-south-east from Lincoln, and 52 feet above the level of the sea. It is a well-built and well-paved town, and has a fine church, built in the 13th century. Pop. (1871) 3592.

SLEEP. This term is employed to designate that state of suspension of the sensory and motor functions which appears to alternate in all animals with the active condition of those functions, and which may be made to give place to it by the agency of appropriate impressions upon the sensory nerves. This definition, which we have borrowed from Dr. Carpenter's article on 'Sleep' in Todd's *Cyclopædia of Anatomy and Physiology*, may seem somewhat complex, but cannot be simplified without rendering it less stringent. The necessity for sleep arises from the fact, that the exercise of the animal functions is in itself destructive of the tissues of the organs which minister to them, so that if the waste produced by their action were not duly repaired, they would speedily become unfit for further use; and it is on the nutritive

regeneration of the tissues which takes place during true healthy sleep that its refreshing power depends. While the sensory and motor functions are suspended during the condition we designate as sleep, the organic functions are uninterruptedly carried on, the respiratory, cardiac, and peristaltic movements proceeding with equal uniformity during the sleeping and waking states.

There can be no doubt that the state of sleep is one to which there is a periodical tendency, and that this disposition is so arranged as to correspond in its recurrence with the diurnal revolution of the earth. Although in man and most animals night is, from its darkness and silence, the natural period for repose, yet there are numerous exceptions to the rule. For example, amongst lepidopterous insects, butterflies are active during the day, hawk-moths during the twilight, and moths during the night. Amongst birds, the goatsucker, or night-jar, and the owls, are nocturnal, and, as a general rule, the same is the case with carniverous animals. The causes of sleep may be divided into the direct and the predisposing. The direct cause of sleep is that feeling of exhaustion or fatigue which is usually experienced when the waking activity has continued during a considerable portion of the twenty-four hours—a feeling that the brain requires repose; and, in fact, unless the brain be in an abnormal condition, sleep will at last supervene, from the absolute inability of that organ to sustain any further demands upon its energy.

Among the predisposing causes which favor the access of sleep, we must especially notice 'the *absence* of sensorial impressions; thus, darkness and silence usually promote repose; and the cessation of the sense of muscular effort which usually takes place when we assume a position that is sustained without it, is no less conducive to slumber.'—Carpenter's *Human Physiology*, 6th ed. 1864, p. 592. On the other hand, persons accustomed to live where there is a continuous noise, as in the neighborhood of mills or forges, often cannot sleep if the noise is suspended. These cases, however, probably fall within the next general predisposing cause —namely, the *monotonous repetition* of sensorial impressions. Thus, the droning voice of an unimpressive reader or preacher, the gentle ripple of the ocean, the hum of bees, the rustling of foliage, and similar monotonous impressions on the auditory nerves, are usually provocative of sleep. In these and similar cases, the influence of the impressions is exerted in withdrawing the mind from the consciousness of its own operations, and in suspending the directing power of the will; and this is the case, says Dr. Carpenter, 'even when the attention is, in the first instance, *voluntarily* directed to them, as in some of the plans which have been recommended for the induction of sleep, when there exists no spontaneous disposition to it. In other methods, the attention is fixed upon some internal train of thought, which, when once set going, may be carried on automatically, such as counting numbers, or repeating a Greek verb. In either case, when the sensorial consciousness has been once steadily fixed, the monotony of the impression (whether received from the organ of sense or from the cerebrum) tends to retain it there; so that the will abandons, as it were, all control over the operations of the mind, and allows it to yield itself up to the soporific influence. This last method is peculiarly effectual when the restlessness is dependent upon some mental agitation, provided that the will has power to withdraw the thoughts from the exciting subject, and to reduce them to the tranquillizing state of a mere mechanical repetition.'

The access of sleep is sometimes quite sudden, the individual passing at once from a state of complete mental activity to one of entire torpor. More generally, however, it is gradual, the mind while remaining poised, as it were, between sleep and the opposite condition being 'pervaded by a strange confusion which almost amounts to wild delirium; the ideas dissolve their connection with it one by one; and its own essence becomes so vague and diluted that it melts away in the nothingness of slumber.'—Macnish, *Philosophy of Sleep*, p. 21. The amount of sleep required by man is affected by so many conditions (amongst which must be especially mentioned *age*, *temperament*, *habits*, and previous exhaustion), that no general rule can be laid down on the subject. The condition of the *fœtus* may be regarded as one of continuous slumber: on its first entrance into the world, the infant passes most of its time in sleep, and this is particularly the case in children prematurely born, such children seeming only to awake for the purpose of receiving food. During the whole period of growth, in which it is necessary that the *constructive* operations of the body should preponderate over the *destructive* processes, an excess of sleep is required; and by the time that adult age has been attained, and the constructive and destructive processes balance each other, the necessary amount of sleep has gradually fallen to about one-third or less of the diurnal cycle. In very old age, again, in consequence of the deficient energy of the nutritive process, a larger amount of sleep is required. With regard to the influence of temperature, it is observed that a plethoric habit of body usually predisposes to sleep, while thin wiry people of a nervous temperament require comparatively little sleep.

Persons of lymphatic temperament are usually great sleepers, but this is probably due, as Dr. Carpenter suggests, to the fact, that 'through the dulness of their perceptions they are less easily kept awake by sensorial or mental excitement' than persons of a happier temperament. The influence of habit is by no means inconsiderable on the amount of sleep required by individuals, and this influence may be brought to act on the protraction as well as the abbreviation of the usual period: as extreme examples, we may mention that General Eliott, celebrated for his defence of Gibraltar, did not sleep more than four hours out of the twenty-four (which is probably the smallest allowance for rest compatible with a life of vigorous exertion); while Dr. Reid, the metaphysician, could take as much food, and afterwards as much sleep, as were sufficient for two days. Moreover, the influence of habit in producing an aptitude for repose, or a readiness to wake at particular periods, is well known. The sleep of soldiers during a siege, of sailors or others who must take their rest as they best can, will often come on at command; nothing more being necessary to induce it than to assume a recumbent, or, at all events, an easy position, and to close the eyes. Thus, Captain Barclay, in his celebrated match, in which he walked 1000 miles in 1000 successive hours, very soon got into the habit of falling asleep the moment he lay down.

The condition of the great nervous centers during sleep is a subject of much interest, on which considerable light was some time ago thrown by the observations of Mr. Durham. These observations were made on a dog from which a portion of bone about as large as a shilling was removed from the parietal region of the skull, and the subjacent dura mater cut away so as to expose the brain; and Mr. Durham draws the following conclusions from them: 1. Pressure of distended veins upon the brain is not, as is generally believed, the cause of sleep, for during sleep the veins are *not* distended.

2. During sleep, the brain is in a comparatively bloodless condition; and the blood in the encephalic vessels is not only diminished in quantity, but moves with diminished rapidity; and this is corroborated by the observations of Dr. J. Hughlings Jackson on the ophthalmoscopic condition of the retina during sleep, the optic disc being then whiter, the arteries smaller, and the retina generally more anæmic than in the waking state. 3. The condition of the cerebral circulation during sleep is, from physical causes, that which is most favorable to the nutrition of the brain tissue.*

This article would be imperfect without a brief reference to the conditions in which there is either an excess or a deficiency of sleep. There are numerous instances on record in which sleep has been continuously prolonged for weeks, or even months. Dr. Carpenter refers to two such cases, namely those of Samuel Chilton (*Phil. Trans.* 1694) and Mary Lyall (*Trans. Roy. Soc. Edin.* 1818). Blanchet, a French physician, has recently recorded three cases of what he terms 'constitutional lethargic slumber' in the *Comptes Rendus*, 1864. In one of these cases, the patient, a lady aged 24 years, who had slept for 40 days when she was 18 years of age, and 50 days when she was 20, at length had a sleep of nearly a year, viz., from Easter Sunday 1862 to March 1863. During this period, a false front tooth was removed in order to feed her with milk and soup, her only food. She was motionless and insensible. The pulse was low, the breathing scarcely perceptible, there were no evacuations, and she showed no signs of leanness, her complexion remaining florid and healthy. In such cases as these, it is not a prolongation of healthy natural sleep that is present, but a condition of hysteric coma.

Again, there are certain states of the nervous system in which there is either an entire absence of sleep (and this may continue for many days, or even weeks) or incomplete sleeplessness. Complete sleeplessness is often a most important symptom of disease. It frequently accompanies certain forms of continued fever, inflammatory affections of the brain, the eruptive fevers, &c., and when it continues for many days and nights, delirium, followed by stupor, is very apt to supervene. When the wakefulness is unattended by any disorder sufficient to account for it, some serious disease of the brain is most probably impending, such as palsy, apoplexy, or insanity. Incomplete or partial sleeplessness is a symptom of far less grave import. It is of frequent occurrence in persons whose minds are much engaged, or whose occupations subject them to great mental exertion or to the vicissitudes of fortune. It is, moreover, a symptom of many chronic diseases, as gout, chronic rheumatism, skin-diseases, disorders of the urinary organs, dyspepsia, hysterica, &c. It may also be excited by certain beverages and articles of diet; thus green tea and strong coffee often occasion wakefulness, and a full meal of animal food late in the day often disturbs the sleep of persons accustomed to dine at an earlier hour.

In the treatment of sleeplessness, or *insomnia*, as it is usually termed by medical writers, the first indication is to remove the cause which occasions it, and 'more particularly to correct a close

* See Dr. Cappie's theory as to the balance of the distribution of blood within the cranium, in *The Causation of Sleep* (2d ed. 1883).

or contaminated air; to reduce the temperature of the apartment when it is high, and the quantity and warmth of the bedclothes; to remove all the excitants to the senses; to abstract the mind from all exciting, harassing, or engaging thoughts; and to remove or counteract the morbid conditions of which this is a symptom or prominent consequence.'—Copland's *Dictionary of Medicine*, art. 'Sleep and Sleeplessness.'

A careful regulation of the secretions, by the due use of purgatives and alteratives, will often remove this symptom; and recourse should not be had to anodynes and narcotics until morbid secretions and fæcal accumulations have been completely got rid of. But these medicines are of great service when the system is thus prepared for their reception. The choice of the individual drug or combination of drugs must be dependent upon the peculiarities of the case, but, as a general rule, there is no more serviceable narcotic mixture for an adult than 25 or 30 minims of the solution of hydrochlorate of morphia (of the British Pharmacopœia), and 10 minims of chloric ether, taken in half a wine-glassful of water: medicines of this class should, however, never be resorted to without the advice of a physician.

SLEEP OF PLANTS, one of the phenomena of Irritability (q. v.) in plants. Light acts on plants as a powerful stimulus, essential to their active and healthful vegetation. When it is withdrawn, the flowers of many plants close, and the greater number show a tendency to it, whilst leaves more or less decidedly incline to fold themselves up. The leaf-stalk also generally hangs down more or less, although in some plants it is more erect during sleep. The sleep of plants, however, is not always nocturnal. The flowers of some open and close at particular hours of the day. Thus, the crocus is a morning flower, and closes soon after mid-day; whilst some flowers expand only in the evening or during the night. Their hours of vegetative rest are probably as essential to the health of plants as those of sleep are to animals. It was Linnæus who first observed the sleep of plants in watching the progress of some plants of *lotus*, the seeds of which he had sown.

SLEEPERS, timbers laid *asleep* or resting along their whole length. They are chiefly used along the top of dwarf-walls for the support of the timbers of the ground floor of houses.—The timbers supporting railway rails, and laid at right angles to them across the railway, are also called sleepers.

SLE'SVIG, a duchy known till the 14th c. as South Jutland, formed part of the Danish dominions till 1864, when it fell into the hands of the Austrian and Prussian sovereigns. In terms of the treaty of 1867, it was incorporated with Prussia. The population in 1864 was 406,486. Within its old recognized limits, it was bounded on the N. by Jutland; on the E. by the Little Belt and the Baltic; on the W. by the German Ocean; and on the S. by Holstein, from which it was divided by the Eyder and the Kiel Canal. The area was 3492 sq. miles. The country consists in its eastern and central parts of a gently undulating plain, deeply indented with fiords and streams; and on its western boundary of flat marshy tracts of ground, which require to be protected from the encroachments of the sea by numerous dams.

The numerous islands which skirt the west coast of S. have probably, at some not very remote period, formed part of the mainland, for navigation is so seriously impeded by the sand-banks, that this coast is now accessible for ships by only three passages. The cluster of small islands known as the Halligers, which lie, unprotected by dams, in the midst of these submerged sand-tracts, are so constantly exposed to the action of waves and storms, that the inhabitants are compelled to raise their houses on piles. On the eastern coast of S. lie the islands of Alsen, Aroe, and Femern, where the principal bays and inlets are the Hadersley and Aabenrade Fiords, opening into the Little Belt; the Flensborg Fiord, the Slie, the Eckernforde Fiord, and the Kieler Fiord, which formed the ancient boundary between S. and Holstein on the S.-E., while the Eyder completed it on the S.-W. The principal branches of industry are agriculture, the rearing of cattle, fishing, and ship-building.

The Slie is the chief seat of the herring and salmon fisheries, which, although still of some importance, are very inferior to those of the middle ages, when, according to the Danish historian, Saxo Grammaticus, herrings were so plentiful in the Belts and Cattegat, that they could be caught with the bare hands. The chief towns of S. are Flensborg (q. v.), Slesvig, now capital of a Prussian province, a very ancient city, and formerly the key of Denmark (pop. about 16,000); Hadersley, Husum, and Tonder. In the south, and partly in Holstein, Rendsborg (pop. 13,000). S. has 800 schools. With regard to the language spoken by the mixed population of the duchy, it may be asserted that rather more than the half speak Danish; and of the remainder, about 30,000 persons who belong to the islands on the western coast, which once formed part of the old province of North Friesland, still use the Frisic language, the rest of the inhabitants using either Low or High German. The original Danish element of S. has remained purest in the northern half of the duchy; while in the southern parts, where the inhabitants are naturally brought much in contact with Holstein, they have of late years adopted the views, tastes, and language of their German neighbors. The Lutheran is the established religion of Slesvig.

In accordance with the conditions stipulated in the treaty of Vienna, August 1864, by which the duchies of Holstein and S. were ceded to Austria and Prussia, the island of Aroe and other districts of S., measuring about 115 sq. m., were to be reunited to Denmark; while the latter power was to give in exchange a territory of about 130 sq. m., which, although situated within the boundary of S., had hitherto been under the jurisdiction of Jutland.

S., which forms part of the ancient Cimbrian Peninsula, has from the earliest period been a debatable land between Danes and Germans; and according to the authorities of the latter, it was anciently included in the Marches of the empire, having been incorporated by Henry the Fowler in 930, and reorganized by Otho I., when in 948 the latter erected bishops' sees in Aarhuus, Ribe, and Slesvig. In 1027, the Danish king Knud (our Canute) obtained from Conrad II. the recognition of the independence of S., which was declared to belong unconditionally to Denmark, and thenceforth given as a Danish fief of the crown to the younger sons of the regal house. In 1232, King Valdemar Seir, whose father, Prince Knud Laward, had ruled ably over the duchy, gave S.—which was then, and for some time later, known as South Jutland—to his younger son Abel. The exact terms of the donation became a subject of dispute during the successive reigns of Valdemar's sons, Eric, Abel, and Christopher, and began the long course of civil wars and family feuds which are associated with this much-contested territory. Abel, and his sons after him, backed by their kinsmen, the Counts of Holstein, maintained that Valdemar had given the duchy as an hereditary, inalienable, and indivisible fief; while, on the part of the Danish crown, it was contested that South Jutland was merely a *precarious* fief, which might be recalled at the pleasure of the sovereign. Its vicinity to Holstein tended to keep up the feuds, to which the vexed question of its mode of tenure had given occasion, and which, in fact, only ceased when the resources of the conflicting parties were exhausted, although the bitterness and ill-will with which they were fed seemed to know no intermission. The following brief summary gives the skeleton of the leading events of the history of S. from the dawn of its troubles till the final outbreak in 1848, when, by the influence of the neighboring Holstein nobles, the Germanized great landed proprietors of S. entered upon the course of armed opposition to the mother-country, which has culminated at the present moment in the forcible separation from the Danish crown of the duchy of S., and its imminent incorporation in the Prussian monarchy.

In 1386, Queen Margaret (q. v.) gave S. in fief to Gerhard, Duke of Holstein; and on the extinction of his male heirs in 1459, it virtually lapsed to the crown, with which it was united in 1460 under the rule of Christian I. (the founder of the Oldenburg line), by a mode disastrous to the integrity of the Danish monarchy. See DENMARK. After frequent division among the younger members of the royal House, which gave rise to a great number of collateral lines of the Oldenburg family (of which the Glucksburg-Sonderborg and the Augustenburg are, with the exception of the imperial House of Russia and the ducal House of Oldenburg, the chief representatives), the ducal portions of S. were inalienably incorporated with the crown of Denmark under King Frederick IV. in 1721. This act, which had the guarantee of the great powers, had resulted directly from the treasonable attitude maintained in the previous wars with Sweden by the Holstein-Gottorp princes of S., and was ratified by Russia and Sweden, no less than by England and France. The different orders of the duchy took the oaths of allegiance for themselves and their heirs, the S. arms were quartered with those of Denmark Proper, and the duchy was included with the latter in one common mode of administration. In 1848, the revolutionary movement of continental Europe fanned the flame of discontent in the duchies into a blaze, and the upper classes of S., who had in the course of time become strongly imbued with the German tendencies of the Holstein nobles, with whom they fraternized, joined the latter in open armed rebellion under the chief leadership of the princes of Augustenburg. The Germanized S. nobles, influenced by the principles of hatred to Denmark, which had long been gathering strength in the university of Kiel, refused to admit the difference between their relations to the crown and those of the Holsteiners, with whom they demanded to be indissolubly associated in separate legislative and executive chambers.

The king refused to separate S. from the monarchy; the irritation increased on both sides; the royal troops appeared in the duchies to restore order; the S.-Holstein army, whose ranks were principally filled by German volunteers, took the field, aided by the confederate forces sent by the Diet to co-operate with the Holsteiners. The troubles by which the German states were

threa ened at home led, after a few indecisive engagements had been fought, to the withdrawal of the confederate armies, and Prussia having made a special treaty of peace (after a preliminary truce with Denmark), the duchies were left to themselves, and the royal authority re-established, on the understanding that the king should submit a new form of constitution for Holstein and S. to the Diet, on account of the former being a member of the Confederation; S. being in the meanwhile put under a provisional government of Danish, Prussian, and English commissioners. By the peace with Prussia, it was solemnly guaranteed that all old treaties, including that of 1721, should be maintained in regard to Denmark; and in 1851, Austria threw an army into the duchies to aid Denmark in supporting her authority, and in dissolving the joint S. and Holstein assembly. On the death of Frederick VII. in 1863, Prince Christian of Glucksburg (see DENMARK), having ascended the throne as Christian IX., king of Denmark, Prince Frederick of Augustenburg called upon the S.-Holstein authorities to refuse the oath of allegiance to the new king, and to acknowledge himself as the rightful duke of S.-Holstein, basing his claims on his descent from the legitimate and elder male line of the House of Oldenburg. This appeal was responded to by 25 members of the Holstein Diet, who, on behalf of their own duchy and of S., petitioned the German Diet to recognize the validity of the claims of the Augustenburg line, and to pronounce the London protocol of the act of succession devoid of force.

The Prince, by this step, set at nought the family compact by which his father, uncle, and himself, for themselves and their heirs, had, at the close of the war of 1848, accepted a sum of money as full indemnity for all claims on the Danish territories, and had been allowed on that condition to evade all further consequences of the open rebellion in which they had stood against the throne. In the meanwhile, the fundamental law of November 1863 for the kingdom of Denmark and the duchy of S., which had passed the Rigsrad, and received the late king's signature shortly before his death, was published, together with a manifesto of Christian IX., stating his intention in regard to Holstein and Lauenburg. The Diet, without committing itself to uphold the Augustenburg claims, put a confederate execution into Holstein; the Danish troops were withdrawn into S.; and on the 6th January 1864, the Holstein towns did homage to the duke; while a Federal commission suppressed the provisional Holstein government, which had exercised its powers since 1862, and established a ducal government at Kiel. The Austrians and Prussians, professing to act for the Diet, summoned the Danish king to withdraw the constitution of November within 48 hours; in reply to which the Danish government demanded a term of six weeks to convoke the Rigsrad, without whose sanction no constitutional change could be adopted. The demand was rejected, and the Austro-Prussian army entered Holstein, and hostilities commenced. For ten weeks the Danes made a gallant stand against their enemy, whose enormous superiority in strength of numbers, and in the efficiency of their artillery and small-arms, made their final victory the inevitable rather than the glorious result of the campaign. The Danes were compelled to suspend hostilities, and to submit to the terms dictated by their conquerors.

A conference was held at Vienna, and after protracted negotiations, Denmark was constrained to accept peace (August 1864), on the hard terms of ceding to Austria and Prussia Holstein, S., and Lauenburg, on the ground that the indivisibility of the two duchies must be firmly established for the German fatherland by these two great powers. Following upon this, Duke Frederick of Augustenburg was in turn the favored and the rejected candidate for the throne of the new state of S.-Holstein. The upper classes in small numbers in S., in Holstein almost unanimously, were in favor of his claims, while the burgher and lower classes of S. appeared equally unanimous in regretting their severance from Denmark; and the decidedly expressed wishes of the Holstein party, backed by the lesser German states, to have the duke as their sovereign, the protests and counter-protests of the Diet and of foreign powers, all resulted in an announcement by Austria and Prussia, that according to the evidence of the commission appointed to examine the merits of the various claims of Denmark, Augustenburg, and Oldenburg to the duchies, Christian IX. was by right of succession the undoubted possessor, and that from him the duchies had passed by right of victory to Austria and Prussia. Prussia sought to annex these duchies to her dominions, and offered Austria pecuniary compensation for her assistance in the war. On the other hand, Austria advocated the independence of the duchies. Neither country would yield, and the dispute ultimately resulted in the war of 1866. According to a treaty concluded in 1867, Austria abandoned her claims in favor of Prussia, but stipulated that a part of S. should be restored to Denmark. This stipulation, however, has never been given effect to. See GERMAMY. The Prussian province of Schleswig-Holstein, formed out of the duchies of Slesvig and Holstein, has an area of 7190 square miles, and a pop. of (1880) 1,127,149.

SLI'CKENSIDES are the smooth and polished, and generally glazed surfaces of flaws in rocks. They are considered to have been produced by the friction of the two surfaces during some movement of the rock. But the two surfaces of the flaw are almost always so uneven that it is impossible to conceive that they could have rubbed against each other; besides, the flaws are generally very small, and the true slickenside is always confined to a single stratum, never passing into the bed above or below. We believe they are the castings of liquids or gases confined in the bed, and subjected to great pressure, and are similar in origin to the glazed cavities produced by gases in slags, or, to use a very familiar illustration, by the compressed steam in breakfast rolls.

SLIDING RULE, an instrument invented by the Rev. William Oughtred, an English divine and mathematician, for the purpose of solving arithmetical problems mechanically, consists of three pieces of wood, of which two are fastened together by slips of brass at a sufficient distance from each other to permit of a third sliding between them. The size of instrument which best combines convenience with accuracy is one about 2 feet long, 2 inches broad, and ¼ inch thick. One side of the rule has the following scales marked on it in order: a line of tenths of inches, of equal parts divided into tenths and hundredths of feet; three lines of numbers, each line consisting of the numbers from 1 to 10 twice repeated; a line of sine rhumbs (logarithmic sines of each quarter-point of the compass); a line of meridional parts; and a line of equal parts. Of these, two of the lines of numbers are on the middle piece or *slider*. On the other side are—two lines of *natural scales*, including sines, secants, tangents, equal parts, &c.; two line of logarithmic sines, two lines of logarithmic tangents, a third line of logarithmic sines, and a line of versed sines. Of these, one line of logarithmic sines and one of tangents are upon the slider. The scale in most common use is that of numbers, and a description of the way in which it is used will give a key to the whole working of the instrument.

It is necessary, however, to notice as a preliminary, that the scale of numbers is not evenly divided, as in this case only addition and subtraction could be performed, but is divided in proportion, not to the numbers, but to their logarithms, so that 3, whose logarithm is very nearly the half of that of 10, stands almost halfway between 1 and 10; and similarly of the other numbers. All questions of numerical proportion can thus be easily worked by means of the line of numbers on the slider, and the adjacent and corresponding one on the fixed part of the rule. To find a fourth proportional to three given numbers, we place the first term (on the slider) opposite to the second term (on the fixed scale), and opposite the third term (on the slider) is the fourth or number required (on the scale). Multiplication is performed by making 1 the first term of a proportion, and division by making it the second or third. The other scales marked on the rule are useful in the solution of trigonometrical, geographical, and nautical problems, and the results obtained are much more accurate than one at first sight would believe. Sliding rules of circular form have been made by the French, but they are not in any way preferable to the ordinary straight form.

SLIDING SCALE, a provision in some of the statutory restrictions formerly in force on the trade in corn, by which, in order to encourage importation when prices were high, and discourage it when low, the import duty was diminished as the price rose, and at famine-prices grain came in duty free. By the act of 1828, wheat was allowed to be imported on payment of a duty of £1, 4*s*. 8*d*. when the average price over England was 62*s*. a quarter. For every shilling less of price, a shilling was added to the duty; and for a rise of price the duty decreased. In 1842, while the agitation regarding the corn-laws was going on, Sir Robert Peel introduced and carried a modification of the Sliding Scale, which, however, did not succeed in mitigating the popular hostility to the corn-laws. By the Sliding-scale Act of 1842, the duty per quarter was fixed at £1 when the price of corn was under 51*s*., and diminished as the price increased, till on the quarter of wheat attaining the price of 73*s*. it fell to 1*s*. See CORN LAWS.

SLI'GO, a maritime county of the province of Connaught, Ireland, bounded on the N. by the Atlantic and the Bay of Donegal, S. by Roscommon and Mayo, E. by Roscommon and Leitrim, and W. by Mayo. It is 41 m. from E. to W., and 38 from N. to S.; the total area is 461,796 acres, of which about 320,000 are under tillage or in pasture, and 140,000 uncultivated. The pop. in 1861 was 124,845; in 1881, 110,955, of whom 101,148 were Roman Catholics, 8006 Protestant Episcopalians, and the rest of other denominations. The coast-line is indented with numerous bays, and, except in the Bay of Sligo, dangerous for navigation. The surface rises gradually from the coast eastwards as far as an elevated range called Slieve Gamph and the Ox Mountains, the highest point of which rises to 1800 feet. S. contains comparatively few and unimportant lakes, but some of these, however, are extremely picturesque, especially Lough Arrow and Lough Gill Only three of its streams are navigable—the Moy, the Owenmore

and the Garrogue, and they are all inconsiderable. The county is traversed by a railway, which is a branch of the Midland Great Western, and connects the county town of Sligo (q. v.) with Dublin. The mineral products of the county, although not very rich, are various, and consist of copper, lead, iron, and manganese. The climate is variable, and although rain is frequent, it is, on the whole, mild and healthy. The soil in the north is mossy and sandy, both being occasionally intermixed, and at times alternating with a gravelly loam. The plain of S. is a deep rich loam; and in the southern portion of the county are found large tracts of corn-land and pasturage. The occupations of the people are mainly agricultural, and, until some years back, they were chiefly engaged in tillage; but the land is now chiefly used for pasturage. The number of acres under crops of all kinds in the year 1880 was 86,914. The cattle in that year numbered 86,087; sheep, 60,409; and pigs, 12,106. The number of holdings ten years before 1852 had been 13,992; which is now somewhat reduced.

The extent of coast-line has led a considerable number of the population to engage, at least partially and occasionally, in fishing. The S. fishery district comprises 110 miles of coast, and kept engaged, in 1879, 140 registered vessels, employing 572 men and 6 boys. The principal towns are Sligo (q. v.), Ardnaree, and Tobercurry. The number of primary schools in the county in 1871 was 206; superior schools, 12. In 1880 there was, at the National Schools, an attendance of 24,267 pupils, of whom 22,691 were Catholics.

S. was anciently the seat of the O'Connors, and was the scene of many conflicts between the several branches of that family. The domestic feuds of the O'Connors were among the causes which facilitated the first inroads of the Anglo-Normans. The district contains many remains both of the Celtic and of the Anglo-Norman period. Of the former, there is one very interesting called the Giant's Cairn, near Sligo; and there are many raths, cromlechs, and ancient caverns. The county of S. sends two members to the imperial parliament.

SLIGO, chief town of the county of the same name, situated on the river Garrogue; distant from Dublin, with which it is connected by a branch from the Midland Great Western Railway, 131 miles north-west. Pop. (1861) 13,361; (1871) 10,670; (1881) 10,764. Four-fifths of the inhabitants are Roman Catholics. S. had its origin in the erection of a Dominican abbey in the 13th c. by Maurice Fitzgerald, Earl of Kildare, around which—and a castle also built by him—a town was gradually formed. In the reign of James I., it received a charter. The modern town stands within a bend of the river, chiefly on the left bank. It is for the most part well built, and contains several handsome public edifices. It possesses few important manufactures, but is a place of considerable commerce, which is directed with judgment and energy by a body of town and harbor commissioners. In 1880, 758 vessels, of 105,571 tons, entered, and cleared the port. The exports are chiefly of corn, flour, meal, butter, provisions, and yarn. Steamers ply regularly between S. and Glasgow, Liverpool, and Londonderry. S. formerly returned a member to parliament, but was disfranchised in 1870.

SLING, a weapon much in use before the introduction of firearms, consisted of a piece of leather, with a round hole in the middle, and two cords of about a yard in length. A round pebble being hung in the leather by the cords, the latter were held firmly in the right hand, and swung rapidly round. When the stone had attained great speed, one string was disengaged, on which the stone flew off at a tangent, its initial velocity being the same as it had at the last moment of revolution. This velocity gives far greater range and force than could be imparted in mere throwing.

SLIP, in a Dockyard, is a smooth, inclined plane, sloping down to the water, on which a ship is built. It requires to have a very solid foundation. Among modern inventions is a slip on which a sort of truck runs on numerous rails. This truck is run under a ship as she floats; the water is diminished till she rests on it, and it is then hauled up the slip by steam power until she is high and dry. Such a slip takes the place of a dry dock. See also LAUNCH and SHIP-BUILDING.

SLIPPED, in Heraldry, a term of blazon applied to a leaf, branch, or flower, which is represented with a stalk, and torn from the parent stem.

SLOANE, SIR HANS, an eminent physician and naturalist, of Scotch parentage, his father having been the chief of the Scottish colony which was settled in Ulster by James I. of Great Britain, was born at Killyleagh, in County Down, Ireland, 16th April, 1660. He devoted himself during his boyhood to natural history and medicine, and in spite of an attack of hæmoptysis, which lasted from his 16th till his 19th year, he arrived in London in 1679, with an excellent knowledge of the first of these sciences, and a fair acquaintance with the second. His apprenticeship to Stafforth, a pupil of Stahl (q. v.), and the acquaintance, subsequently ripened into close friendship, which he formed with Boyle and Ray, two of the most celebrated naturalists of their time, did much to encourage and advance him in his favorite studies.

During a brief sojourn in France, he attended the lectures of Tournefort and Du Verney, obtained on his return, by the active support of Sydenham (q. v.), a footing in London as a physician, and was elected a member of the Royal Society in 1685, and of the Royal College of Physicians in 1687; but in September of the latter year, he accompanied Monk, Duke of Albemarle, to Jamaica, and investigated the botany of that and the adjoining islands with such zeal and diligence during the 15 months of his stay, that his herbarium numbered 800 species. Resuming his professional practice on his return, he became physician to Christ's Hospital (1694—1724), President of the College of Physicians (1719—1735), Secretary to the Royal Society (1693), Foreign Associate of the French Academy of Sciences (1708), and succeeded Sir Isaac Newton as President of the Royal Society in 1727. He had been created a baronet and physician-general to the army in 1716, and in 1727 received the further honor of being appointed royal physician. Though of remarkably delicate constitution, he lived to the great age of 92, dying at Chelsea, 11th January 1753. The chief point to be remarked in S.'s moral character was his benevolence, as shown in the charitable uses to which he applied the whole of his salary as physician of Christ's Hospital, in his zealous promotion of the various schemes for affording medicine and attendance gratuitously to the poor, and his support of the Foundling Hospital, of which he was one of the founders. By long-continued perseverance, he succeeded in forming a most extensive museum of natural history, a library of 50,000 volumes, and 3560 MSS., which he directed to be offered at his death to the nation for £20,000 (about one-fourth of its real value), and which formed the commencement of the British Museum (q. v.). He also contributed numerous memoirs to the *Philosophical Transactions*, whose publication he superintended for a number of years. But his great work was the *Natural History of Jamaica* (fol. 1707—1725), containing also an excellent account of the topography, meteorology, and population of the island, which book was the means of introducing into the Pharmacopœia a number of excellent drugs, hitherto unknown.

SLOBDO'SK, or SLOBODSKOI', a town of Russia, in the government of Viatka, is situated on the river Viatka, about 16 miles north-east of the town of the same name. Pop. (1867) 6904.

SLOE, or SLOE-THORN (*Prunus spinosa*), a shrub of the same genus with the plum, and perhaps really of the same species with it and the bullace. It is generally a shrub of 4—10 feet high, sometimes becoming a small tree of 15—20 feet. It is much branched, and the branches terminate in spines. The youngest shoots are covered with a fine down. The flowers are small, snow-white, and generally appear before the leaves. The fruit is ovate, or almost globose, pale blue with blackish bloom, and generally about the size of the largest peas. The S. is abundant in thickets and borders of woods, and in arid places in Britain and almost all parts of Europe. The shoots make beautiful walking-sticks. Although spiny, the S. is not suitable for hedges, as its roots spread, and it encroaches on the fields. The bark is bitter, astringent, and tonic. The flowers, with the calyx, are purgative, and are in some places much used as a domestic medicine. The leaves are used for adulterating tea. The unripe fruit dyes black. The fruit is very austere. It is much used on the continent of Europe for making a preserve, also in some places for making a kind of brandy. An astringent extract, called *German Acacia*, is prepared from it, which was once much employed in cases of diarrhœa and mucous and bloody discharges. The juice is much used to impart roughness to port wine, and in the fabrication of spurious port.

SLO'NIM, a town of European Russia, in the government of Grodno, and 72 miles south-east of the town of that name. It has large manufactures of cloth. Pop. (1880) 13,500.

SLOOP is a one-masted cutter-rigged vessel, differing from a cutter, according to old authorities, in having a fixed bowsprit and somewhat smaller sails in proportion to the hull. The term 'sloop' and 'cutter' appear, however, to be used nearly indiscriminately. In the British navy, a sloop-of-war is a vessel, of whatever rig, between a corvette and a gun-boat, and ordinarily constituting the command of a commander. In the days of the sailing navy, sloops-of-war carried from 10 to 18 guns; but, with the introduction of steam, the number of guns has ceased to be distinctive.

SLOPS, in the Navy, are somewhat more extensive than 'necessaries' in the army. They comprise the clothes and bedding of a sailor. Within certain limits, government, acting through the ship's paymaster, supplies the men with slops at cost price. When a sailor dies, his slops are sold by auction for the benefit of his representatives.

SLOTH (*Bradypus*), a genus of mammalia, of the order *Edentata*, and family *Tardigrada*. The name was given from observation of the very slow and awkward movements of the animals of this genus on the ground; but a better acquaintance with their

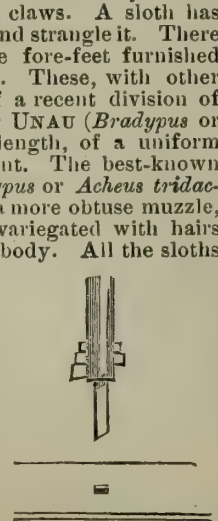
habits, and observation of their movements among the branches of trees, for which their conformation peculiarly adapts them, have shown it to be by no means appropriate or descriptive. In like manner, Buffon's notion that they are creatures of imperfect organization, and doomed to a miserable existence, has been completely exploded. Their structure, like that of every other creature, is admirably adapted to their mode of life. They feed on the leaves, buds, and young shoots of trees, amongst the branches of which they are born and spend their whole life, rarely and unwillingly descending to the ground. They do not walk upon the branches, but cling beneath them, with the back downwards.

The fore-legs are much longer than the hinder ones, and are used for embracing a branch, or for drawing in the branches on the foliage of which they are to feed, and both the fore and hind feet are furnished with very long, curved, and sharp claws. The pelvis is very wide; and the hind-legs, thus widely separated, also diverge from one another. The structure of the wrist and ankle-joints is such that the palm or sole is turned towards the body, so that upon the ground, the animal is compelled to rest on the side of the hind-foot, whilst the length of the fore-legs causes it to rest on the knee or elbow of them, struggling forward by a shuffling movement, and dragging itself along by stretching out the fore-legs alternately and hooking the claws into the ground, or grasping some object. But in a dense tropical forest, sloths generally find it easy to pass from the branches of one tree to those of another, often taking advantage for this purpose of a time when branches are brought within their reach by the wind. Where the trees are more distant from each other, they will eat up the whole foliage of a tree ere they descend from it. The hair of sloths is coarse and shaggy, of a very peculiar texture, inelastic, and much like grass withered in the sun, but affords an excellent protection from insects, whilst it also gives them such an appearance that they are not readily observed except when in motion.

Three-toed Sloth (*Bradypus trydactylus*).

The muzzle of sloths is short, and the tail is short. There are no incisor teeth, but sharp canine teeth, and eight molars in the upper, six in the lower jaw. The molars are cylindrical, penetrated by no laminæ of enamel, and adapted merely for crushing, not for grinding the food. For this, however, there is compensation in the stomach, which is somewhat imperfectly divided, by transverse ligatures, into four compartments, for the longer retention and more thorough digestion of the food, although there is no rumination. The female sloth produces only one young one at a birth, which clings to its mother till it becomes able to provide for itself. The voice of sloths is a low plaintive cry. Their chief enemies are large snakes, but against these they defend themselves by their powerful fore-legs and claws. A sloth has been known to grasp a dog round the neck and strangle it. There are very few species. One species has the fore-feet furnished with only two toes; the others have three. These, with other differences, have been made the ground of a recent division of the genus into two. The TWO-TOED S., or UNAU (*Bradypus* or *Cholœpus didactylus*), is about two feet in length, of a uniform grayish-brown color, often with a reddish tint. The best-known species of THREE-TOED S. is the AI (*Bradypus* or *Acheus tridactylus*), which is smaller than the Unau, has a more obtuse muzzle, and is generally brownish gray, slightly variegated with hairs of different tints, the head darker than the body. All the sloths belong to the tropical parts of America.

SLO'TTING-MACHINE, a machine for cutting slots, or square grooves, in metal. It is of great importance in mechanical engineering, and many very ingenious inventions have been made for facilitating the process. The principle is, however, very simple, and is the same in all. It consists of a cutting tool, or chisel, held very firmly in an arm, which is pressed down and raised alternately. The tool is thus made to pare off a thin portion of the metal each time it descends, until it has cut a slot of sufficient size. Water is continually thrown on, to prevent the metal from becoming overheated by the friction.



Slotting-machine.

SLOUGH, a village of England, in the county of Buckingham, 18 miles west of London, by the Great Western Railway. On the road between S. and Windsor, which is distant about two and a half miles, lived Sir William Herschel, and at the observatory which he erected here, in which was placed his great telescope, many of his important astronomical discoveries were made. Pop. (1871) 4509; (1881) 5080.

SLOVAKS, THE, are the Slavic inhabitants of North Hungary, who, in the 9th c., formed the nucleus of the great Moravian kingdom, but who, after the bloody battle of Presburg (907 A.D.), were gradually subjugated by the Magyars, to whom even yet they bear no friendly feeling. The S., who are of a soft, pliant disposition and industrious character number about 1,900,000, and are mostly Catholics. The S., whose character probably comes nearest to that of the old Slavic type, travel in great numbers over Germany and Poland as Pedlars. Their language is a dialect of Bohemian. Among the most notable of the Slovak authors are the poets Holly and Kollar (q. v.); Matth. Bel (1684—1749); Stephan Leschka (1757—1818) editor of the first Slovak journal; Bernolak, author of a Slovak grammar; Palkovitsh (died 1835); and Tablitsh, who published four volumes of poetry (1806—1812). A fine collection of popular Slovak ballads has been published by Kollar (2 vols., Ofen, 1834).

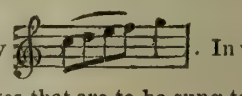
SLOW-MATCH, a combustible material, such as cotton, hemp, tow, &c., often dipped in a solution of nitrate of potash (saltpetre), and formed into a thin rope. It is used for exploding gunpowder in various ways, on account of its slow, steady way of burning, a sufficient length being taken to enable the operator to remove to a safe distance before the explosion. Slow-match was much used by artillerymen for firing of cannon, but it has generally given way to friction fusees and percussion caps.

SLUBBING. See SPINNING.

SLUG (*Limax*), a genus of gasteropodous molluscs, of the division *Monœcia* (hermaphrodite), and of the family *Limacidæ*, which is closely allied to the snail family, *Helicidæ*, but has no external shell. There is, however, a rudimental shell, generally concealed within the mantle, placed over the respiratory cavity. The *Limacidæ* are diffused over the whole world. They commit great ravages among field and garden crops during moist weather. In frosts, they become dormant, taking shelter under clods and at the roots of plants. They lay eggs in clusters, in moist places, often at the roots of grass. The eggs resemble small oval bags of jelly. The body is generally oval or oblong, elongated. The foot is not distinct from the body. There are four retractile tentacles; the eyes are at the tips of the longer pair. Slugs often climb trees in quest of decaying vegetable matter on which to feed, and let themselves down by means of mucous threads, for the formation of which there is a small aperture at the hinder end

Slugs.
1. Gray slug; 2. Black slug; 3. The same full grown, and as it appears when at rest; 4, Its eggs.

of the body. Of British species, one of the most common is the GRAY S. (*Limax agrestis*), which is of a whitish ash color; another is the GREAT GRAY S. (*L. maximus* or *antiquorum*), the largest British species; another is the BLACK S. (*L. ater*), often popularly called the Black Snail. The RED S. (*Agrion agrestis*) is also very plentiful. Careful gardeners often gather slugs by the aid of a lantern at night, and destroy them. The may also be killed by watering the ground with a weak solution of ammonia.

SLUR, in Music, an arch drawn over two or more notes *not* on the same degree, to indicate that these notes are to be played *legato*, or smoothly and fluently  . In vocal music a slur is placed over all the notes that are to be sung to the same syllable, unless where they are grouped together by a common line. A slur must be distinguished from a *tie*, which is a similar arch drawn over two notes on the same degree, and denoting that

instead of the two notes written, one is to be played of the length of both.

SLUTSK, a town of European Russia, in the government of Minsk, about 63 miles S. of the town of that name, near the source of the Lesser Slutch. With the exception of its public buildings, the houses are almost entirely of wood. Pop (1880) 17,200.

SMACK is a generic term for small decked or half-decked vessels employed in the coasting and fishing trade. The majority of smacks are, however, rigged as cutters, sloops, or yawls. According to Wedgewood, the *m* in this word is a corruption of *n*; the Anglo-Saxon has *snakk*, a small vessel, and there is a corresponding form in the other Teutonic and Scandinavian tongues.

SMALL-ARMS, in the modern acceptation, consist of the weapons actually carried by a man. They have been described under their respective heads, BAYONET, FIREARMS, LANCE, SWORD, PISTOL, &c.

SMALL-ARMS FACTORIES, ROYAL, are the establishments through which all the small-arms of every description are supplied to the regular army, the militia, yeomanry, and volunteers. The headquarters are at Enfield, where there is a vast manufactory; and at Birmingham, there is a considerable establishment for viewing the arms supplied by contractors. For many years, there had been a small ordnance factory at Enfield Lock, where a few thousand muskets were laboriously forged by hand each year; but when the sudden introduction of the rifle, and the demands of the Russian war, called for a supply of arms, which the trade of all Europe and America was unable to meet, government determined to erect machinery for the fabrication of arms. For this purpose, the factory at Enfield was entirely remodelled; machinery of great power and delicacy was adopted, and now, when in full work, the factory can turn out daily 1000 complete and proved rifles, besides a corresponding complement of other small-arms. At the same time, the accuracy of workmanship is so great, that a hundred rifles might be taken entirely to pieces, the several portions thrown promiscuously together, and a hundred complete rifles could be forthwith re-formed without any difficulty from the same pieces. Much of the merit of this great establishment was due to Major-general Manley Dixon of the Royal Artillery, who long superintended the factory after it was remodelled. The success of the factory has reduced in a remarkable degree the cost of rifles, and has brought down correspondingly the price charged by the trade for the large quantities still intrusted to it. The successive adoption of the Snider and Martini rifles has been the means of producing a great change in the plant at Enfield.

The cost of the factories, when in full operation, is of course considerable. In the year 1874, when the army was being armed with the Martini rifle, the charge was £172,837; in 1883, £115,234.

SMALL DEBTS is a phrase current in Scotland to denote debts under £12, recoverable in the Sheriff Court. See SHERIFF. In England, the same debts are recoverable in the County Court (q. v.).

SMALLPOX, or VARI'OLA, is one of the most formidable of the class of febrile diseases known as the *Exanthemata* (q. v.). All cases of regular smallpox are divisible into three stages—viz. (1), that of the initial or eruptive fever; (2), that of the progress and maturation of the specific eruption; and (3) that of the decline. Some writers make a primary stage of the period of incubation or of the time intervening between the reception of the poison into the system, and the first appearance of febrile symptoms; but this is not entitled to be regarded as a stage of the disease, seeing that no symptoms of disorder have begun to show themselves. The *first stage* begins with rigors, followed by heat and dryness of the skin, a quickened pulse, furred tongue, loss of appetite, pain in the pit of the stomach, with nausea, vomiting, headache, and often pains in the back and limbs. The violence of the pains in the back, and the obstinacy of the vomiting, are frequently very well marked and characteristic symptoms. In children, the disease is often ushered in by convulsions; while delirium sometimes attends its outset in adults. On the third day, minute red specks begin to come out first on the face, then on the neck and wrists, and on the trunk of the body, and lastly on the lower extremities. The fever usually begins to subside as soon as the eruption appears, and by the beginning of the fifth day, when the eruption is generally completed, the fever has entirely disappeared. The *second stage* commences when the eruption is fully out.

Upon the second or third day of the eruption, a little clear lymph is seen in each pimple, which has increased considerably in size since its first appearance, and which is thus converted into a *vesicle*. The vesicles gradually increase in breadth, and become converted into *pustules*, which are at first depressed in the center, but by the fifth day of the eruption become turgid and hemispherical; the suppuration on the face being complete by about the eighth day from the commencement of the fever, and the same process rapidly following in the other parts of the body in the same order of succession as that in which the eruption originally appeared. The pustules then break, and scabs or crusts form over them, which usually fall off after four or five days' existence. The number of pustules in any special case and the severity of the disease, stand in a direct ratio to one another; for 'the number of pustules indicates, in the first place, the quantity of variolous poison which has been reproduced in the blood; and, in the second place, it is also a direct measure of the extent to which the skin suffers inflammation. Sometimes there are not more than half-a-dozen pustules; sometimes there are many thousands. If all these were collected into one, it would be an enormous phlegmon. For both these reasons, the system suffers commotion, distress, and peril, in proportion to the quantity of the eruption.'—Watson's *Lectures*, &c., 4th ed. vol. ii. p. 857. The progress of the pustules is usually accompanied with swelling of the skin of the face, with a painful sensation of heat and tension; the scalp is often swollen; soreness of the mouth and salivation usually supervene; and the patient exhales a peculiar and disagreeable odor.

About the eighth or ninth day of the disease, a recurrence of the fever, known as 'the fever of maturation,' sets in with varying degrees of intensity, according to the number and arrangement of the pustules. When the pustules are numerous, they run together; when they are few, they keep separate. Hence the division of smallpox into the two great varieties of *distinct* and *confluent*, or *variola discreta* and *variola confluens;* and this division is of the highest importance, because the distinct form of the disease, in which the pustules are isolated, is scarcely ever dangerous; while the confluent form in which they coalesce, is never free from danger. The *third* or *declining stage* is, in the distinct variety, little more than a period of convalescence. About the eleventh or twelfth day, the pustules on the face become brown and dry at the top, or some of them break, and the fluid which oozes out solidifies into a yellowing crust; and from this time the process of *desiccation* goes on, the swelling of the face subsides, and at last only dry scabs remain, which gradually fall off about the fourteenth day. It is not till three or four days after the scabs have formed on the face, that the same process is completed over the whole body. The scabs are usually completely gone by the twenty-first day, leaving behind them blotches of a reddish brown color, which sometimes continue for some months before they quite disappear; and some of the pustules, in consequence of ulceration of the true skin, leave pits, especially on the face, which remain permanently.

The period of scabbing is accompanied by various symptoms of improvement: the tongue becomes clean, the appetite returns, and by the time that the scabs have fallen off, the patient may be regarded as restored to health; so that the entire course of a case of distinct or discrete smallpox occupies about three weeks. In the confluent form of the disease, the eruptive fever is more violent, the pain in the back is more severe, and the sickness more obstinate, and the eruption comes out earlier and less regularly than in the distinct variety which we selected for description as representing the more natural course of the disease. Moreover, the pustules do not fill so completely, nor are they of the normal yellow purulent hue, being whitish, brown, or even purple. But the most important difference between the two forms is in the *secondary fever*, which sets in when the pustules are mature. This fever, which is slightly marked in distinct smallpox, is usually intense, and highly dangerous in the confluent form; and it is at this period of the disease that death most commonly occurs. Statistics show that the eighth day of the eruption is the most perilous *day*, and the second week the most perilous *week*. The early occurrence of death—that is to say, during the first week—denotes a peculiar malignancy in the disease. 'The nervous system,' says Dr. Watson, 'appears to be overwhelmed by the force of the poison. During the second week, the disorder proves fatal chiefly in the way of apnœa; from some affection of the respiratory passages. After that period, the characters of asthenia commonly predominate, the patient sinks under some casual complication, or the powers of life are gradually worn out by so much irritation of the surface, and so large an amount of suppuration.' —*Op. cit.*, vol. ii. p. 860.

The above are the essential symptoms of smallpox, both in the distinct and confluent form. This disease is, however, often accompanied by other symptoms, which we have merely space to name; such as sore throat (which often depends upon pustules situated there), salivation, and (in the confluent form, during the secondary fever) erysipelatous inflammation, leading to the formation of abscesses, glandular swellings, sloughing sores on the sacrum, &c. In pregnant women, the disease often causes abortion, which is most commonly followed by death. The dead child occasionally, but not often, is covered with pustules.

The *cause* of smallpox is universally allowed to be a specific contagion, of whose nature we are in the most profound ignorance. There is probably no disease so contagious as this. Dr. Haygarth stated (in 1793) that, during his long attention to this

subject, not a single instance has occurred to prove that persons liable to smallpox could associate in the same chamber with a patient in the distemper without receiving the infection; and he was informed by an American physician of an instance in which the poisonous effluvium crossed a river 1500 feet wide, and affected ten out of twelve carpenters who were working on the other side. The contagion acts either through the air, or by contact with the skin, or by inoculation; and the disease may be caused by the dead body, even when it has not been touched. What products of the diseased body are contagious, is not exactly known, but the contents of the pustules and the dried scabs certainly are so. Opinions are divided as to the period at which the disease begins and ceases to be contagious. It is safest to maintain that it is capable of self-propagation as soon as the febrile symptoms have exhibited themselves. How soon the patient ceases to be dangerous, cannot be decided with accuracy; but the stability of the contagious principle may be inferred from the fact, that clothing will retain it for months, and it is said for years, when confined.

Like all the contagious exanthemata, smallpox appears in an epidemic form, at irregular, and, in our ignorance, it would almost seem capricious intervals. After an extraordinary exemption, perhaps for years, a district is suddenly invaded by it, and continues to suffer for a longer or shorter period, after which the disease spontaneously disappears—dies out, as it were—and does not reappear perhaps for years. Different epidemics vary very much in their severity, and isolated cases are usually milder than those occurring when the disease is epidemic. Race has much to do with the severity of the disease; the constitution of the dark races, the Negro and the Red Indian, being singularly susceptible of the contagion, and exhibiting very little power of resisting the fatal tendency of the disease.

It is universally admitted that the discovery of *Vaccination* (q. v.), by which smallpox is deprived of its danger, is the greatest triumph of modern medicine. *Inoculation* (q. v.) protected the individual, but increased rather than diminished the total number of deaths, while vaccination has the advantage of protecting both the individual and the community. Although, in the great majority of cases, vaccination affords perfect protection against smallpox, it not very unfrequently happens that vaccinated persons, when exposed to the contagion of smallpox, get the disease in a modified form, milder and shorter even than after inoculation, and therefore incomparably milder than in the natural form. The disorder occurring under these circumstances, has received the various names of *modified* or *post-vaccinal* smallpox, or the *varioloid* disease. As Dr. Wood observes: 'It is impossible to describe minutely all the shapes which the varioloid disease assumes. There is every shade between the slightest symptoms, scarcely recognizable as having affinity with smallpox, and the nearest possible approach to the regular disease.'—*Practice of Medicine*, 4th ed., vol i. p. 380. In whatever form the varioloid disease appears, it wants the peculiar odor of smallpox, and secondary fever is very rare. The constitutional disturbance which, for the first week, may have been as severe as in the true disease, usually subsides entirely when the eruption has reached its height, and the patient is convalescent at the period when, if he had not been vaccinated, he would have been in the greatest danger.

With regard to prognosis, it may be stated generally, it is a very fatal, and was formerly an extremely destructive disease—one death occurring in every four cases. Modified smallpox is very seldom fatal, although instances of death are occasionally reported. Smallpox is more fatal at the two extremes of life than in the intervening period, and, as has been already noticed, is especially dangerous in pregnancy. In olden times, it was believed that the eruption was an effort of nature to get rid of the noxious matter, and hence heating and stimulating measures were adopted with the view of promoting the eruption. To Sydenham (q. v.) belongs the credit of first recommending an entirely opposite or cooling mode of treatment; but his suggestions met with the most severe opposition, and it was not till long after his death that the cooling treatment was fairly established. In mild cases, and in cases of varioloid disease, the physician has merely to guard the patient against hurtful influences, such as stimulating foods or drinks, too hot a room, or improper exposure to cold, and to prescribe cooling drinks during the fever, and occasional laxatives if they shall be required. In more severe cases, the fever may be combated by saline purgatives, prescribed so as to produce two or three liquid stools daily, and by free ventilation of the surface of the body. When the eruption is all out, if the pimples on the face are few and distinct, the danger may be regarded as over, and no further treatment is required. If, however, the disease assume a confluent form, wakefulness and restlessness are apt to come on about the eighth day, and opiates in free doses may be prescribed with benefit.

If the pustules are abnormally torpid in reaching their maturity, it may be expedient to administer strong broths, or even wine; and when the pustules are livid, and intermixed with Petechiæ (q. v.), bark and acids must be additionally ordered, although the patient is then too often beyond the reach of help. During the secondary fever, the bowels must be kept gently open, and opiates should be prescribed once or twice each day. A more nourishing diet is now called for, and wine should be given if the pulse is very weak. The external itching is partly relieved by the opiates, but local applications are also employed: cold cream, or a mixture of equal parts of olive oil and lime-water, may be thus used with advantage. Special methods have been devised for the purpose of preventing the pitting or seaming of the face, which is often a hideous permanent disfigurement to the patient. The best application of this kind is probably that of nitrate of silver. Mr. Higginbottom, who first suggested this application, touched each distinct papula with a solid stick of lunar caustic, previously moistened; but when the spots were confluent, he washed the whole face, about the third day after the eruption, with a strong solution of this salt, containing eight scruples to the ounce of water. In the Paris hospitals, various mercurial preparations are employed, which are said to cause the pustules to abort. M. Briquet recommends mercurial ointment simply thickened with powdered starch. Dr. Wood of Philadelphia remarks, that as the ointment sometimes salivates, it should be diluted with an equal quantity of lard before the starch is added. Professor Bennett of Edinburgh recommends the application of calamine (carbonate of zinc) mixed with olive oil; it forms a coherent crust, and thus excludes the air.

During the period of desquamation, an occasional warm bath may be prescribed with advantage; and the patient should always resort to this measure, as a precaution against carrying the contagion about with him, before again mixing in society.

The history of this remarkable disease is clothed in considerable obscurity. There is no evidence that it was known to the Greek or Arabian writers of the 6th c., and the first accurate description of it is that of Rhazes, an Arabian physician, who flourished early in the 10th century. It appears to have reached England towards the close of the 9th century. After the Crusades, it prevailed in most of the temperate countries of Europe, but did not reach the northern countries of Norway, Lapland, &c. for some time later. In 1517, it was carried from Europe to St. Domingo; and three years later, it reached Mexico, where it committed fearful devastations, and whence it spread with intense virulence throughout the New World. (According to Robertson, three millions and a half of people were destroyed in Mexico alone.) In 1707, it was introduced into Iceland, when more than a fourth part of the whole population fell victims to it; and it reached Greenland still later (in 1733), when it spread so fatally as almost to depopulate the country. These cases are striking illustrations of the law that seems universally true, that a contagious disease is always most virulent on its first introduction to a new scene of action.

SMALLPOX IN SHEEP (*Variola ovina*), although resembling the smallpox of men, is a distinct disease, not communicable either by contagion or inoculation to men or children, or even to dogs or goats. Although common on the continent of Europe, it was unknown in this country for at least a century, until in 1847 it appeared in Norfolk and the eastern counties, and in the summer of 1862 in Wiltshire, near Devizes. Variolous sheep or infected skins appear in both cases to have imported the disease from abroad. About ten days after exposure to contagion, the infected sheep become feverish, have a muco-purulent nasal discharge, and a hot tender skin. The red pimples which first appear, in about three days become white, and afterwards leave scabs or ulcers. The weakness is great, and the mortality varies from 25 to 90 per cent. Good food and nursing are the appropriate remedies. Promptly and carefully must the sick be separated from the sound; but if the spread of the disorder be not thus immediately checked, the whole of the sound flock should be inoculated. The disease thus artificially produced appears in ten days, runs a mild course, occasions a loss of from two to five per cent., and in three weeks the disorder is got rid of, and all risk of contagion over.—Further details will be found in Professor Simmonds' 'Report on Smallpox,' in vol. 25 of the *Journal of the Royal Agricultural Society of England*.

SMALT, a name applied to the colored glass compositions used for making the tesseræ employed in forming mosaics. See also COBALT.

SMART-MONEY. See RECRUITING.

SMEATON, JOHN, an eminent civil engineer, was born at Austhorpe, near Leeds, in 1724, and early showed a bent towards mechanical pursuits. At the age of 15, he had constructed a machine for rose-engine turning. About 1750, he removed to London, to commence business as a mathematical instrument maker; but we find him in the following year resuming his desultory experiments in mechanical invention, an 'odometer' for ships, a compass, and improvements in water and wind mill-machinery being the chief products of his inventive genius. His improvements on mill-work were found on trial to be of great

value, increasing the effective force by one-third, and gained S. the Copley Medal of the Royal Society in 1759. In 1753, he was chosen a member of the Royal Society; and in the following year, to extend his practical acquaintance with engineering, he visited the Netherlands, and inspected the embankments, canals, and other remarkable works of that country. In 1755, an event occurred which was to afford him the opportunity of attaining the very summit of his profession—the second wooden light-house on Eddystone rock was destroyed by fire in December. The speedy re-erection of another beacon was of the utmost importance, and the execution of the work was intrusted to Smeaton. The new light-house was built of stone; the cutting of the rock for the foundations commenced in August 1756, the building was executed between June 1757 and October 1759, and the lantern lighted on 16th October of the latter year. This great work, the greatest of its kind hitherto undertaken, remained for 120 years a stable monument of S.'s engineering skill. Yet he seems to have had little employment for some time subsequently, as he applied for and obtained in 1764 the post of 'receiver of the Derwentwater estate,' the funds of which were applied for the behoof of Greenwich Hospital; and this situation he held till 1777, by which time he was in full professional employment.

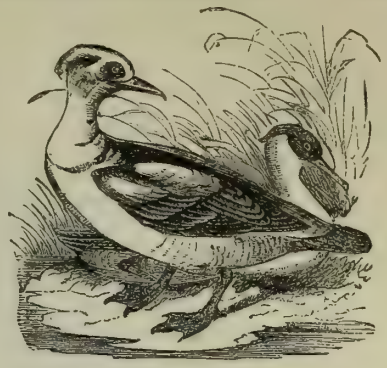
The chief of his other engineering works were, the construction of the greater portion of Ramsgate harbor (1774); the laying out of the line of the Forth and Clyde Canal, and the superintendence of the excavation of most of it; the rendering of the Calder (Yorkshire) navigable; the erection of Spurn light-house, and of several important bridges in Scotland, together with an immense amount of mill-machinery. He also greatly improved Newcomen's steam-engine, but the mighty achievements of Watt in the same field threw his labors completely into the shade. He is said to have prevented the fall of the old London Bridge for many years by sinking a great quantity of stones around one of the piers, which had become undermined by the strength of the Thames current. In 1783, his health began to decline, and he retired from active business, dying at Austhorpe of paralysis, 28th October 1792. He was one of the chief promoters of the 'Society of Civil Engineers,' which was started in 1771, and after S.'s death published (1797) in three 4to volumes his numerous professional Reports, which were regarded by his successors 'as a mine of wealth for the sound principles which they unfold, and the able practice they exemplify.' For a large portion of his life S. was in constant attendance on parliament, which, in difficult or important engineering schemes, invariably demanded, and almost always followed, his advice—a proof not only of his eminence in his profession, but of his caution, judgment and integrity. See the biography prefixed to his 'Reports.'

SMELL. See NOSE.

SMELT (*Osmerus*), a genus of the Salmon or Trout family (*Salmonidæ*), of which only a few species are known, differing from the salmon, trout, &c. in having long conical teeth on the jaws and tongue, and on the tip of the vomer, the rest of the vomer being destitute of teeth; two distinct rows of teeth on each palatine bone.—The COMMON S. (*O. eperlanus*), called *Spirling* or *Sparling* in Scotland, and *Eperlan* in France, is a fish of 8 or 10 inches (rarely 12 inches) in length. The form is very trout-like—rather more slender—the tail larger in proportion, and more forked. The lower jaw is much longer than the upper. The scales are small; the back is whitish, tinged with green; the upper part of the sides shows bluish tints, the lower part of the sides and the belly are of a bright silvery color. The S. has a peculiar, cucumber-like smell, and a delicious flavor, on account of which it is highly esteemed for the table, where it often appears as an accompaniment of other fish. The S. is partly an inhabitant of fresh water, and partly of the sea. It ascends rivers to no great distance from the sea in autumn, and descends in spring. Great numbers of smelts are taken in estuaries, and near the mouths of rivers by small-meshed nets. They are also taken on the open sea-coast, chiefly on low sandy shores, as that of Lincolnshire. The attempt has been successfully made to keep the S. continually in fresh-water ponds, in which it not only throve well, without loss of flavor, but propagated abundantly. No effort has yet been made to turn this discovery—not a very recent one—to any economical account. Although found both on the eastern and western coasts of Britain, the S. is unknown on the south coast of England, where the name S. or SAND S. is given to the Atherine (q. v.).—Another British species, the Hebridean (*O. Hebridicus*), was first discovered near Rothesay in 1837, and described by Yarrell. It is so rare as to be unimportant.—The AMERICAN S. (*O. viridescens*) is regarded as distinct from the Common Smelt. It has a longer body and a greener back. It is found on the north-eastern coasts of America, as far south as the Hudson.

SMELTING. See IRON.

SMEW (*Mergellus albellus*), a bird of the family *Anatidæ*, very nearly allied to the goosander and mergansers, but having a shorter bill. The whole length of the male is not quite 18 inches; that of the female, not quite 15. The S. is only known in Britain as a winter visitant, appearing in greatest numbers in severe winters, and sometimes on inland lakes and ponds, as well as on the sea-



Smew (*Mergellus albellus*).

coast. It abounds on the northern coasts of Asia, and in some parts of continental Europe.

SMILA'CEÆ, a natural order of exogenous plants, ranked by Lindley in his class Dictyogens (q. v.), and consisting of herbaceous or half-shrubby plants, generally more or less climbing, with reticulated leaves, and bisexual or polygamous flowers, a 6-parted perianth, six stamens, a free 3-celled ovary, with cells one or many seeded, three stigmas, and a roundish berry. There are about 120 known species, mostly of the genus *Smilax*, scattered over the globe, but most numerous in the temperate and tropical parts of Asia and America. The root-stocks (*rhizomes*) of many species yield Sarsaparilla (q. v.). But some species have fleshy tubers, particularly *Smilax China*, a native of China and Japan, the tubers of which are very large and nutritious, and used for food. *Smilax pseudo-China*, an American species, has similar tubers.—The roots of *Roxburghia viridiflora*, after being boiled and soaked in lime-water, to remove their acridity, are preserved in syrup as an article of food in the Eastern Peninsula and Malayan Islands. The stems of this plant are sometimes 100 fathoms long.

SMITH, ADAM, the founder of political economy as a separate branch of human knowledge, was born in the town of Kirkcaldy, in Fifeshire, on the 5th of June 1723. His family belonged to the respectable middle class of Scotch life; his father was comptroller of the customs at the port of Kirkcaldy, and his mother, Margaret Douglas, was the daughter of a small Fifeshire laird. His father died a short time before his birth, and he was the object of the care and solicitude of a widowed mother, to whom he was closely attached, and who long lived to be proud of his attainments. When he was no more than three years old, the poor woman got a sad fright from a calamity hardly known at the present day—the child was stolen by gipsies; but he was tracked and recovered by his uncle as they were seeking a hiding-place in the neighboring wood of Leslie. This was the only adventure in his quiet life. After getting the usual burgh-school education in Kirkcaldy, he was sent, in 1737, to the university of Glasgow. He there secured an exhibition on the Snell foundation, which took him to Balliol College, Oxford. He studied there for seven years, and left traditions as of a man of large acquirements and peculiar independence of thought. It is said that he was intended for the English Church, but if so, his own convictions crossed the designs of his friends. He returned to Kirkcaldy, and lived for a while with his mother there in undisturbed seclusion and study. It was said to be his practice to stand ruminating, with his back to the fire, and his head leaning against the chimney-piece—and over an old fire-place in Kirkcaldy it used to be shown how he had thus worn a piece off the paint. In 1748 he came to Edinburgh, where silently and unostentatiously he became one of the brilliant little circle of men of letters who were then rising to importance. In 1751, he got the chair of Logic in the university of Glasgow, and this was changed a year afterwards for that of Moral Philosophy.

In 1759, appeared his *Theory of Moral Sentiments*, celebrated for its reference of the mental emotions to the one source of sympathy. The *Dissertation on the Origin of Languages* was published along with the latter editions of this book. Both had a great reputation in their day, and although they are now among obscure books in comparison with that other by which the author's name is remembered, the position they held with respectable thinkers gave a hearing to his doctrines on political economy which they would hardly have otherwise obtained. In 1762, the university of Glasgow gave him the degree of Doctor of Laws. In the following year he undertook a task, which might at first seem very uncongenial to a mind like his, given to retired study and independent thought and action. He became 'governor' or

traveling tutor to the young Duke of Buccleuch. He was then sedulously collecting materials for his great work, and no doubt the inducement to accept of the office was the opportunity it gave him for traveling and seeing for himself. He had the opportunity of being nearly a year in Paris, and of mixing in the circle of renowned wits and philosophers of the reign of Louis XV. In 1766, his function came to an end, and he returned to Kirkcaldy to live in the old house with his mother. The year 1776 was an era in the history of the world as well as that of the Kirkcaldy recluse, in the appearance of the *Inquiry into the Nature and Causes of the Wealth of Nations*. If there was any living man to whose works he was indebted for the leading principles of this book, it was David Hume, and it was from him, as best understanding the fulness and completeness of the exposition, that it had its first emphatic welcome. He wrote immediately on receiving it: 'EUGE BELLE.—DEAR MR. SMITH—I am much pleased with your performance; and the perusal of it has taken me from a state of great anxiety. It was a work of so much expectation by yourself, by your friends, and by the public, that I trembled for its appearance, but am now much relieved. Not but that the reading of it necessarily requires so much attention, and the public is disposed to give so little, that I shall still doubt, for some time, of its being at first very popular. But it has depth, and solidity, and acuteness, and is so much illustrated by curious facts, that it must at last take the public attention.'

This was not destined to be exactly the literary history of this great work. Its startling doctrines, fine clear style, and abundant illustration from curious facts took at first; but counteracting influences arose when people saw how far the new doctrines went in playing havoc with old prejudices. The French revolution set the mind of this country bigoted against everything that breathed of innovation. It was known that the younger Pitt participated at first in S.'s free-trade notions, but he had afterwards, whether from permanent connection or temporary policy, to put himself in the foremost ranks of the enemies of innovation. It was not until long after the terrors of that epoch and the nervous vicissitudes of the war had passed over, that S.'s work had an opportunity to revolutionize the public mind on matters of trade and finance. It came up, as it were, the leader of a great literary host, for expounders had crowded in numbers round *The Wealth of Nations* as the text-book of sound economy. Of a book so well known and so much read, it is needless to speak. The only reproach brought against it is, that it is not systematic in its form, and that its nomenclature is not exact. But its author was not arranging the results of established knowledge—he was rather pulling down existing structures, compounded of ignorance and prejudice. Nor, indeed, have those who have attempted to make an exact science out of political economy, practically vindicated the reproach they have cast on him of being unmethodical. Whatever we may yet come to, very few portions indeed of political economy admit of being treated as exact science. It is too closely connected with human passions and energies, and consequently with special results and changes, to be so treated; and the best books on the subject are still characterized by the discursiveness and mixed philosophy and fact of the *Wealth of Nations*. In 1778, S. was made a Commissioner of Customs. The only effect of this was to bring him to Edinburgh, and increase his means for indulging in his favorite weakness, the collection of a fine library; for he was, as he called himself, a 'beau in his books.' In 1784, he suffered that affliction which was sure to come if he lived long enough for it—the loss of his worthy mother. He followed her six years afterwards, dying in July 1790.

SMITH, ALEXANDER, poet, was born at Kilmarnock, in Ayrshire, December 31, 1830, received, as a boy, a fair English edution, and passed from school into a Glasgow warehouse as a pattern designer. While following this occupation, he began to write poetry. His first volume, entitled the *Life Drama*, was published in 1853, and created something like a furor in literary circles. A reaction, however, followed, and the author had scarcely found himself famous when he began to be abused. The faults of his book were obvious enough: every page contained evidence of immaturity, and its natural result, extravagance; while a rather narrow reading having made him passionately attached to a few modern poets, as Keats and Tennyson, their peculiar turns of expression reappeared in his verse, and gave color to the charge of plagiarism, which was pushed to an absurd length. But impartial critics were not slow to perceive a richness and originality of imagery that more than atoned for all defects of taste and knowledge. In 1854, S. was appointed Secretary to the university of Edinburgh; and in the following year, along with Sydney Dobell (q. v.), produced a volume of *Sonnets on the War*. He afterwards wrote *City Poems* (1857), *Edwin of Deira* (1861), and several prose works, as *Dreamthorp* (1863), *A Summer in Skye* (1865), and *Alfred Hagart's Household* (1865). S. was perhaps not less distinguished as a writer in prose than in verse, his prose style being marked by picturesqueness, polish, and originality. He died in 1867.

SMITH, GOLDWIN, LL.D., son of a Berkshire physician, was born at Reading in 1823. He received his education at Eton, from whence he proceeded to Oxford, and matriculated at Christ's Church, but was soon afterwards elected to a Demyship at Magdalen. His undergraduate career was one of unusual brilliancy, only equalled, indeed, by Sir Roundell Palmer and Professor Conington. He gained both University Scholarships, the Latin Verse, and the two Prize Essays, and was placed in the first class in 1845. In 1847, he was elected Fellow of University College, where he officiated for a time as tutor. In the same year he was called to the bar at Lincoln's Inn. The ministry of the day availed themselves of Mr. S.'s services in carrying out their plans of university reform. He was nominated Assistant-secretary to the first, and Secretary to the second Oxford Commission, by which the somewhat antiquated statutes of the university were reconstructed, and the rich endowments of the colleges opened to public competition. Mr. S. was also a member of the Popular Education Commission appointed in June, 1858. The chair of Modern History having been vacated about this time by the resignation of Professor Vaughan, was offered by Lord Derby to Mr. S. He accepted the offer, and discharged his professional duties with zeal and efficiency until his resignation in 1866. In 1868, he was elected to the chair of English and Constitutional History in the university at Ithaca, New York. He has lately resided in Canada. Goldwin S. has long been known as a publicist of the highest class, and has completely identified himself with the more advanced school of reformers.

During the American war, he was an earnest defender of Federal interests, and combated with success, in the *Daily News* and elsewhere, the singular theories of the rights of slavery and the duties of neutrals, which were then somewhat fashionable. He was also active in denouncing the Jamaica massacres, and in advocating an extended measure of reform. His lectures on 'Three English Statesmen,' delivered at some of the chief towns in the north, called forth the remark from Mr. Disraeli that he was a 'wild man of the cloister, going about the country maligning men and things.' Mr. S.'s writings are characterized by great extent and accuracy of information, by a style singularly vigorous and condensed, and by great powers of sarcasm. Among his principal publications may be enumerated: *Irish History and Character; Two Lectures on the Study of History, with a Supplementary Lecture on the Doctrine of Historical Progress; The Empire*, a reprint from the *Daily News* of 1862—1863; *England and America*, a lecture delivered before the Boston Fraternity, and reprinted from the *Atlantic Monthly; A Plea for the Abolition of Tests at Oxford; Rational Religion and the Objections of the Bampton Lecture in* 1858; several pamphlets on the American question; contributions to Oxford Essays; *A Short History of England;* &c. He is also the author of some of the most admired compositions in the *Anthologia Oxoniensis*.

SMITH, JAMES AND HORACE, authors of *The Rejected Addresses*, were sons of an eminent London solicitor. James was born February 10, 1775, died December 24, 1839; Horace was born December 31, 1779, died July 12, 1849. James followed his father's profession, and succeeded him as solicitor to the Board of Ordnance; Horace adopted the profession of a stock-broker, and realized a handsome fortune, on which he retired with his family to Brighton. Both were popular and accomplished men—James remarkable for his conversational powers and gaiety, and Horace (the wealthier of the two) distinguished for true liberality and benevolence. The work by which they are best known is a small volume of poetical parodies or imitations, perhaps the best in the language. On the opening of the new Drury Lane Theater in October 1812, the Committee of Management advertised for an address to be spoken on the occasion, and the brothers Smith adopted a suggestion made to them, that they should write a series of supposed 'Rejected Addresses.' They accomplished their task in the course of a few weeks—James furnishing imitations of Wordsworth, Southey, Coleridge, Crabbe, Cobbett, &c.; while Horace contributed imitations of Scott, Byron (all but the first stanza), Monk Lewis, Moore, and others. In point of talent, the authors were about equally matched; for though James had the greater number of successful imitations, the one by Horace of Scott, is the most felicitous of the whole. It is a curious fact in literary history that a work so exceedingly popular should have had great difficulty in finding a publisher; and that the copyright, which had been originally offered to Murray for £20, and refused, was purchased by him in 1819, after the book had run through 16 editions, for £131. The authors received above £1000 from the sale of the work. James was afterwards an occasional contributor to the periodical literature of the day, and author of the humorous theatrical entertainments of Charles Mathews (for which he received £1000). Horace S. wrote several novels—*Brambletye House, Tor Hill,* &c.

SMITH, JOSEPH. See MORMONS.

SMITH, Rev. Sydney, a celebrated wit and humorist, and the original projector of the *Edinburgh Review*, was born at Woodford, in Essex, in 1771. His father was an eccentric English gentleman of moderate independence; his mother was the grand-daughter of a French refugee; and Sydney, it was said, fairly represented both nations. He was educated at Winchester School and New College, Oxford, and having entered the church, became curate of Amesbury in Wiltshire. 'The squire of the parish,' he says, 'took a fancy to me, and requested me to go with his son to reside at the university of Weimar; before we got there, Germany became the seat of war, and in stress of politics, we put into Edinburgh, where I remained five years.' During this time, he officiated in the Episcopal chapel there, and published *Six Sermons*, 1800. In conjunction with a few accomplished literary associates —Jeffrey, Horner, Brougham, Dr. Thomas Brown, Playfair, &c. —S. started the *Edinburgh Review*, the first number of which appeared in October 1802, constituting a new era in the history of periodical literature, and of independent thought and criticism in this country. In 1803, S. removed to London, and was soon popular as a preacher, as a lecturer on moral philosophy (1804—1806), and as a brilliant conversationist, the delight and wonder of society. Church preferment, however, came slowly. In 1806, during the short reign of the Whigs, he obtained from Lord Erskine, when Lord Chancellor, the rectory of Foston-le-Clay, in Yorkshire; some 18 years afterwards, the Duke of Devonshire gave him the living of Londesborough, worth £700 per annum, to hold until Mr. Howard, son of the Earl of Carlisle, came of age. In 1828, Lord Chancellor Lyndhurst presented him to a prebendal stall in Bristol, and enabled him to exchange Foston for Combe Florey, a more desirable rectory in Somersetshire.

In 1831, Earl Grey appointed him one of the Canons Residentiary of St. Paul's and this completed his round of ecclesiastical preferments. He sighed for a mitre, but it never came; and Lord Melbourne is said to have regretted this omission in his career as Prime Minister. The writings of S. subsequent to 1800 were his contributions to the *Edinburgh Review*, which he collected and republished, with other miscellaneous works, in 1839; *Peter Plymley's Letters*, written in 1807, to promote the cause of Catholic emancipation, and abounding in wit and irony worthy of Swift; *Sermons* in two volumes, 1809; *Speeches on the Catholic Claims and Reform Bill*, 1825—1831; *Three Letters to Archdeacon Singleton on the Ecclesiastical Commission*, 1837—1839; *The Ballot*, a political pamphlet, 1837; *Letter to Lord John Russell on the Church Bills*, 1838: *Letters on Railways*, 1842; *Letters on American Debts*, 1843; &c. Though gay, exuberant, and witty to the last, S. suffered from periodical attacks of gout and other complaints, and he died on the 22d of February 1845. Ten years afterwards, his daughter, wife of Sir Henry Holland, physician, published a Memoir of her father with a selection from his letters.

The works of S. were mostly written on temporary topics and controversies, yet they bid fair to take a permanent place in our literature as specimens of clear and vigorous reasoning, rich unctuous humor, and solid good sense. His jokes, exaggeration, and ridicule are all logical, driving home his argument; and his wit was sportive, untinctured with malice.

SMITH, William, called the Father of English Geology, was born in Oxfordshire, 23d March 1769. His profession of land-surveying led him to geological observation; and in 1794 he began his map of the strata of England, and became the founder of stratigraphical science. His epoch-making Geological Map of England (see Geology) was published in 1815. He published numerous other geological maps, received many honors, and died at Northampton, 28th August 1839.

SMITHFIELD, a noted cattle-market in London, was in the 12th c. an open spot which served the citizens as a playground and a place for a stroll. Being a little north of Newgate, and west of Aldersgate, it was outside the city walls. It was in S. that the rebel Wat Tyler met his death in 1381. Several noted tournaments were held here; and the place is associated with trials by battle, the burnings of martyrs, public executions during many centuries, and a variety of incidents connected with the history of the metropolis.

The most celebrated fair in England, Bartholomew Fair (q. v.), was always held in Smithfield.

A cattle-market was held in S. at least seven centuries ago, for Fitzstephen mentioned it in 1150. The corporation had official control over the market for more than 500 years, dating from 1345; and the city authorities have never to this day relaxed their hold over the one only live-cattle market in the metropolis. At one time, there was a project for removing the market to a field near Sadlers' Wells, at another, to a spot near the north end of Gray's Inn Lane; while a spirited projector spent £100,000 in building a new market at Islington; but powerful influences prevented the removal of the cattle-market until 1855.

The last market-day in the old spot was on June 11th in that year; after which, the trade was transferred to the large and very complete establishment built by the corporation at Pentonville. For several years after this, S. was practically useless. In 1860, however, the corporation obtained an act for erecting market buildings on the site of S., and the first stone of a magnificent Dead-meat Market, from the designs of Mr. Horace Jones, the city architect, was laid in June 1867. The building, which was formally opened in November 1868, is 636 feet long, by 246 broad, is traversed by numerous avenues, and has about 200 shops for dealers in meat, which is partly country-killed. This arrangement has enabled the city authorities to abolish Newgate Market, which had become a serious obstruction to city traffic. Under the market, three railways sunk deeply below the ground-level, traverse the area—one going eastward to Aldersgate and Finsbury, one southward to Ludgate and Blackfriars, and one north-westward to King's Cross and the north of London. Near the middle of S. is a circular spiral road descending to an underground railway goods-station. The remainder is laid out in well-paved carriage and foot ways with a small ornamental green or garden, including paths, seats, and a drinking-fountain. There is also a new market for poultry, butter, cheese, pork, &c., distinct from the meat-market. The extensive new works and alterations have greatly improved the appearance of S., and increased its salubrity.

SMITHSO'NIAN INSTITUTE, at Washington, District of Columbia, U. S., was organized by act of Congress in 1846, in accordance with the will of James Smithson, who bequeathed the reversion of an estate amounting to 515,169 dollars to the United States of America, to be devoted to 'the increase and diffusion of knowledge among men.' He was an Englishman, a natural son of Hugh, third Duke of Northumberland, and Mrs. Elizabeth Macie, a niece of Charles, Duke of Somerset. He devoted his life to scientific pursuits, especially to chemistry, and died at Genoa in 1829. The Institute is governed by regents appointed by the Federal government, and has erected a spacious edifice, with museum, library, cabinets of natural history, and lecture-rooms, which occupies a prominent situation at Washington, the capital of the United States. It receives copies of all copyright books, and exchanges with other countries, and its museum is enriched with the gatherings of national exploring expeditions. A portion of its funds is devoted to scientific researches, and the publication of works too expensive for private enterprise. There are departments of Astronomy, Ethnology, Meteorology, and Terrestrial Magnetism. See *James Smithson and his Bequest*, by Rhees (1881). Among the publications issued are the quarto volumes of the *Smithsonian Contributions to Knowledge*, distributed gratis to libraries; *Annual Reports*, and *Miscellaneous Collections*. The courses of public lectures by eminent scientific men are among the attractions of the American capital.

SMOKE-NUISANCE, in London, is punishable with fine. The act applies to every furnace employed in working engines by steam, and every furnace in any mill, factory, printing-house, dye-house, distillery, bake-house, &c., which is not constructed so as to consume its own smoke, or which is so negligently used that the smoke is not consumed. The penalty is from two to five pounds. The statute only applies to the metropolis and to the river Thames.—In Scotland, a similar act is not confined to the Scotch metropolis.

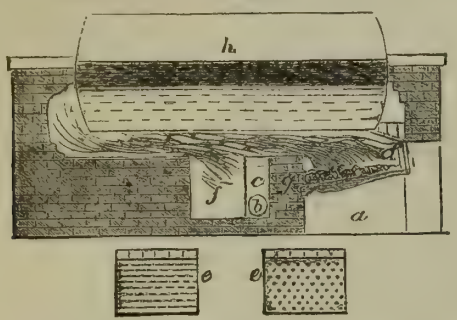
Large consumers of fuel are naturally more anxious about how it can be best burned economically than about how the escape of smoke into the atmosphere can best be prevented. The two questions are not at all the same, although plans may be devised which will accomplish both objects at the same time. Thus with ordinary bituminous coal not only may the volatile hydrocarbons which sometimes yield twenty per cent. of the heating-power pass up the chimney unburned, but nearly two-thirds of the coal may be wasted by the conversion of the carbon into carbonic oxide instead of carbonic acid—that is, if the carbonic oxide escapes as such—and yet no smoke may appear. At the same time, it is the fact that the most complete combustion of the coal insures there being no smoke.

There is a great difference of opinion even about the apparently simple question of how the coal should be laid on the furnace bars. The late Professor Macquorn Rankine and others, reasoning on theoretical grounds, say that the fresh coals should be laid on the front of the fire; whilst Dr. Anderson, late of the Woolwich Arsenal, judging from great practical experience, says that, on the contrary, they should be mainly piled up at the back of the fire. Mr. Wye Williams again, whose name is so famous in connection with such questions, asserts that the coal is best spread evenly over the furnace bars.

Whether the fuel is heaped at the front, at the back, or spread uniformly over the fire, the end in view is the same. It is to secure that the volatile hydrocarbons are burned, and that carbon is converted into carbonic acid, and this can only be done when these gases are conducted over a hot portion of the fire with a sufficient supply of air. If the fresh coal is laid on the front, that of a

previous charge having been pushed inwards, the coal vapors will of course pass over the thin layer of burning fuel at the back, and be more or less burned. When on the other hand, the fuel is kept banked up at the back (that is at the bridge), and spread evenly over the rest of the grate, although a little smoke may be given off at first, it would nevertheless appear that by this plan the mass of incandescent fuel at the bridge is yet more effectual in burning these vapors. The balance of opinion would, however, seem to be in favor of the method of rapid, thin, and uniform spreading of the coal over the grate, care being taken that no part of the furnace bars are left bare.

With regard to the admission of air to the furnace, it is necessary, in order to obtain the best result, that it be admitted through small orifices, and at such a point or points where the temperature is sufficiently high for the combustion of the coal vapors, and that it be so regulated that heat is not uselessly absorbed by an excessive supply. It is of course also necessary to have sufficient air passing up between the furnace bars to burn the non-volatile coke. The arrangement recommended by Mr. Wye Williams



will be understood by the help of the annexed drawing, which represents one of his furnaces under a boiler *h*. The fire is fed, as usual, through the door at *d*; it slopes downward to the bridge *g*, which rises much above the firebars, so that the flames have to pass over it. The bridge consists of two parts, the solid masonry or brickwork, *g*, and the chambered portion behind it, *c*, called the distributer. Into this a tube, *b*, opens, through which a supply of atmospheric air enters, and becoming heated, passes through a number of plates with slits, or with perforations as shown in *ee'*, into the mixing-chamber, *f*; here the heated air enters into combustion with the carbon in the smoke-laden flame, deprives it of that element, and greatly increases the heat by its combustion.

Smoke prevention arrangements may be classified as follows: I. Apparatus for the regular addition in small quantities and uniform application of the fuel to the fireplace of the furnace. The chief kinds are: (1.) A hopper kept charged with small coal or slack, and feeding a rapidly rotating horizontal disc. (2.) A hopper and rollers to reduce the size of the coals, and a screw spreader for throwing them on the fire. (3.) An under grate stoker, which feeds a circular furnace by causing the fresh coal to pass from below through a central orifice into the middle of the incandescent fuel. (4.) A hopper and traveling furnace bars. II. Arrangements for the admission of air above as well as below the furnace bars. This is usually done either by means of air-holes with slide or slides to cover them; or opening and shutting slits in the furnace door or above it. Another plan is to have a valve at the further end of tubular flues in the furnace to regulate the admission of air. In one or two instances a clockwork arrangement has been introduced for gradually closing the air inlets in the furnace doors after firing.

SMOKE-STACK, in a steam-vessel, is the group rising above the deck, and comprising the Funnels (q. v.), and the several escape-pipes for the steam, which are beside it. In ships-of-war, all these are frequently made telescopic, that they may be drawn down out of danger in action or in a strong head-wind.

SMOLE'NSK, a government of European Russia, bounded on the east by the governments of Moscow and Kaluga. Area, 21,554 sq. miles. Pop. (1880) 1,223,890. S., which is watered by the Dnieper, Dvina, Gshat, Oka, Iput, &c., is one of the most fertile provinces of the empire, and produces great quantities of corn, hemp, and flax. Extensive forests yield splendid timber and mast. The rearing of swine is much followed. Manufacturing industry and export trade are both largely expanding.

SMOLENSK, a fortified town of Russia, capital of the government of the same name, is picturesquely situated on a range of steep declivities overlooking the river Dnieper, 250 miles west-south-west of Moscow. It is one of the oldest towns in the empire, having been a place of note in the 9th c., is surrounded by massive walls (with 17 towers), and has three cathedrals, about 32 churches, and several monasteries, together with a diocesan seminary, a gymnasium, a military school for nobles, hospitals, &c. S. carries on manufactures of linens, soap, leather, and carpets, and a considerable export trade in corn and flax. Pop. 1880) 24,350. S. is historically notable as the scene of a bloody repulse of the Russians, under Barclay de Tolly and Prince Bagration, by Napoleon, August 17, 1812, when on his march for Moscow.

SMOLLETT, TOBIAS, an eminent British novelist, born in the year 1721, was descended from an old and distinguished family in Dumbartonshire. His grandfather, Sir James Smollett of Bonhill, was one of the commissaries or consistorial judges of Edinburgh, and sat in the Scots parliament as representative of his native county. Had the novelist survived about four more years than the term of his too short life, he would, as heir of entail, have succeeded to the ancestral estate in the beautiful vale of Leven. He lost his father while very young; but he was well educated, and afterwards apprenticed to a surgeon in Glasgow. He is said to have wished to enter the army, and being disappointed, to have avenged himself on his grandfather, who thwarted his inclinations, by describing Sir James under the unamiable character of the old Judge in *Roderick Random*. This is related by Scott and all the biographers, but it must be wrong; for Sir James, the grandfather, died in 1731, when Tobias was only in his tenth year. The duty of attending to the education and settlement of the youth would naturally devolve on his widowed mother and on the Laird of Bonhill, his cousin.

It is certain, however, that S. inherited no fortune; and in his 18th year, he went to London with a tragedy which he had written on the assassination of James I. of Scotland, and which he trusted would lead to distinction, if not wealth. He was grievously disappointed, and was glad to accept the post of surgeon's-mate on board one of the ships in the unfortunate expedition to Carthagena, in 1741. He soon quitted the service in disgust, although not before he had seen enough of naval life and character to be of inestimable value to him as a novelist; and returning to London, he commenced, and for the remainder of his life followed, the profession of an author. He made, indeed, repeated attempts to obtain practice as a physician, and in 1750, got a diploma of M.D. from Aberdeen; but his hasty irritable temper and independent spirit, joined to his natural propensity to satire, were fatal to his hopes. Even his literary career was a ceaseless warfare. In 1748, in his 27th year, he produced his *Roderick Random*, which was read with the utmost avidity, and seemed at once to place its author very near, if not in the actual rank of Fielding as a novelist. In 1751, appeared *Peregrine Pickle*, a more ambitious and not less successful work; and in 1753, *Ferdinand Count Fathom*, an inferior production, though containing scenes of striking adventure and eloquent description. S. next translated *Don Quixote* (1755), in which, it is admitted, he was surpassed by Motteux and Jarvis. He then undertook the editorship of a new Tory journal, *The Critical Review*, which was the most unfortunate of all his engagements, as it involved him in endless quarrels and personalities. For one article, an attack on Admiral Knowles, he suffered three months' imprisonment, and was fined £100. In 1758, he published his *History of England*, 4 vols. quarto—a history from the descent of Julius Cæsar to the treaty of Aix-la-Chapelle, in 1748, but which was begun and completed in 14 months, realizing for its author a sum of £2000. Though superficial and inaccurate, this history has passages of fine animated writing and masterly delineation of character.

We next find S. involved in political controversy with Wilkes and others, and defending Lord Bute's administration; but he wanted tact and temper for work of this description, and reaped no laurels as a politician. Another novel appeared in 1760—1761, *The Adventures of Sir Launcelot Greaves;* in 1766, two volumes of querulous *Travels in France and Italy;* in 1769, *The Adventures of an Atom*, a political satire unworthy of its author; and in 1771, only a few months before his death, *The Expedition of Humphrey Clinker*, the best of all the novels of S.; and in the opinion of Thackeray, one of the very best in the whole range of imaginative literature. Worn out with literary cares, private misfortunes, anxiety, and ill-health, the novelist retired to Italy, and died at Leghorn, October 21, 1771, in the 51st year of his age.

As a novelist, S. is distinguished by his broad humor and burlesque, the great variety of his incidents and characters, and the excellence of his easy, picturesque style of narrative. He is often careless, but rarely dull. He does not indulge in digressions, like Fielding, and though less of a literary artist than his great English rival, his works are read with more intense interest. He had, in fact, greater imagination and poetical sensibility. He added largely to our stock of original characters and humorists—Strap, Tom Bowling, Morgan the Welshman, Lismahago, and Matthew Bramble are still unsurpassed. Delicacy of taste was denied to both Fielding and S., and perhaps the latter is the more gross and sensual of the two. But the novelist lived in a coarse age, and possessed an exuberant fancy. There is a good deal to regret and to condemn; but to an author who has conferred so much true, healthy pleasure and enjoyment on countless generations of readers, forgiveness is easily extended, and is soon lost in admiration.

SMOLT. See SALMON.

SMORZA'TO, or SMORZANDO (Ital. dying away), a musical term, indicating a gradual diminution in tone, till the sound altogether fades away.

SMUGGLING is the offence of importing or exporting goods prohibited, or without paying the duties imposed on goods not prohibited. The offence in general leads to forfeiture of the goods. If goods are imported to defraud the revenue, treble value of the goods is forfeited. Many of the offences connected with smuggling are felonies, and punished with severity under the Customs' Consolidation Act. Where high protective tariffs separate the industry of adjoining countries, smugglers are certain to abound; no prohibitory decrees can keep the goods out. It was in vain that Napoleon fulminated the Berlin and Milan decrees for closing all continental ports against British shipping; British goods were landed at Salonica, passed on horseback through Hungary to Vienna, and thence distributed in all directions. Similarly, French manufactures reached England, often most circuitously: some a year in transit by way of Smyrna; others, *viâ* Archangel, after two years' journey. A vast cost was incurred in England in maintaining a Coast Guard and Preventive Service; but so long as smuggled goods could be sold at much lower prices than those at which they could be lawfully imported, so long would it be absolutely impossible wholly to suppress the traffic. The duties on French goods evaded in 1831, by the aid of smuggling, were estimated at £800,000. The true remedy for smuggling is a free, or, at least, very liberal tariff, without any prohibitive rates. Since the adoption of free trade by Great Britain, its Coast-guard has ceased to have any preventive duties to perform, and has been converted into the far better institution of a defence for the coasts from foreign foes, a reserve of trained men for the sea-service, and last, though far from least, a branch of skilful auxiliaries ready to aid any ship thrown in distress upon the British coast. The leading instance of smuggling, so far as England or Englishmen are concerned, is the great amount of contraband traffic from Gibraltar into Spain.

SMUT, the popular name of certain small fungi of the section *Coniomycetes*, and group or family *Uredineæ*, parasitical on plants, particularly on grasses, and notable for the great abundance of dark-colored spores which they throw off. The name S., although somewhat variously used, is now very generally limited to the genus *Ustilago*, in which the character just mentioned, of the profusion of dark-colored spores, is very remarkable. The name S. is often given to *Ustilago segetum*, or *Uredo segetum*, also called DUST-BRAND, a species very common and destructive, parasitic on wheat, barley, oats, and rye (see ERGOT), at the base of the german and glumes, causing the death of the inner parts of the flower, and then converting the whole into a sooty dusty mass. At first, a fine mycelium alone is seen, which ere long produces spores. There is no disagreeable smell, as in some of the allied fungi. A remarkable kind of S. infests maize, swelling the ears to an enormous size, sometimes even a foot in length. No remedy or preventive is known for smut. It does not seem to be communicated through infected grains; but perennial plants attacked by fungi of this kind remain diseased in subsequent years. Some kinds of S. attack other parts of plants than those chosen by *Ustilago segetum*. The reeds of the fenny districts of England are often much affected by a species (*Ustilago typhoides*), which much impairs their quality for all purposes, and has the more remarkable property of greatly affecting the health of the laborers employed in cutting and sorting them, producing not only a sense of oppression, but swelling of the head, the formation of vesicles, and inflammation of the bowels, besides other smyptoms, such as are often produced by cantharides. Mr. Berkeley says: 'The subject is worth attention, not only as curious in itself, but because it is very possible that, like the ergot, the fungus may afford a valuable addition to the Pharmacopœia.'

SMY'RNA, one of the most ancient and important cities of Asia Minor, and the only one of the Greek cities on the western coast which has retained its name and importance to the present day. The early history of S. is very obscure: varying accounts represent it either as originally an Ionian colony, or as having been at first an Æolian city, which, by an act of treachery, fell into the hands of Colophonian (Ionian) exiles, and subsequently, about 700 B.C., formed part of the great Ionian League. This earliest city of S., known among the Greeks as 'Old Smyrna,' was situated on the banks of the little river Meles, on the north-east side of the Hermæan Gulf, now the Gulf of Smyrna, and claimed the honor of being the birthplace of Homer; and here, near the source of the river, a grotto was shown, in which he was said to have composed his poems. This old city of S. was destroyed, we are told, by the Lydian king Ulyattes, and the place remained deserted and in ruins till after the Macedonian conquest, when the city was rebuilt at the distance of between two and three miles south of its original site. This city of 'New Smyrna' was founded by Antigonus, and enlarged and embellished by Lysimachus; it was laid out with great magnificence, and adorned with several fine buildings, among which was the *Homereum*, where the poet was worshiped as a hero. The city had an excellent harbor; and from its admirable situation, soon became one of the finest and most flourishing in the world. In the early history of Christianity, S. holds a distinguished place as one of the Seven Churches addressed in the Apocalypse, and as the scene of the labors and martyrdom of its first bishop, Polycarp. After various vicissitudes during the middle ages, it fell finally into the hands of the Turks, in whose possession it has since remained—the most flourishing city of the Levant.

The modern city of S. (Turkish *Izmîr*) occupies the site of New S., being built partly on the plain at the head of the gulf, partly on the declivity of a hill, the ancient Mons Pagus, and, from the sea, has an attractive appearance. There are some good quays, and some handsome buildings of stone; but the greater part consists of low wooden houses, for the most part of one story high; and the streets, with a few exceptions, are ill-paved, narrow, crooked, and dirty. The city, however, in these respects is better than most other Turkish towns, and improvements have of late years been made. The pop. is estimated at 150,000; of whom 80,000 are Turks, 40,000 Greeks, 15,000 Jews, 10,000 Armenians, and 5000 Franks. As is usual in Turkish towns, each people has its separate quarter. S. contains several Greek, Armenian, Roman Catholic, and Protestant churches, and about 20 mosques. There are six journals published here in five different languages. The harbor is excellent; ships of large burden anchor close to the quays; and the trade is most important and extensive. A railway, 81 miles long, constructed mainly with English capital and by English engineers, has been recently opened to Aidin, an important inland commercial town, and is now in operation. Another railway, extending 61 miles inland (to Cassaba), was finished in 1866, and afterwards extended to Philadelphia (Alasher). The chief imports are woollen, cotton, and silk fabrics, iron, tin, lead, copper, steel, zinc, glass, and hardware goods, coffee to the amount of 6,000,000 lbs. annually, sugar, spirits, spices, indigo, cochineal, &c. The exports consist of wool, cotton, silk, carpets, hides, opium, madder, copper, valonia, olive-oil, drugs, and gums, figs, raisins, and many other articles. Upwards of 2500 vessels (of some 1,500,000 tons) annually enter and clear the port; and in the ten years 1870—1880 the annual value of the imports was £3,800,000, and of the exports £4,200,000.

S. is regularly visited by the ships of the French, Austrian, and Russian Steam-navigation Companies, and by traders from Great Britain and other countries. It suffered severely from fire in the summers of 1841 and 1845, and has been often ravaged by earthquakes and the plague. The city and its territory are governed by a pasha. Of the ancient cities, not much remains. Some slight ruins mark the site of Old Smyrna. Of New S., some remnants of the massive walls on the hill south-east of the city are still to be seen; the site of the Stadium in which Polycarp is supposed to have suffered martyrdom, is pointed out; there are some fragments of the ancient theater, and columns belonging to a temple; and numberless architectural fragments have been built into the walls of the Turkish town, or used in the construction of graves in the large Turkish cemetery.

SMYRNA, GULF OF, an inlet of the Ægean Sea, on the west coast of Asiatic Turkey, is so called from the city of Smyrna (q. v.), which stands at its head. It is 40 miles long, is about 20 miles in greatest breadth, and contains several islands. Its waters are deep, and it affords good anchorage.

SNAIL (*Helix*), a genus of gasteropodous molluscs of the family *Helicidæ*, having generally a sub-globose, sometimes a depressed, spiral shell; the mouth of the shell more or less encroached upon by the last whorl but one, strengthened with an internal thickened rib, its edges more or less reflexed; the *foot* of the animal long, and pointed behind; the tentacles four, the lower pair much smaller than the upper; the tongue armed with many—often from 100 to 200—longitudinal rows of teeth. The species are very numerous, more than 1400 having been described; besides fossil species, of which also there are many. Some of the groups have been constituted into separate genera by recent authors, but all retain the popular name S., which is indeed often extended to all the *Helicidæ*.

As an instance of the general distribution of snails, it may be noticed that *Helix aspersa*, one of the common garden snails of Britain, is found very generally throughout Europe, great part of Asia and the north of Africa, and in South America.—Snails feed chiefly on vegetable substances, although they are very indiscriminate in their appetite, and even devour the dead of their own kind. The mischief which they do to garden-crops is too well known; and gardeners lay down cabbage-leaves and the like to attract them, in order that they may be destroyed; any greasy substance increasing the attractiveness of the bait.—Snails delight in warm moist weather; in dry weather, their chief time of activity is during the night, and they

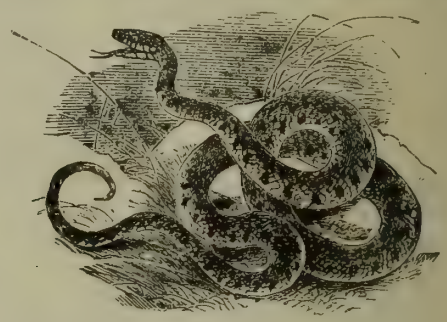
hide themselves by day; but after rain, they come forth at any hour in quest of food. At the approach of winter, or in very dry weather, they close the mouth of the shell with a membrane (*epiphragm*), formed by the drying of the mucous substance which they secrete, and become inactive and torpid. Some, as the Edible S. (*H. pomatia*), make a succession of such membranes; the outer one of which is also strengthened by a quantity of calcareous matter, the secretion being at first a white viscid fluid,

Common Snail and Eggs (*Helix aspersa*):
1, Eggs; 2, Appearance when newly hatched; 3, Slightly advanced stage; 4, Mature Snail.—Copied from Morton's *Cyclopædia of Agriculture*.

but quickly hardening like plaster of Paris. When this is to be removed, a fresh secretion of fluid mucus softens it at the edges. Snails retreat into crevices for the winter, or into holes which they make in the earth, and which are roofed over with earth, dead leaves, &c., agglutinated by secreted mucus.—Snails are hermaphrodite, but mutual impregnation takes place, and when they are about to copulate, they excite each other by pricking or even piercing with a sharp calcareous glass-like style, affixed to a peculiar muscular sac which serves for its protusion, and which is produced by recent secretion, not being found in them on dissection, except at the season of reproduction. Extraordinary as this circumstance is, it has been the subject of much exaggeration, and in works on natural history not of very old date, we read of snails throwing darts (*spicula amoris*) at each other, all which appears to be merely fabulous, although it is probable that the calcareous style may be often broken off in its use.

The eggs of snails are round, and enveloped in a skin; they are generally deposited in little clusters. The eggs of the common garden-snails of Britain are about the size of peas, and are deposited just under the surface of the soil.—Snails possess in a very high degree the power of repairing injuries, not only of the shell —although the removal of the whole shell is fatal to them—but also of the soft parts. When the tentacles are cut off, they grow again; and even if the head is cut off, a new head is produced.—We do not think it necessary to describe any of the common British species, as there is nothing of peculiar interest connected with any of them; and the rarer and smaller species have still less claim to notice. The EDIBLE S. (*H. pomatia*) of the south of Europe is the only one that deserves to be particularly mentioned. It is found in the chalk and oolite districts of the south of England, where it is said to have been introduced from the continent in the 17th c.; but this is very doubtful. It has a shell about two inches in diameter and two inches in height, whitish or pale tawny, with four darker bands, often not very distinct. It was much esteemed as an article of food by the ancient Romans, who fattened their snails in enclosures (*cochlearia*) made for the purpose, feeding them delicately on meal and boiled wine. It is still in much esteem for the table in various parts of Europe, and is occasionally used in England. Nor is it the only species so used; the common garden-snails are probably equally good, although not so large, and 'the glassmen at Newcastle once a year have a snail-feast; they generally collect the snails themselves in the fields and hedges the Sunday before the feast-day.'—Turton's *British Land and Fresh-water Shells*. Snails of different species are also an article of exportation on a small scale from England to the United States, packed in old casks, in which they are conveyed very well, fixing themselves one upon another to the cask, and leaving a vacant space in the center. Snails boiled in milk are popularly regarded as a remedy for diseases of the chest, and for this purpose they are brought to Covent Garden market. If any benefit results from the use of them, it is probably due to their nutritious qualities.—Some of the tropical species of Helix are very large, and some have very beautiful shells.

SNAKE, a term synoymous with serpent.—The name COMMON S. is very generally given in England to a species very abundant in most parts of that country, and throughout Europe from the south of Scandinavia to the Mediterranean, although there is only one doubtful instance of its having been found in Scotland. Its range extends also over great part of the north of Asia. This species (*Natrix torquata* or *Tropidonotus natrix*) is also known as the RINGED S. and the GRASS SNAKE. It belongs to the family *Colubridæ*, and to a section of it which some naturalists constitute into the family *Natricidæ*. It grows to the length of four and even five feet, although specimens exceeding three feet are rare. The female, as in serpents generally, is much larger than the male. The head is ovate, the muzzle rather narrow, the back part considerably broader than the neck; the body thickens towards the middle, and again tapers towards the tail, which is about one-fifth of the entire length, tapering to a rather sharp point; the gape is wide; the upper part of the head covered with large plates; the scales of the back have an elevated keel; those of the sides are larger, the keel merely rudimentary; the belly is covered with broad oblong plates; the under part of the tail has plates arranged in two rows. The teeth are very small, directed backwards, and arranged in two rows on each side of the jaws. The upper parts are grayish brown, tinged with green; at the back of the head are two crescent-shaped bright yellow spots, forming a kind of ring or collar; immediately behind these are two broad black spots, sometimes confluent. Two rows of small black spots are arranged alternately down the back, and larger ones at the sides; but these vary much in size and other particulars. The belly is pale lead color, often marbled with black. The outer skin is changed at intervals varying according to the weather and other circumstances. Mr. Bell says: 'I have known the skin shed four or five times during the year. It is always thrown off by reversing it; so that the transparent covering of the eyes, and that of the scales also, are always found concave in the exuviæ.



Common, or Ringed-Snake (*Natrix torquata*).

'Previously to this curious circumstance taking place, the whole cuticle becomes somewhat opaque, the eyes are dim, and the animal is evidently blind. It also becomes more or less inactive, until at length, when the skin is ready to be removed, being everywhere detached, and the new skin perfectly hard underneath, the animal bursts it at the neck, and creeping through some dense herbage, or low brushwood, leaves it attached, and comes forth in far brighter and clearer colors than before.' This snake is partial to damp situations, and often enters water, in which it swims with great ease, moving with singular gracefulness. It sometimes remains at the bottom for a considerable time. It sometimes climbs trees, its body, when ascending the stem, being 'straight and rigid as a stick.' See SERPENTS. It is very voracious; its food consists of frogs, small birds and quadrupeds, &c. Its teeth being incapable of tearing, cutting, or masticating food, the prey is always swallowed entire and living. Mr. Bell heard a frog emit a cry some minutes after it had been swallowed by a snake. The S. has no poison-fangs. It has another kind of defensive armor, in certain glands, which emit a volatile substance of most offensive and penetrating odor, which, like that of the skunk, can hardly be removed from the skin or clothes. No such odor is emitted except in moments of irritation or other passion. The Common S. is oviparous: its eggs—usually about fifteen or twenty in number, whitish, with a parchment-like skin, and united into a string by a glutinous substance—are deposited in moist and warm situations, often in dunghills. The mother is said sometimes to coil herself around them, but generally leaves them unregarded. This snake is capable of being tamed, and becomes familiar with those who are kind to it, whilst the approach of a stranger, or of a dog or cat, alarms it, and causes an emission of stench. In winter, it seeks some refuge from severe cold, and becomes lethargic or dormant. Large numbers of snakes often take refuge in one hole; but seldom so many as in an instance recorded by Dr. Carpenter, in which about 1300 were found in an old lime-kiln.

Much interest was excited in 1862 by the discovery in England of a species of snake, *Coronella lævis* (see CORONELLA and SERPENTS), previously unobserved in Britain, but common in the middle and south of Europe, and sometimes distinguished by the name of AUSTRIAN S., sometimes by that of SMOOTH S., none of the scales being ridged or keeled, as in the Common Snake. It inhabits much drier situations than those affected by the Common S., where it is often found in company with the Sand Lizard, situations more resembling those in which the viper is found.

This snake is also more similar to the viper in form and appearance than the Common S., and these circumstances have probably led to its being often mistaken for the viper, and its existence in England remaining unnoticed so long. It attains a length of about two feet; is of a shining brown color, ornamented with checkered irregular patches of black; a yellow mark on the back and sides of the head; the lower parts yellowish, with square black spots. The head is not flattened, as in the viper, but is narrowed in a similar way towards the neck; there is much difference in the plates of the head; the yellow mark on the head is a very characteristic distinction, and the back does not exhibit a broad zigzag pattern, as in the viper. Unlike the Common S., the *Coronella lævis* is ovoviviparous, the eggs being hatched within the mother.

SNAKE-BIRD. See DARTER.

SNAKE-BITES. See VENOMOUS BITES and STINGS.

SNAKE-EEL, the popular name of the fishes forming the family *Ophisuridæ* of some naturalists, included by others, with all the eels, in the family *Murænidæ*, and distinguished by the want of a tail-fin, and the tail ending in a conical point like that of a serpent. They are inhabitants of the seas of warm climates. One species, *Ophisurus serpens*, is found in the Mediterranean. It attains the length of about six feet, and the thickness of a man's arm; is brown above, silvery beneath, and has a slender and pointed snout.

SNAKE RIVER, also called LEWIS' FORK, is the great southern branch of the Columbia (q. v.).

SNAKE-ROOT. See POLYGALA and ARISTOLOCHIA.

SNAKE-STONES, small rounded pieces of stone or other hard substance, popularly believed to be efficacious in curing snake-bites. A belief in their efficacy has been long and very widely diffused, and probably extended to Britain and other western parts of the world from the East. Small perforated balls and rings of various kinds of stone, ivory, &c., strung together like beads, were formerly used as snake-stones in Scotland, being given to cattle to chew when they were bitten by vipers. Of course they could only be expected to act as a kind of charm. Many of the snake-stones used in India and the further east seem to be of no greater value. Some of them, however, appear to be really efficacious, being applied to the wound and absorbing blood from it with the poison before it has entered the system. Remarkable instances are related of speedy cures thus effected. The snake-stone adheres for a short time to the wound, and then falls off. The wounded limb is meanwhile rubbed downwards. Two small snake-stones, each the size of a large pea, brought from India, and which were known to have cured a man bitten by a cobra, were found by Mr. Quekett to be composed of some vegetable matter. Another, also known to have cured a cobra's bite, having been brought from Ceylon by Sir James E. Tennent, was examined by Mr. Faraday, and was deemed by him to be 'a piece of charred bone, which has been filled with blood, perhaps several times, and then carefully charred again.'—See Buckland's *Curiosities of Natural History*, and Tennent's *Ceylon*, vol. i.

SNAKE-WEED, another name of BISTORT (q. v.).

SNAKE-WOOD, another name of LETTER-WOOD (q. v.).

SNAPDRAGON (*Antirrhinum*), a genus of plants of the natural order *Scrophulariaceæ*, consisting of annual and perennial herbaceous plants, chiefly natives of the temperate parts of the northern

Snapdragon (*Antirrhinum majus*).

hemisphere. They have the calyx 5-parted; the corolla swollen at the base, but without a spur, and *personate* (Lat. *persona*, a mask), i. e., its mouth closed by the pressure of the lower against the upper lip; and the fruit is a 2-celled oblique capsule, opening by three pores at the apex. The English name refers to a peculiarity of the corolla, the lower lip of which, if forcibly parted from the upper, so as to open the mouth, shuts with an elastic spring or snap. Some of the species have very pretty flowers. *A. majus* has long been a favorite in our gardens, in which there are many fine varieties of it.

SNAPHAUNCE, an old musket of the 17th and first half of the 18th c., called also Asnaphan. See LOCK.

SNEE'HÄTTEN. See NORWAY.

SNEEK, a prosperous trading and manufacturing town in the Netherlands, province of Friesland, 13 miles south-south-west of Leeuwarden. It is built in the form of an irregular triangle, has three canals, and good water-way to the sea. Rich meadow-lands, in some places tending to be marshy, surround the town, and in the neighborhood is a considerable lake called the Sneekermeer. Pop. (Jan. 1, 1875) 9654; 6972 Reformed, and 1450 Roman Catholics, the remainder chiefly Baptists, except 150 Jews. S. is the largest butter and cheese market in the province; the quantity sold reaching 5,000.000 lbs. of butter, and 2,250.000 lbs. of cheese annually. The principal buildings are the Reformed Church, Town-house, Baptist Church, and Jewish synagogue.

SNEEZE-WOOD (*Ptæroxylon utile*), a tree of the natural order *Sapindaceæ*, a native of South Africa, common in the eastern districts of Cape Colony. The timber rivals mahogany in beauty, takes a fine polish, is very solid, strong, and durable. It receives its English name, and its Dutch name, *Nieshout*, from the sternutatory properties of its sawdust, by which workmen are often much annoyed.

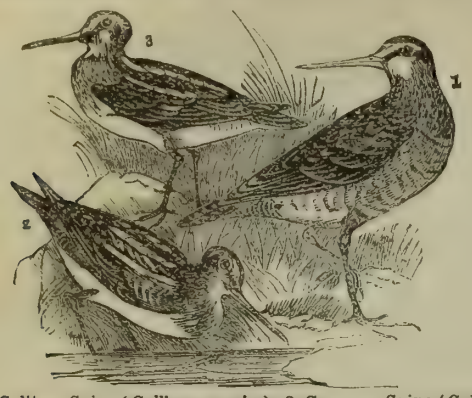
SNELL EXHIBITIONS. These exhibitions were founded in the year 1677 by John Snell of Uffeton, in the county of Warwick, for the purpose of educating Scottish students at the university of Oxford. Snell was born in the parish of Colmonell, in Ayrshire, in 1629, and entered the university of Glasgow, in 1644. He afterwards removed to England, where, after holding several offices of a legal nature, he was appointed seal-bearer to the Court of Chancery. He died at Holywell, near Oxford, in 1679, leaving his estate of Uffeton, near Leamington, to trustees (the Vice-chancellor of the university of Oxford, the Provost of Queen's College, the Master of Balliol College, and the President of St. John's College), for the foundation of the scholarships which bear his name (at present 14 in number). The exhibitions have been the subject of much litigation in the Court of Chancery, and are now administered under a scheme settled in 1861. The exhibitioners are nominated by the college of Glasgow, and receive about £110 annually each during five years. Candidates for these scholarships must have been born in Scotland, or must be sons of fathers born in Scotland, and must have resided for two years at least in Glasgow College, or for one year in that college, and two at least in some other college in Scotland. None are admitted to examination who have completed their 21st year, or have been members of the university of Oxford of more than two years' standing from the day of their matriculation inclusive. Two exhibitioners are nominated annually after public competition. The list of Snell exhibitioners includes not a few well-known names, such as J. G. Lockhart, Sir W. Hamilton, the late Archbishop of Canterbury (Tait), &c.

SNIA'TYN, a town of Galicia, in Austrian Poland, is situated on the Pruth, and was formerly a frontier stronghold. It has tanneries, and a considerable trade in cattle and horses. Pop. (1880) 10,375, among whom are many members of the Armenian Church.

SNIPE (*Scolopax*), a genus of birds of the family *Scolopacidæ* (q. v.), having a very long straight bill, with nasal grooves extending almost to the tip, which expands a little, the upper mandible slightly exceeding the lower in length, the whole bill soft and very sensitive, smooth and shining in the living bird, but soon after death becoming pitted like the end of a thimble by drying. The head is compressed; the eyes large, and placed far back in the head, an evident adaptation to the mode of life, enabling the bird to guard against danger, whilst its bill is plunged in the mud. The feet have three toes before, divided to the base or very nearly so, not edged by membrane, the hind-toe short. The tail is short. The genus naturally divides itself into two sections, sometimes regarded as distinct genera, the first consisting of the Woodcocks (q.v.), to which the generic name *Scolopax* is appropriated; the second containing the species popularly known as Snipes, which receive the generic name *Gallinago*, and are distinguished by their lighter form, by their longer legs, and by having a little of the lower part of the tibia bare.—The COMMON S. (*S. gallinago*, or *Gallinago media*) is about 11 inches in entire length, the bill almost 3 inches. The sexes are alike in plumage, but the female is rather larger than the male. The general color of the upper parts is blackish brown, finely mixed with pale brown and with a rich buff color; three pale brown streaks along the head; the neck and breast pale rust color mottled with black; the belly white. The tail

consists of 14 feathers. The S., when flushed, changes its course several times in a zigzag manner in the air, and then darts off very swiftly, so that young sportsmen find it a very difficult bird to shoot.

The S. makes a very inartificial nest of a little dry herbage, in a depression of the ground, or sometimes in a tuft of grass or rushes. The eggs are four in number, pale yellowish or greenish white, the larger end spotted with brown. This species of S. is plentiful in all the moory and marshy parts of Britain, and gen-



1, Solitary Snipe (*Gallinago major*); 2, Common Snipe (*Gallinago media*); 3, Jack Snipe (*Gallinago gallinula*).

erally throughout Europe, also in some parts of Asia, and it is found in the north of Africa. It breeds in Britain, even in the south of England, although many of the snipes which spend the winter in Britain migrate northwards in spring. The S. is capable of being tamed, and becomes very familiar, but is difficult to keep from the prodigious quantity of worms and other such food which it requires. A tame S. has been known to eat nearly twice its own weight of worms in twelve hours. The S. is in high esteem for the table, and is included amongst game in Britain.—The habits of all the other species of S. correspond very nearly with those of the Common Snipe. The GREAT S., or SOLITARY S. (*S.* or *G. major*), is comparatively a rare bird in Britain, but abounds in the extensive marshes of continental Europe, and is found also in Asia. Its entire length is about 12½ inches, the bill not quite so long in proportion as that of the Common Snipe. There are 16 feathers in the tail.—The JACK S., or JUDCOCK (*S.* or *G. gallinula*), the smallest of the British species, is like the Common S. in plumage. It is common in Britain, but mostly as a winter visitant, and is found also, during summer or winter, in most parts of Europe and of the north of Asia.—North America has a number of species. The COMMON AMERICAN S. (*S.* or *G. Wilsoni*) is about equal in size to the Common S. of Europe, and much resembles it also in plumage. The tail has 16 feathers. This species is abundant in summer in the northern parts of the United States and in Canada, in the more southern states in winter. It is in much request for the table, and is often caught in snares.—Snipes are found also in other parts of the world. The name S. is extended in popular usage to include the genus *Macrorhamphus*, in which the outer toes are connected at the base by a membrane. In other characters, as well as in plumage and habits, the similarity to the true snipes is very great. The RED-BREASTED S., or BROWN S. (*M. griseus*), of North America has been occasionally seen in Britain and in Scandinavia. In size it is nearly equal to the Common Snipe.

SNIPE-FISH. See TRUMPET-FISH.

SNI'ZORT, LOCH, a large and picturesque inlet of the sea, in the north-west of Skye (q. v.), between Totternish Point and Vaternish Point. At its head, the loch is only a few furlongs broad; but it gradually expands, and at its entrance the breadth is over 7 miles. It is 13 miles long.

SNORRI STURLESSON, a learned historian, and a distinguished Icelandic politician, was born in 1178 at Hvamma in Iceland where his family, who traced their descent to the ancient kings of Norway and Sweden, had been settled since the early colonization of the island. S. S. was placed at an early age under the care of John Loptson, the grandson of Sæmund Sigfusson, the learned compiler of the old Edda, by whom he was instructed in the history, mythology, and poetry of the North, as well as in classical literature. By his marriage, at the age of 26, with a rich heiress, and the speedy death of his father, S. S. early attained a position of wealth and influence, and by the free choice of the people, was elected supreme judge, or chief magistrate of the island. In this post, he was distinguished for his profound knowledge of the laws and civil institutions of his native country; but his ambition, avarice, and love of intrigue embroiled him personally in sanguinary feuds, and contributed to hasten the destruction of Icelandic independence. His love of intrigue led him to take part in the intestine troubles of Norway, and thus drew upon him the suspicion and ill-will of the Norwegian king, Hakon, who sent secret instructions to Iceland for his arrest, or, if need be, his assassination. The king's intentions were carried out to their fullest extent; and his numerous enemies joining together in a plot against him, S. S. was attacked in his own house, and murdered in the year 1241.

S. S. was a poet of no mean order, and composed numerous *drapas*, or laudatory poems, on the kings and jarls at whose courts he sojourned. His great work is the *Heimskringla*, or Mythic Ring of the World, in which he records the history of the kings of Norway from the earliest times to the death of Magnus Erlingsson, in 1177; and which he compiled from ancient genealogical tables and other documents. It was translated into Danish about 1559 by Peder Clauson, and published first by Olaf Worm (Cop. 1633). This translation has been republished in more recent times by Gruntvig (3 vols., Cop. 1818—1822) and others. German, Swedish, and Latin versions have also been executed. S. S. is believed to have had a share in collecting and arranging the songs of the elder or poetic Edda (q. v.), and to have contributed very materially towards the compilation of the Skalda and other parts of the younger or prose Edda.

SNOW is the frozen moisture which falls from the atmosphere when the temperature is 32° or lower. It is composed of crystals, usually in the form of six-pointed stars, of which about 1000 different kinds have been already observed, and many of them figured, by Scoresby, Glaisher, and others. These numerous forms have been reduced to the following five principal varieties.—1. Thin plates, the most numerous class, containing several hundred forms of the rarest and most exquisite beauty (figs. 1 to 6). 2. A

Fig. 1. Fig. 2. Fig. 3. Fig. 4.

spherical nucleus or plane figure studded with needle-shaped crystals (fig. 8). 3. Six or more rarely three sided prismatic crystals. 4. Pyramids of six sides (fig. 9). 5. Prismatic crystals, having at the ends and middle thin plates perpendicular to their length (fig. 7). The forms of the crystals in the same fall of snow are generally similar to each other. The crystals of hoar-frost being formed on leaves and other bodies disturbing the temperature, are often irregular and opaque; and it has been observed that each tree or shrub has its own peculiar crystals.

Snow-flakes vary from an inch to $\frac{7}{100}$ths of an inch in diameter, the largest occurring when the temperature is near 32°, and the smallest at very low temperatures. As air has a smaller capacity

Fig. 5.

for retaining its vapor as the temperature sinks, it follows that the aqueous precipitation, snow or rain, is much less in polar than in temperate regions. The white color of snow is the result of the combination of the different prismatic rays issuing from the *minute* snow-crystals. Pounded glass and foam are analogous cases of the prismatic colors blending together and forming the white light out of which they had been originally formed. It may be added that the air contained in the crystals intensifies the whiteness of the snow. See RED SNOW. The limit of the fall of snow coincides nearly with 30° N. lat., which includes nearly the whole of Europe; on traversing the Atlantic, it rises to 45°.

but on nearing America descends to near Charleston; rises on the west of America to 47°, and again falls to 40° in the Pacific. It corresponds nearly with the winter isothermal of 52° Fah. Snow

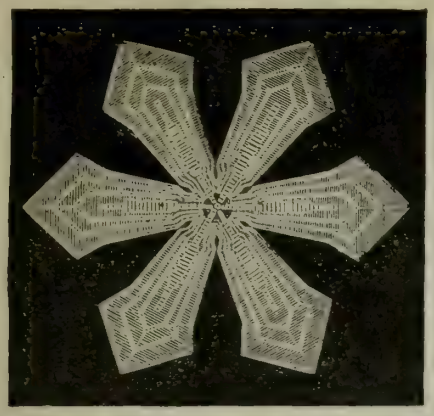


Fig. 6.

is unknown at Gibraltar; at Paris, it falls 12 days on an average annually, and at St. Petersburg 170 days. It is from 10 to 12 times lighter than an equal bulk of water. From its loose texture, and its containing about 10 times its bulk of air, it is a very bad con-

Fig. 7. Fig. 8. Fig. 9.

ductor of heat, and thus forms an admirable covering for the earth from the effects of radiation—it not unfrequently happening, in times of great cold, that the soil is 40° warmer than the surface of the overlying snow. The flooding of rivers from the melting of the snow on mountains in summer, carries fertility into regions which would otherwise remain barren wastes.

SNOW-BALL TREE. See GUELDER ROSE.

SNOWBERRY (*Symphoricarpos* or *Symphoria racemosa*), a bushy deciduous shrub of the natural order *Caprifoliaceæ*, a native of the northern parts of North America, and now very common in British shrubberies. It has simple leaves and small flowers; berries about the size of black currants, remaining on the bush after the leaves, quite white, but uneatable.—The name SNOWBERRY is also given to *Gaultheria serpyllifolia*, a native of the bogs of North America

SNOW-BIRD (*Junco* or *Fringilla hyemalis*), a North American bird of the Finch family (*Fringillidæ*), common from Louisiana to the Fur Countries, in all the eastern parts of North America. The wings are rather short, the tail slightly notched. The whole length is rather more than six inches; the upper parts are lead-color, the lower parts white, the two outer tail-feathers white, the next white margined with black. This bird migrates northwards early in spring, and southwards late in autumn. It is often to be seen in small flocks, visiting barn-yards, and hopping about with the domestic poultry. In cold weather, it retires to holes in hay-stacks. Its song is sweet. From its frequent familiar approach to human habitations, the S. is regarded with favor throughout great part of North America, as the Redbreast is in Britain. In the south, however, it is often brought to market, its flesh being very pleasant. In the western parts of North America, another but very similar species, the OREGON SNOW-FINCH (*F. Oregona*), takes the place of this.

SNOW BUNTING, or SNOWFLECK (*Plectrophanes nivalis*), a bird of the Bunting family (*Emberizidæ*), of a genus distinguished

Snow Bunting (*Plectrophanes nivalis*).

from the true buntings by the long and nearly straight claw of the hind-toe, in this resembling the larks. There is also an approach to larks in habits; there is a similar ease and celerity in running along the ground, and the song is very different from that of any of the true buntings. The S. B. abounds in summer in all parts of the arctic regions, and in winter in more southern countries of Europe, Asia, and America. Linnæus says it is the only living creature that has been seen 2000 feet above the limits of perpetual snow on the mountains of Lapland. Great flocks are seen in Britain, particularly in severe winters, generally frequenting uplands in mild weather, but descending to the low grounds and seashore in hard frosts. Comparatively few visit the south of England. A few remain during summer on the highest mountains of Scotland. The nest is placed on the ground, or in a crevice of a rock. The S. B. is generally very fat, and is highly esteemed for the table. The Greenlanders kill great numbers, and dry them for winter use.

SNOW'DON, a mountain-range in Caernarvonshire, North Wales, stretches in a north-east-by-north direction from a point 5 miles north of Cricceith, near the head of Cardigan Bay, to near Conway; but is broken up by valleys and river-courses into four mountain groups, whose chief peaks are Carnedd-Llewelyn, 3460 feet; Moel-Siabod, 2878 feet; and *Moel-y-Wyddfa* ('the Conspicuous Peak'), the highest mountain in South Britain, 3571 feet above sea-level. Seen from the top, Moel-y-Wyddfa, the 'King of Snowdonia,' appears to send out three ridges, which gradually divide and subdivide, giving birth to numerous valleys and corries. The ascent of the highest peak of S. is effected by tourists from Llanberis (on the north), Beddgelert (on the south), Llyn-Cwellyn (on the west), and Capel Curig (on the east); the first is shortest and easiest; the last is longest, most difficult, but at the same time by far the grandest. The district of 'Snowdonia' was made a royal forest by Edward I. of England, but was disafforested in 1649.

SNOWDROP (*Galanthus*), a genus of plants of the natural order *Amaryllideæ*, of the same tribe with Amaryllis, Snowflake, Crinum, &c. The three outer segments of the perianth spread, so as to make a bell-shaped flower; the three inner are shorter, erect, and notched at the summit. The flowers arise from a spathe. The root is bulbous, and produces two leaves and one single-flowered leafless stem (*scape*). The Common S. (*G nivalis*), a plant too well

Common Snowdrop (*Galanthus nivalis*).

known to need description, is a native chiefly of the south o Europe, growing in woods and pastures. It is found apparently wild in some places both in England and Scotland, but is probably rather naturalized than native, having long been much cultivated in gardens. Another species of S. (*G. plicatus*), with much broader leaves, is found in the south of Russia and in Asiatic Turkey.

SNOW-LINE. The snow-line marks that height above the sea-level below which all the snow that falls annually melts during summer; higher than this lies the region of perpetual snow. No general rule for the height of this line can be given, owing to the different causes which may determine it. These are—the situation of the slope in respect of the sun's rays, and hence, other things being equal, it is higher on the south than on the north side of mountains; the situation with respect to the rain-bringing winds; the steepness of the slope; and the dryness or humidity of the region. The following are the observed heights of the snow-line in English feet, in different parts of the globe:

	N. Lat.	Height.
Spitzbergen	78	0
Sulitelma, Lapland	67	3,835
Kamtchatka	59½	5,249
Unalashka, W. America	56½	3,510
Altai	50	7,034
Alps	46	8,885
Caucasus	43	11,063
Pyrenees	42¾	8,950
Rocky Mountains	43	12,467

	N. Lat.	Height.
North Himalaya	29	19,560
South Himalaya	28	15,500
Mountains of Abyssinia	13	14,065
Purace, Columbia	2½	15,381
	S. Lat.	**Height.**
Nevados of Quito	0	15,820
Arequipa, Bolivia	16	17,717
Paachata, Bolivia	18	20,079
Portillo, Chili	33	1,473
Cordilleras, Chili	42½	6,010
Magellan Strait	53½	3,707

From lat. 0° to 20°, it sinks only a very little; from 20° to 70°, it continues to fall equably; but from 70° to 78°, it sinks with great rapidity. To this general statement there are some important exceptions. It is about 4000 feet higher on the north than it is on the south side of the Himalaya, owing to the greater depth of snow that falls on the south side; to the greater dryness of the climate of Tibet, which increases the evaporation and the heating power of the sun's rays; and to the naked rocks and soil of the north absorbing more heat than surfaces covered with vegetation. It is higher in the center of continents than near the coasts (the rain being less, and the heat greater), as seen on comparing the Pyrenees and Caucasus; and on the east than on the west coasts of continents, which is strikingly illustrated by Kamtchatka (5249) and Unalashka (3510), situated respectively on the west and east coasts of the North Pacific. South of the equator, it rises from 0° to 18° very considerably, and more so on the west than on the east of the Cordilleras, owing to the small amount of rain and snow which falls on the west of these mountains. It is as high in 33° south lat. as in 19° north lat.; but south of this it sinks very rapidly, so that in the south of Chili it is 6000 feet lower than in the same latitude in the Rocky Mountains, and 3000 lower than in Western Europe. The mean temperature of the snow-line varies much from the equator to the pole—from 35° to 20° Fah. In the Alps, it is about 25°; and in Norway, about 23°.

SNOW-SHOES, a species of shoe much used by the Esquimaux, Laplanders, and others who inhabit those regions where snow prevails for a great portion of the year. It consists of a flat frame, of a lanceolate form (see fig.), from 8 to 14 inches in breadth at its widest part, and of great length—sometimes as much as 7, though generally about 4 feet. It is either wholly of wood, or is a wooden frame filled in with wicker-work or thongs, and has cross-straps on the upper surface to attach it to the foot. The broad surface prevents the foot from sinking in the snow.

Snow-shoe.

SNUFF. See TOBACCO.

SNYDERS, or SNEYDERS, FRANCIS, a Belgian artist, celebrated for his powers as an animal-painter, was born at Antwerp in 1579, and was formed in the school of Henry van Baelen. Originally, he confined himself exclusively to painting fruits, and worked with Rubens. In his pictures, with figures by Rubens, Jordaens, Honthorst, and Mierevelt, it is difficult to discover any difference of touch. For Philip III. of Spain he executed several hunting and battle pieces. S. knew how to give expression to the passions of the lower creation, and his bear, wolf, and boar fights are scarcely surpassable. The best specimens of the artist are contained in the galleries of Vienna, Munich, and Dresden, but there are also some fine pictures of his in private English collections. S. died at Antwerp in 1657.

SOAP (Lat. *sapo(n)*, Welsh *sebon*—the Romans considered soap to be a Celtic invention). This well-known material, according to Pliny, first became known to the Romans by their conquest of Gaul. There are some notices of it in the English version of the Bible, but it is believed that the words *borith* and *nether*, there rendered into soap, really mean potash and soda.

The *chemical composition* of soap may be explained as follows: The fixed fatty bodies, stearine, palmitine, and oleine (we do not include margarine, for it is now generally admitted that the fat to which this name was applied is merely a mixture of stearine and palmitine), when heated with alkaline solutions, undergo the remarkable change known under the title *Saponification*, or conversion into soap, during which process the fats yield up a clear viscid liquid, which, from its sweetness, is termed *Glycerine* (q. v.). The nature of this change may be ascertained by decomposing the soap that is thus formed, and which exists as a homogeneous transparent mass, freely soluble in warm water, by the addition of some acid, such as tartaric or hydrochloric, which combines with the alkali, and forms a soluble compound with it. A fatty matter separates in flakes, which melt on the application of heat, and form an oily layer on the surface of the fluid. This substance, when cold, is found to be very different from the original fat. It has acquired a strongly acid reaction, as may be ascertained by applying test-paper to it in its melted state, and it is freely soluble in alcohol, the solution being strongly acid. It at once forms a clear solution in hot alkaline liquids, while the original fat would under similar conditions have formed a milky-looking fluid. It is, in fact, a true *acid*, capable of forming salts, the potash and soda salts being known as *soft-soap* and *hard-soap*, which have been thus generated out of the elements of the neutral fat under the influence of the alkali. Stearine, when thus treated, yields *Stearic Acid* (q. v.); palmitine yields *Palmitic Acid* (q. v.); and oleine *Oleic Acid* (q. v.); while common fat, which is a mixture of the three above-named fats, affords, on saponification with an alkali, and subsequent decomposition of the soap, a mixture of the three fatty acids.

The term soap is sometimes extended in meaning, so as to include compounds of the fatty acids with other bases besides the alkalies, e. g., lime, baryta, magnesia, &c.; but these compounds being insoluble are inapplicable to the purpose of cleaning. The true soaps owe their cleaning power to their solubility, and their attraction for the matters that ordinarily constitute 'dirtiness.' The presence of a portion of free alkali increases the detergent power, especially in the case of greasy matter.

Manufacture.—In this country, and in the north of Europe generally, hard-soap is made from tallow, palm oil, bone grease, and kitchen fat, by boiling to saturation with caustic-soda. Cocoa, palm nut, and some other oils are occasionally used, chiefly in imitating superior soaps, and the only other ingredient of consequence is rosin, the residuum of the distillation of rough turpentine. In the south of Europe, coarse olive-oil is the staple material, and from this is produced the marbled soap known as 'Marseilles.'

The soap-maker first dissolves in boiling water 6 to 8 cwt. of crude soda-ash (see SODA) in a cast-iron circular vessel (contents may be 1000 gallons), furnished with a steam-pipe in its center. He then adds half the weight of *pure caustic* lime, and boils the mixture. When the lime has rendered the soda caustic, the boiling is discontinued, subsidence takes place, and the lye is ready for use.

Soap-pans are of various sizes. One of moderate dimensions may turn out from six to eight tons, and is usually formed of four pieces of cast-iron—lower casting, say five feet in diameter; upper, eleven. Heat is applied either by means of a furnace beneath the bottom piece, or by open steam introduced by a pipe led to a circular perrorated ring at the bottom of the pan. Steam-boiling being now extensively adopted, our description will apply to that method.

Curd or White Soap.—20 cwt. of tallow being put into the soap-pan, and a quantity of the prepared lye, steam is turned on, and boiling continued until the lye is thoroughly incorporated with the tallow, and becomes a pasty mass. A few shovelfuls of common salt are now thrown in when the lye begins to separate. The partially formed soap is allowed to cool, and the salted lye, now deprived of its soda, subsides, and is drawn off from the bottom by a pipe, or removed by a pump. The operation of adding and boiling with lye is repeated until the tallow is saturated with soda, and the lyes show as much alkali after boiling as before. The soap is now treated with weaker lye, and by more or less water brought to the consistency the maker requires. From its tendency to thicken rapidly, it is transferred to the frame at a higher temperature than the soap next described.

Pale or Yellow Soap.—When the tallow is saponified as above described, about ⅛d of its weight of rosin is added, and the boilings with lye repeated, until the mass is thoroughly saponified. The practised workman being aware that perfect soap is insoluble in strong alkali, avoids the risk of imperfect particles escaping the action of the lye from being enveloped in perfect soap, by reducing the mass with water, and adding lye gradually until the soap again floats as a curd on the liquid. The soap is then cooled down, and the lye being removed as completely as possible, it is boiled with the quantity of water necessary to bring it to the consistency required. These later operations require much experience, and the best theoretical knowledge requires the aid of tongue and eye to carry them through with success. The soap being now *finished* (the technical term), the copper is covered up, and the contents allowed to settle until the temperature falls to about 160° Fahrenheit. According to the quantity of water used, so is the deposit, called the *nigre*, greater or less. When too much water is used, the produce of soap is too small; when too little, the produce is large, but of inferior quality, from the insufficient deposit of impurities. This nigre is employed in making second-class soap. When of proper temperature, the soap is removed into frames, now mostly made of cast-iron, containing about 10½ cwt. each, where, after solidifying, which it does in three days, it is cut by wire into slabs, which are again cut transversely into bars ready for the market.

London Mottled is made of kitchen fat (no rosin). The process described in the making of curd soap is followed here, except that

when perfect the soap is, when almost boiling, put into wooden frames three or four times as high as the ordinary frame of 52 inches, and the lye allowed to percolate through the soap to the lower part of the frame, producing the mottled appearance desired. As this soap, when subjected to any mixing operation, lost its *mottle*, it long enjoyed a high reputation as a genuine soap; but now that cheap imitations, having a beautifully marbled appearance, are produced from cocoa and palm nut oils, with coloring and silicious matter, its prestige is somewhat on the wane.

The numerous patents taken out for improvements in soap-making have had for the most part more the object of cheapening, by the addition of various articles to soap in its semi-fluid state, than of improving the manufacture.

Soft-soap differs from hard from having potash for its base instead of soda. The repeated changes of lye described in the manufacture of hard-soap are here inadmissible, for all the lye employed remains in combination with the oily materials, and is never separated. Hence open steam, as throwing in water into the mass, cannot be applied, nor can salt, so useful an agent in the former manufacture, be used, as it would tend to separate the soap from the lye, while a thorough combination is essential. The making of soft-soap requires much experience and nicety, it being so easy to overdo the supply of alkali, which cannot happen in hard-soap. A ton of materials, consisting of 1900 lbs. of fish or other oil, with 340 lbs. tallow, is put into the soap-pan with 200 gallons of American potash lye of such strength that 6600 grains of real potash are in each. After being boiled by the heat of a furnace, and well beat down on the surface to keep in bounds the frothy mass, a stronger lye, containing about 8700 grains of potash per gallon, is added at short intervals, and the boiling carried on until the workman ascertains by taste and appearance that the soap is perfect. The tallow serves to give consistency to the soap, and also produces white specks of stearate of potash, which much enhance its appearance.

SOAP, MEDICAL USES OF. The only kind of soap that should be used internally is *White Soda Soap*. It is prepared from caustic soda, and either olive or almond oil. In its purest state, it is called *Medicinal Soap*, while in its less pure forms it is known as Alicant, Venice, or Spanish Soap. When properly made, it should be perfectly soluble in pure water and in alcohol. It is chiefly employed to form pills of a gently aperient and antacid action. Pills containing a combination of soap and dried carbonate of soda, are of great use in certain forms of gravel. Soap is often added to pills as an adjuvant, or for the purpose of preventing them from becoming hard and insoluble. White soap affords a ready antidote in cases of poisoning with the strong mineral acids. *Soft-soap* ought to be made with olive oil and potash, and it should be of yellowish-white color, inodorous, and of the consistence of thick honey. It is of great service, as an external application, either alone or in association with sulphuret of potash, and other remedies, in various cutaneous affections.

SOAPBERRY (*Sapindus saponaria*, a West Indian tree, of the natural order *Sapindaceæ*, the pulp of the fruit of which is used instead of soap in washing. This property belongs to other species of the same genus. With the exception of *S. marginatus*, found in the southern states of North America, the genus is entirely tropical. The use of the pulp as soap, if often repeated, is apt to injure linen; but it is capable of cleansing as much linen as sixty times its weight of soap. Each fruit contains a nut of a shining black color. These nuts are very hard, and were formerly imported into Europe to be made into waistcoat buttons, being tipped with silver or other metal. They were little liable either to be injured by wearing or to be broken.

SOAP-STONE. See STEATITE.

SOAP-TEST. This test, for which science is indebted to Professor Clark of Aberdeen, is now universally employed for determining the degree of hardness of water. Every one knows how much more readily a lather is formed—as, for example, in washing the hands—with soft than with hard water. This is accounted for by the earthy bases of the hard water displacing the alkaline bases of the soap, and forming compounds insoluble in water. This is the foundation of the soap-test. A hard water of known strength is first prepared by dissolving 16 grains of pure carbonate of lime in pure hydrochloric acid, evaporating to dryness, and dissolving the resulting chloride of calcium in a gallon of distilled water. This gallon of chloride of calcium solution accurately represents a natural water whose hardness is due to 16 grains of carbonate of lime in a gallon. A solution of soap in proof-spirit is next prepared of such strength, as that a quantity of it which will fill 32 measures of a volumetric tube, each measure of which contains 10 grains, will be exactly able to convert 1000 grains' measure of the standard solution of hard water into the earthy soap described. This point is thus ascertained: The hard water is placed in a stoppered bottle, and the soap solution added to it by degrees, the bottle being shaken after each addition when a bubble will form, which rapidly disappears so long as any lime is present; but when at last it is all used up, a froth of soap bubbles remains after hard shaking, such as to last unbroken for three minutes. If, now, a given sample of water be examined, and this point is reached at the expense of the entire 32 measures, it is a water of 16 degrees of hardness. Now, perfectly soft water consumes 2 measures of the soap solution before permanent bubbles are formed, so that a water of 16 degrees of hardness has in reality only consumed 30 measures of the soap solution. But $\frac{16}{30} = 0{\cdot}53$; hence, if any given measures of the soap-test be used in estimating the hardness of a water, we must first subtract 2 from the amount, and then multiply by 0·53; and the result will give us the degree of hardness. For example, let a given sample require 27 measures of the soap-test. On subtracting 2, and multiplying by 0·53, we find its hardness to be 12·25.

Clark's Soap-test Table for Hardness of Water is given in the article 'Soap-test' in Knight's *English Cyclopædia;* and full details regarding the mode of working the test, to determine the amount of lime, magnesia, soda, sulphuric acid, and pure carbonic acid, are given in Dr. Parkes's *Manual of Practical Hygiene* (Lond. 1864).

SOAPWORT (*Saponaria*), a genus of plants of the natural order *Caryophyllaceæ*, having a cylindrical or ventricose,5-toothed calyx, without any outer calyx or attendant bracteæ, five undivided petals with long claws, ten stamens, two stigmas, and a capsule opening at the top by four valves. Some of the species have very beautiful flowers. *S. Calabrica* has of late become one of

Soapwort (*Saponaria officinalis*).

the most favorite annuals of our flower-gardens.—COMMON S. (*S. officinalis*) is found on waysides, in thickets, and on the banks of streams, in most parts of Europe, although it is a somewhat doubtful native of Britain. Both the root and the leaves contain Saponin (q. v.), in consequence of which they are sometimes employed for washing. The brownish-red color of the bark of the root, however, is apt to tinge white articles. The root of this plant has also medicinal properties, being aperient, resolvent, and alterative. It is sometimes sold as RED SOAPROOT.

Nearly allied to the genus *Saponaria*, but having an angular calyx and a 5-valved capsule, is the genus *Gypsophila*, some species of which are called SOAP-ROOT, and contain much saponin. Thus, the EGYPTIAN SOAP-ROOT (*G. struthium*), and the SPANISH SOAP-ROOT (*G. Hispanica*), called *Jabonera* in Spain, have been employed for washing from time immemorial, and the roots not having a dark rind, can be used for washing white articles, and are to some extent an article of commerce, being used for silken and other stuffs, the colors of which will not bear the application of soap. The roots of *Lychnis dioica*, one of the most common British plants, possess the same properties in an inferior degree.—The bark of *Quillaja saponaria*, a Chilian tree of the natural order *Rosaceæ*, contains much saponin, is generally used for washing in Chili and Peru, and there forms a considerable article of commerce.—Some of the tropical South Sea Islands produce a species of vine (*Vitis saponaria*), the stem of which, especially the thicker part, cut into pieces, and softened by cooking on hot stones, produces in water a rich lather almost equal to that of soap. See also SOLANUM.

SOBBING is merely a modification of the ordinary movements of respiration excited by mental emotions. It is the consequence of a series of short convulsive contractions of the diaphragm, and is usually accompanied by a closure of the glottis, preventing the entrance of air into the lungs.

SOBIESKI, JOHN. See JOHN III.

SOBRAO'N, a village on the left bank of the Sutlej, 25 miles east-north-east of Ferozpur, near which, on 10th February 1846, a most obstinate battle was fought between the British army of

15,000 men, under Sir Hugh Gough, and a Sikh force numbering 30,000. The Sikhs were strongly entrenched, and vigorously resisted the attacks of their opponents, but the courage and perseverance of the latter ultimately gave them the mastery; the various earthworks were captured in succession, and the Sikhs driven across the Sutlej, with a loss in killed, wounded, and drowned of 13,000. Gough immediately followed up his victory by crossing into the Punjab in pursuit of the fleeing enemy.

SOCAGE, or SOCCAGE (originally *hlaford-socn*, seeking a lord; whence we have also *soc*, a right of holding a court), a tenure of lands in England, of which the characteristic feature is, that the service is fixed and determinate in quality, thereby differing both from knight-service and from villeinage. It was originally peculiar to the Anglo-Danish districts of England. At the time when the allodial tenure was converted into immediate dependence on the crown, this tenure seems to have arisen out of the necessity for commendation or seeking a lord. In Domesday, socmen are often mentioned as bound 'to seek a lord,' or free to go with their land where they pleased. The socmen of Stamford are said to be free to seek a lord, being only liable to the king for the toll attached to them as inhabitants of a borough. The obligation of socage in its origin has been compared to the mutual bonds of allegiance of later times so common in the Highlands of Scotland, and known as Bonds of Manrent (see MANRENT). Three kinds of socage have been enumerated as existing at a later period—viz., free and common socage, socage in ancient tenure, and socage in base tenure. The second and third kind are equivalent to tenure in ancient demesne and copyhold tenure (see DEMESNE, ANCIENT, and COPYHOLD), and the first is what has generally and more properly been denominated socage, where the services were both certain and honorable. Besides fealty, which the socager was bound to do when required, he was obliged to give attendance at the court baron of his lord, if he held one, either for a manor or for a seigniory in gross.

By an act passed during the Commonwealth, and confirmed after the Restoration by 12 Car. II. c. 24, tenure by knight-service was abolished, and all lands except church-lands held in free-alms, were directed to be held in free and common socage, which is now (with that exception) the universal tenure of real property in England and Ireland.

Socage tenures are unknown in Scotland, where, unless at a very early period, they never existed.

SOCIALISM, the name given to a class of opinions opposed to the present organization of society, and which seeks to introduce a new distribution of property and labor, in which organized *co-operation* rather than *competition* should be the dominating principle, under the conviction that the happiness of the race, and especially of the classes without capital, would be benefited thereby. Historically considered, Socialism, like many of the significant phenomena of our age, is a product of the French Revolution. That terrible outburst of popular discontent is most properly regarded as an anarchic attack on the social system that had its roots in the feudalism of the middle ages. The furious hatred of the court and the aristocracy, the passionate love of the 'people,' of 'humanity,' of 'liberty,' though called forth by special circumstances, and never formally worked out into a theory of social life, virtually contained in themselves the germs of all later proposed organizations. In the middle ages, the *right* of freely and fully enjoying life, property, and political independence was limited to a favored few; while the great masses were condemned to dumb servitude, and a perpetual minority. Even the industrial population did not recognize the Socialistic idea. The members of the different guilds or fraternities claimed exclusive right to exercise certain branches of industry, and probably the great majority of the inhabitants of a town remained in a disregarded and dependent state. Amid such social conditions, resting, as they did, on a belief in the necessity of different distinct ranks, the free action of individual life, and even the vital progress of the whole community, became well-nigh impossible.

We have not space here to trace the course of the various minor reforms that weakened the authority of the medieval theory of life; but we must not omit to notice the speculations of the political philosophers of the 18th c. in France, England, and Germany, as operating powerfully in favor of a new social system, in which the idea of humanity (assuming, at the French Revolution, as we have observed, the concrete form of the 'people') stands out prominently. Nevertheless, the first shape that the modern spirit of industry took, was not Socialistic, in the strict and proper sense of the term: it was rather individualistic, and found, as it still finds—for it is yet the prevailing theory—its natural expression in such proverbs as, 'A fair field, and no favor;' 'Everyone for himself, and God for us all.' But still, even this lawless individualism is to be regarded as a protest against the false *class*-legislation of preceding times, and as an assertion of the absolute right of *each member of society* to a share in the general welfare. That it has not universally commended itself to civilized mankind, as a perfect system, is demonstrated by the appearance and temporary popularity of such schemes of society as those of Owen (q. v.), Fourier (q. v.), St. Simon (q. v.), and the enthusiasm excited at intervals in different parts of Europe by the promulgation of extreme communistic opinions. See COMMUNISM. It is objected to Socialism, under its various forms, that it makes human happiness too much dependent on material gratifications; that it robs man of that energy that springs from ambition; that it unphilosophically ignores an individualism and inequality to which Nature herself has given her inviolable sanction; and that, by the abolition of social rewards and punishments, it neither holds out any hope to the industrious, nor excites any apprehension among the indolent. On the other hand, we must admit that the vigorous assertion of Socialistic principles has led men to a more liberal and generous view of humanity as a whole. Moreover, it has forcibly called public attention to numerous evils that have sprung up along with the modern development of industry, for which no remedy—not even a name—had been provided; to the vital interdependence of all classes; and to the inadequacy of the individual or 'selfish' system, as it has been called, to redress the wrongs or cure the evils that inevitably spring from its own unchecked operation. The recent spread of Socialistic opinions in Germany, taken in connection with the two attempts made on the life of the emperor, has led, in 1878, to special and stringent legislation designed to check the growth of Socialism. In 1878 it was computed that there were in Germany 75 Socialistic publications, with 135,000 regular subscribers.

SOCIAL SCIENCE, a name that has of late years been given to the study of all that relates to the social improvement of the community. A society, called 'The National Association for the Promotion of Social Science,' was first organized at a meeting which was held under Lord Brougham's auspices in July 1857, to consider the best means of uniting together all those interested in social improvement. The annual meetings have been held each year at a different place. The Association as now constituted comprises five sections—1. Jurisprudence and Amendment of the Law (subjection, Repression of Crime); 2. Education; 3. Health; 4. Economy and Trade; 5. Art. The Association aims at promoting improvement in all matters falling within these departments, by means of bringing together, for free discussion, societies and individuals interested in social problems.

SOCIOLOGY is the somewhat barbarous name that has of late been used to denote the study of the origin, organization, and development of human society.

SOCIETIES are associations of individuals for the promotion or accomplishment of some particular object. Such objects are numerous, including the promotion and investigation of almost every well recognized branch of science, art, and literature; the diffusion of knowledge, religion, and morality; intercourse between those of the same profession or trade; the removal of legal grievances; mutual aid in case of distress; and an abundance of other aims, which are either beneficial to the general public, or to the members of the society alone. In Great Britain, any number of persons may agree to constitute themselves a society, if the object of their union is legal. Those whose objects are scientific or literary are occasionally called *Academies* (q. v.), and under this or their own special names will be found notices of the chief societies at present existing. 'Secret' societies for the accomplishment of some object which involves a subversion of existing political arrangements, spring up from time to time in France, Ireland, Italy, &c.

SOCIETY ISLANDS, a small archipelago in the South Pacific Ocean, in lat. 16°—18° S., long. 148°—155° W., is formed of a number of islands, which are now all actually or practically French possessions. There are 13 main islands—Tahiti or Otaheite, Maitia, Eimeo, Maiaoiti, Tetuaroa, Otaha, Moorea, Tuba, Lord Howe's Island, Scilly Island, Huahine, Raiatea, and Borabora. Area 650 sq. m.; pop. 18,000. The capital of Tahiti is Papiete (pop. 2000). The chief agricultural enterprise in Tahiti is an estate of 10,000 acres in the hands of an English company. The islands closely resemble each other in appearance. They are mountainous in the interior, with tracts of low-lying and extraordinarily fertile land occupying the shores all round from the base of the mountains to the sea. They are surrounded by coral reefs, are abundantly watered by streams, and enjoy a temperate and agreeable climate. Almost every tropical vegetable and fruit known is grown here; but agriculture is in a backward state. The animals are those usually found in the South Sea Islands. The inhabitants belong to the Malay race, are affable, ingenious, and hospitable, but volatile and sensual. The practice of tattooing has almost wholly disappeared, and the native costume now closely resembles that of civilized nations. There are now no native manufactures, these having been entirely superseded by imported goods. Cocoa-nut oil, oranges, lime-juice, kauri shells and pearl shells are the principal articles exported; and cocoanuts are the general article of barter throughout the islands for calicoes, cotton cloth, knives, cordage, groceries, &c., which are imported chiefly from Tahiti. The exports from Tahiti, the principal island, amounted in 1875 to £105,000, and the imports to £120,000.

Tahiti is said to have been visited as early as 1606. Captain Cook reached it in 1769, and discovered many of the other islands of the archipelago, to which he gave the name of S. I., in honor of the Royal Society of London. In 1797, the first mission-ship fitted out by the newly formed London Missionary Society arrived at Tahiti. After 19 years of apparently fruitless labor, the influence of the missionaries began to be felt, and soon afterwards became so powerful as to be almost paramount. A quarrel between the Protestant and the Roman Catholic missionaries, who thought it better to enter upon ground already occupied by Protestants than to take up new ground for themselves, occasioned the interference of France in favor of the latter, and the island of Tahiti was taken possession of in the name of Louis Philippe, by a strong French force in 1844. All the possessions of the native ruler were afterwards placed under the protection of France; and by a treaty concluded in 1880, Tahiti and its dependencies (particularly Moorea, Tetuaroa, and Raiatea), became French possessions. Many of the Protestant missionaries left the island in consequence of the interference of the French authorities with their labors. Some, however, remained, and the congregations continued to meet. An application to the British government procured a concession on the part of the French government of some of the rights of religious liberty, which had been taken away by the local authorities.

SOCINUS, the name of two celebrated heresiarchs, uncle and nephew, who have given name to a sect of Christians, the Socinians, better known, however, as Unitarians (q. v.).—**Lælius Socinus**, the elder of the two, was born at Siena, in Tuscany, in 1525, and belonged to a family that had long been distinguished for its cultivation of literature and science. His father, Marianus Socinus, was an able lawyer, and designed his son for the same profession. But Lælius soon displayed a strong preference for theological inquiry, and in order to better prosecute his biblical studies, he made himself familiar with Greek, Hebrew, and Arabic. The only result of his legal training that one can discern is an obstinate aversion to believe anything 'unreasonable.' The principles of the Reformation had slowly found their way into Italy, and in 1546, a secret society was formed at Vicenza for the discussion of religious questions. It was composed of 40 persons, distinguished by their rank, their occupations, and their titles. S. was admitted a member. The conclusions at which they arrived were unfavorable to the dogma of the Trinity, which they held to have been borrowed by the early church from the speculations of Greek philosophers. The purpose of their meetings together having been discovered, the society broke up. Some of the members were arrested and put to death, others sought safety in flight. Among the latter was S., who traveled in France, England, Holland, Germany, and Poland, making the acquaintance, and acquiring the esteem, of many transalpine scholars, and finally settled in Zürich, where he died in 1562, when only 37 years of age. Lælius S., unlike most heretics, was a prudent and reticent man. His speech at least never bewrayed him; but in his correspondence with his Italian relatives and friends, he showed himself an ardent and eloquent disputant, and made not a few proselytes. Once, in a moment of mistaken confidence, he disclosed himself to Calvin, who grimly warned him to get rid of his 'itch of inquiry,' lest he should 'draw on himself great torments.' In the same year occurred the murder of Servetus.—See Illgen's *Vita Lælii Socini* (Leip. 1814), and *Symbolæ ad Vitam et Doctrinam Lælii Socini* (Leip. 1826).

Socinus, Faustus, nephew of the preceding, was the son of Alessandro Socinus, and was also born at Siena, 5th December, 1539. By the mother's side, he was very highly connected; but having lost his parents while still young, his education was carelessly conducted; and he himself, at a later period, lamented the imperfection of his scholastic culture. His want of learning, however, only induced him to speculate the more freely, and thus it happened, partly from native bias, and partly from his uncle's epistolary arguments, that Faustus was a heretic and anti-Trinitarian before he was out of his teens. In 1559, when only 20 years of age, he found it advisable to seek an asylum in France, and was living at Lyon when he got news of his uncle's death. He immediately proceeded to Zürich, and possessed himself of his relative's MSS., after which he returned to Italy. He entered the service of the Grand Duke of Tuscany, and during twelve years seemed to forget, amid the cares of office and the dissipations of a court, the thorny questions of theology. But at the ex-

piry of that period, he was seized with a stronger desire than ever to investigate the truths of religion, and in spite of all remonstrances, proceeded to Germany—the center of theological activity. In 1574, he retired to Basel, to prosecute his studies more closely; but a disputation which he had with a certain Fr. Pucci (1578), obliged him to leave Switzerland. At the request of George Blandrata, he visited Transylvania, where anti-Trinitarians were numerous, especially among the nobles, and eagerly sought (not without success) to make converts to his opinions. In 1579 he went to Poland. Anti-Trinitarianism was even stronger there than in Transylvania, and S. soon obtained a great influence. He preached, and disputed, and wrote with a zeal that Socinianism has seldom displayed since. His position in relation to the Reformers was, that Luther and Calvin had rendered great services to the cause of religion, but that they had not gone far enough, that the only solid basis on which Protestantism could rest was human 'reason,' that everything that contradicted it should be rejected as false and incredible, and that dogmas that were absurd should not be allowed to shelter themselves from criticism because their defenders chose to call them 'mysteries.' The Protestants were alarmed, and the ablest among them undertook publicly to confute Socinus.

A disputation was held in the college of Posna, which ended in S. reducing all his opponents to silence; but they retaliated (after the unscrupulous fashion of the times) by trumping up against their vanquisher a charge of sedition, which, although ridiculously groundless, made it necessary for S. to withdraw from Cracow. While living in retirement on the estate of a Polish noble, Christopher Morsztyn, he married the daughter of his protector. She seems to have been a tender and affectionate wife; and when S. lost her in 1587, he almost broke his heart through grief. About this period, his property in Italy was confiscated; but he had powerful and wealthy friends in Poland, who proved generous to him in his needs. In 1588, he took part in the synod of Brest (on the borders of Lithuania), and combated all the principal dogmas of the church—the divinity of Christ, propitiatory sacrifice, original sin, human depravity, the servitude of the will, and justification by faith. In 1598, on the publication of his *De Jesu Christo Servatore*, his enemies stirred up the populace of Cracow against him; and S. was pulled from a sick-bed, and nearly murdered. Soon after he left the city, and found a refuge with one of his friends in the village of Luclavie, where he died, 3d March 1604. S.'s works are no longer read; but his opinions have never wanted advocates in any Protestant country. He and his uncle may be regarded as precursors of that spirit of Rationalism which has rooted itself so deeply in the thought of the modern world.—See Przipcow's Life of S., prefixed to a collection of his works in the *Bib. Frat. Polonorum* (Amst. 1656); Bayle's article in the *Dictionnaire;* and Toulmin's *Memoirs of the Life, Character, &c. of F. S.* (Lond. 1777).

SOCOTRA, an island near the entrance to the Gulf of Aden, 80 miles long and 30 broad. Area over 1000 square miles; pop. 5000. It was partly explored under the auspices of the British Association in 1879, and new information obtained as to its fauna and flora. The surface consists for the most part of a table-land of from 700 to 800 feet high, and low plains skirt the northern and southern shores. All the streams of the island, with the exception of a few rivulets, are dry at a certain season; but rain water is collected in reservoirs, and in most parts water can be obtained by digging a few feet below the surface. Owing to the somewhat unfertile character of the soil, most of the districts are more adapted for pasture than for agriculture; but grain, fruits, and vegetables are grown in the eastern districts. The aloe plant and the dragon's-blood tree are the chief commercial products. S. belongs to the sultan of Keshin, who, in 1876, concluded a treaty, by which, in respect of S., he becomes a feudatory of Great Britain.

SOCRATES, the celebrated Greek philosopher, was born at Athens in the year 469 B.C. His father, Sophroniskos, was a sculptor; and he followed the same profession in the early part of his life. His mother, Phænarete, was a midwife, to which avocation he was wont to compare his own peculiar method of conversational teaching. His family was respectable in descent, but humble in point of means. His physical constitution was robust to an extraordinary degree, enabling him to endure the hardest military service, and to live his own chosen life of superiority to all wants above the barest necessaries of life. While his ordinary diet was simple and abstemious, he could, on religious festivals or social occasions, drink more wine than any one else without being intoxicated. He had the usual education of an Athenian citizen, which included not only a knowledge of the mother-tongue, and readings in the Greek poets, but also the elements of arithmetic, geometry, and astronomy as then known. As a young man, he frequented the society of the physical philosopher, Archelaus, (a disciple of Anaxagoras); but the philosophers that did most to determine his own special turn of mind must have been Parmenides and 'the double-tongued and all-objecting Zeno.'

Excepting in connection with his philosophical career, few circumstances of his life are known. He served as a hoplite, or heavy-armed foot-soldier, at the siege of Potidæa, at the battle of Delium, and at Amphipolis, and his bravery and endurance were greatly extolled by his friends. On two memorable occasions, he stood forward in political life. After the battle of Arginusæ, in 406, the ten generals in command were publicly arraigned for neglecting to obtain the bodies of the killed to receive the rites of interment. The clamor for their condemnation was so great, that the court wished to proceed in violation of the legal forms; but S., as the presiding judge, firmly refused to put the question. The other occasion was during the tyranny of the Thirty, who took up the policy of compelling a number of influential citizens to take a part in their illegal murders and confiscations; but S. withstood them at the peril of his own life.

Somewhere about the middle period of his life, he relinquished his profession as a statuary, and gave himself up to the career that made him famous. Deservedly styled a philosopher, he neither secluded himself for study, nor opened a school for the regular instruction of pupils. He disclaimed the appellation of teacher; his practice was to talk or converse, 'to prattle without end,' as his enemies said. 'Early in the morning, he frequented the public walks, the gymnasia for bodily training, and the schools where youths were receiving instruction; he was to be seen in the market-place at the hour when it was most crowded, among the booths and tables where goods were exposed for sale. His whole day was usually spent in this public manner. He talked with any one, young or old, rich or poor, that sought to address him, and in the hearing of all who chose to stand by. He visited all persons of interest in the city, male or female; his friendship with Aspasia is well known; and one of the most interesting chapters of Xenophon's *Memorabilia* recounts his visit to and dialogue with Theodotê—a beautiful *hetæra*, or female companion. Nothing could be more public, perpetual, and indiscriminate as to persons than his conversation; and as it was engaging, curious, and instructive to hear, certain persons made it their habit to attend him in public as companions and listeners. These men, a fluctuating body, were commonly known as his disciples or scholars, though neither he nor his personal friends ever employed the terms *teacher* and *disciple* to describe the relation between them.'—Grote's *Greece*, chap. lxviii.

Another peculiarity of S. was his persuasion of a special religious mission. He had been accustomed all his life to hear what he considered a divine voice, or preternatural sign, which came to him solely as a prohibition or warning, and never as an instigation to act. In deference to it, he had kept back from entering public life, and it caused him to refrain from premeditating the defence that he made on his trial. Nor was this all; relying, like his countrymen, on divine intimations by dreams and oracles, he believed that his mission had been signified to him by these. One oracular intimation in particular he described in his defence as the turning-point of his life. An admirer and friend of his, Chærephon, about the time when he began to have some repute as a wise man, consulted the oracle at Delphi as to whether any man was wiser than Socrates. The priestess replied: 'None.' The answer, he said, perplexed him very much; for he was conscious to himself that he possessed no wisdom on any subject, great or small. At length, he resolved to put the matter to the test by taking measure of the wisdom of other persons as compared with his own. Selecting a leading politician, accounted wise by himself and by others, he put a series of questions to him, and found his supposed wisdom was no wisdom at all. He next tried to demonstrate to the politician himself how much he was deficient; but found him impracticable on this head, refusing to be convinced. He then saw a meaning in the oracle to the effect that his superiority to others lay not in his wisdom, but in his being fully conscious of his ignorance. He tried the same experiment on other politicians and rhetors, then on poets, and lastly on artists and artisans, and with the same result. Thereupon, he considered it as a duty imposed upon him by the Delphian god to cross-question men of all degrees as to their knowledge, to make them conscious of their ignorance, and thereby put them in the way of becoming wise. We shall see presently wherein this low view of the human intelligence differed from the contemptuous tone of a mere satirist.

The intellectual characteristics of S., through which he influenced the whole subsequent course of human thought, may be stated under three heads: 1. Subject, 2. Method, and 3. Doctrine.

1. As to Subject.—Here he effected a signal revolution, metaphorically expressed by the saying of Cicero, that 'Socrates brought down philosophy from the heavens to the earth.' The previous philosophies consisted of vast and vague speculations on nature as a whole, blending together Cosmogony, Astronomy, Geometry, Physics, Metaphysics, &c. S. had studied these systems, and they left on his mind a feeling of emptiness and un-

suitability for any human purpose. It seemed to him that men's endeavors after knowledge would be better directed to the human relationships, as involving men's practical concerns. He could not go to any public assemblage without hearing questions agitated respecting the just and unjust, the honorable and base, the expedient and hurtful; moreover, he found that the opposing disputants were, without knowing it, very confused in their ideas as to the meanings of those large words in which the weightiest interests centered. Accordingly, he was the first to proclaim that 'the proper study of mankind is man;' human nature, human duties, and human happiness made up a field of really urgent and profitable inquiry. In astronomy, he saw a certain utility for navigation, and for the reckoning of time, to which extent he would have it known by pilots and watchmen; geometry was useful in its literal sense of land-measuring; arithmetic he allowed in like manner so far as practically useful; but general physics, or the speculations of philosophers, from Thales downward, as to the origin of all things out of water, fire, air, &c., he wholly repudiated. 'Do these inquirers,' he asked, 'think that they already know *human* affairs well enough, that they thus begin to meddle with divine? Do they think that they shall be able to excite or calm the winds at pleasure, or have they no other view than to gratify an idle curiosity?' He considered it not only unprofitable but impious to attempt to comprehend that department. The gods, he thought, managed all those things after their own fashion, and refused to submit them to invariable laws of sequence, such as men might discover by dint of study; the only means of knowledge permitted was religious sacrifice and prayer, and the consultation of the oracles. While this was the appointed way in reference to divine things, it was equally appointed that human things should be learned by diligence in study and investigation.

2. In regard to Method, S. was the author of still greater innovations. It was to little purpose that men applied themselves to human affairs, if they conceived them loosely, and with no regard to evidence. S. introduced at least one element of logical precision into the handling of questions, by insisting on accuracy in Definition and Classification. His mode will be seen in the statement of Xenophon. 'Socrates continued incessantly discussing *human* affairs, investigating—What is piety? What is impiety? What is the honorable and the base? What is the just and the unjust? Men that knew these matters, he accounted good and honorable; men that were ignorant of them, he assimilated to slaves.'

His investigation thus took the form of ascertaining the exact meaning—that is, the definition—of the leading terms in ethics and in politics, the settling of what J. S. Mill calls the *connotation* of a general word, which determines how to apply it rightly to each individual case. The very idea of defining a general term, now so obvious, never seems to have suggested itself to any one previous to Socrates. And his manner of seeking out those definitions is also characteristic, and links itself to his conversational method, and his convicting men in general of ignorance in things that they thought they knew. Professing himself to be able to furnish no exact definition (this professed ignorance was called the Socratic irony) of justice, temperance, courage, &c., and finding every one else quite confident in their ability to supply the want, he asked some one to state his definition; and on its being given, he put a few further interrogations (as he said) by way of making sure that he understood the meaning, but with the speedy effect of driving the respondent into a humiliating self-contradiction. His method is most fully exemplified in certain of the Platonic dialogues, as the first *Alcibiadês*, *Lachês*, *Charmidês*, *Euthyphron*, &c.

According to Xenophon, he could pass from his severe cross-examining method, with its humiliating shock of convicted ignorance, and address to his hearers plain and homely precepts, inculcating self-control, temperance, piety, duty to parents, brotherly love, fidelity in friendship, diligence, &c.—such direct admonitory influence being common to him with the so-called Sophists. He probably went beyond the ordinary teaching of the Sophists in exhorting men 'to limit their external wants, to be sparing in indulgence, and to cultivate, even in preference to honors and advancement, the pleasures arising from a performance of duty, as well as from self-examination and the consciousness of internal improvement.' This strain of exhortation, his manner of life in harmony therewith, and the virtual self-immolation of his death, may be considered as the conjoint root of the Cynic and the Stoic philosophies.

3. As regards Doctrine, S. was distinguished chiefly by his theory of virtue. Virtue, he said, consisted in knowledge. To do right, was the only road to happiness; and as every man sought to be happy, vice could arise only from ignorance or mistake as to the means; hence the proper corrective was an enlarged teaching of the consequences of actions.

We cannot, on any fair interpretation of knowledge, regard this as other than a one-sided view. It takes note of one condition of virtue, since there can be no right conduct without understanding the tendency of actions, or, at all events, the meaning of rules; but it omits, what is also essential, the state of the emotions or dispositions, which may be directed either to exclusively self-regarding ends, or to ends involving also the good of others. There is an obvious connection between the doctrine and the Socratic analogy of virtue to the professions. The virtue of an artisan is almost exclusively contained in his skill or knowledge; his dispositions can usually, though not always, be depended on, through the pressure of his immediate self-interest. But the practice of S. was larger than his theory; for, as already remarked, his exhortations were addressed to men's feelings or sentiments as well as to their intellect. His political doctrines were biased by the same analogy of special professions. The legitimate king or governor was he alone that knew how to govern well.

In the year 399 B.C., an indictment was laid against S., in the following terms: 'Socrates is guilty of crime: first, for not worshiping the gods whom the city worships, and for introducing new divinities of his own; next, for corrupting the youth. The penalty due is death.' The trial took place before a dikastery, or law-court, composed of citizen-judges, like our juries, but far more numerous; the number present seems to have been 557. His defence is preserved by Plato, under the title *Apology of Socrates*. The tone of it, so admirable to us, was such as to make acquittal all but impossible, from the number of enemies created by his cross-questioning annoyance of all classes of men, and from various other causes. He dwelt on his mission to convict men of ignorance for their ultimate benefit; pronounced himself a public blessing to the Athenians; declared that, if his life was preserved, he would continue in the same course; and regarded the prospect of death with utter indifference. By a majority of either five or six, the charges were declared to be proven. A vote had then to be taken on the sentence. By the Athenian practice, the accuser named a penalty, and the accused was asked to do the same; the judges were restricted to one or other of these. The accuser named death. S., maintaining the same high tone, declared at first that he deserved the highest public reward; but, on the instigation of his friends, he ended by proposing a trifling fine. The court, by a majority, decided for the capital sentence. There was an accidental interval of 30 days before the execution, during which S. in prison conversed with his friends as usual; on the last day occurred his conversation on the Immortality of the Soul, referred to in the Platonic dialogue called *Phædon*. He then drank the hemlock, and passed away with the dignity and calmness becoming his past life.

'There can be no doubt,' says Mr. Grote, 'that the individual influence of Socrates permanently enlarged the horizon, improved the method, and multiplied the ascendant minds of the Grecian speculative world, in a manner never since paralleled. Subsequent philosophers may have had a more elaborate doctrine, and a larger number of disciples who imbibed their ideas; but none of them applied the same stimulating method with the same efficacy; none of them struck out of other minds that fire which sets light to original thought; none of them either produced in others the pains of intellectual pregnancy, or extracted from others the fresh and unborrowed offspring of a really parturient mind.'—See Grote's *Greece;* Zeller's *Philos. der Griechen*.

SODA. See SODIUM.

SODA, MANUFACTURE OF. Soda, or more correctly, carbonate of soda, occupies the chief place among our leading chemical manufactures, alike from its own importance, and also on account of its influence on other great chemical industries, such as glass-making, soap-making, bleaching, &c.

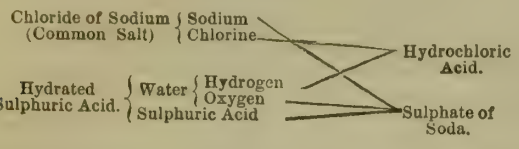
A native carbonate of soda, or rather a sesqui-carbonate, called Natron (q. v.), is found in Egypt and some other parts of the world. In Hungary several manufactories exist for the purification of a native soda found there. Formerly, most of the soda in use was extracted from certain plants; and two kinds were known in commerce under the names of Barilla (q. v.) and Kelp (q. v.).

But the quantity of soda got from all other sources is now insignificant in comparison with that manufactured from common salt (chloride of sodium—see SODIUM). The process was invented by a Frenchman named Leblanc, and was first made known to the world by a commission of the French republic in 1794, although dating some years earlier. It is unquestionably the most valuable discovery in the entire range of chemical manufactures; and it has been practised for nearly ninety years without any important alteration. It is sad to think that the author of this invention reaped no benefit from it himself, but spent the last of his days in an hospital, 'a wreck in fortune, health, and hope.' Owing partly to the war between France and England, and partly also to the existence of a duty of £30 per ton on common salt, which continued for eight years after the close of the war, Leblanc's process was not adopted in Great Britain except on a very limited scale till 1823. After the repeal of the tax in that year, Mr. James Muspratt erected his celebrated works at Liverpool, adopted the process in its entirety, and succeeded, after overcoming many diffi-

culties, in establishing in Great Britain a chemical manufacture which has since become the most important in the world, and for which nearly 600,000 tons of common salt are now annually required.

The object of the soda-process is to separate the sodium of the salt, and unite it with oxygen to form caustic soda, or, what is more generally done, to unite the sodium with both oxygen and carbonic acid to form carbonate of soda. The several stages of the process are as follows:

First Operation—The Production of Sulphate of Soda.—The decomposition of the common salt is effected by treating it with sulphuric acid, which transforms it into sulphate of soda and hydrochloric acid. The following diagram illustrates the interchange of elements which takes place:



This operation was long conducted in a common Reverberatory Furnace (q. v.), and the hydrochloric acid was suffered to escape into the air. Not only was the acid thus lost, but it destroyed all vegetation in the neighborhood of soda-works, and involved their owners in serious law-suits for damages. The great chimneys of the St. Rollox Works, Glasgow, and Mr. Muspratt's, Liverpool, which are nearly 500 feet high, were erected with a view of curing this evil, but they were found to be ineffectual. One of the most improved furnaces now in use for the purpose is shown in figs. 1 and 2.

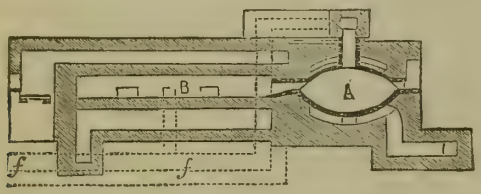


Fig. 1.—Vertical Section of Decomposing Furnace.

They are built in pairs, and in the front part of each there is a shallow cast-iron pan A, nine feet in diameter, with a sheet-iron cover, and so built that the fire may act on the bottoms and sides. Behind this, an oblong brick-chamber, B, 30 feet by 9 feet, is situated, with separate fire-places, and called the salt-cake furnace. Acid flues, *f*, *f*, are led from each compartment of the

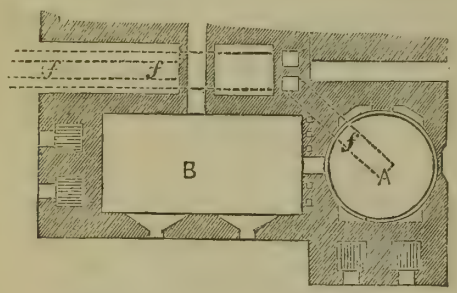


Fig. 2.—Plan of Decomposing Furnace.

double furnace into one main flue, which has its outlet into a condensing tower, to be presently described. Separate flues are also provided for the conveyance of smoke to a main chimney. The furnace is worked in the following way; when it is properly heated, salt to the amount of 10 cwts. is thrown in by an opening, and about 80 gallons of strong sulphuric acid are heated and run in. The mixture, which is well stirred with an iron rake, gradually thickens, and in about an hour the pasty mass, not yet all decomposed, is pushed through the opening into the salt-cake chamber, B. Here it is spread out on the sole, and maintained at a red heat for another hour, when the whole of the hydrochloric acid is expelled, and the conversion into sulphate of soda complete. A pair of furnaces, about one-half larger than those above described, will produce about 19 tons of sulphate of soda in a day, for which 16 tons of common salt are required. At the St. Rollox Chemical Works, Glasgow, about 500 tons of common salt are decomposed weekly.

A very important part of this operation is the condensation of the hydrochloric acid gas which is disengaged in large volumes during the decomposition of the salt. As already stated, it was formerly allowed to escape into the atmosphere. The acid flues convey it to the condensing towers (fig. 3), which are generally filled with pieces of burnt coke, through which a supply of water is kept running. The gas enters at the bottom of the first tower,

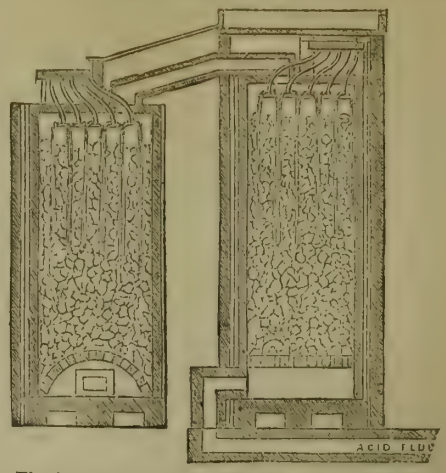


Fig. 3.—Section of Coke Towers for condensing the Hydrochloric Acid Gas.

passes upwards, and descends the second, and is gradually absorbed by the water, forming strong liquid acid, which is run out by openings at the bottom of the condenser. So perfect is the system of condensation now in use at some works, that of the acid produced by 100 tons of pure chloride of sodium which should yield 62 tons, as much as 58½ tons have actually been collected; and it has been instanced as a curious illustration of this in another way, that Mr. Muspratt's great works, which were at one time forced out of Liverpool as a nuisance, have been established there again without causing any protest. Nevertheless such works being still considered obnoxious to their neighborhoods, an 'Alkali Act' was passed by parliament in July 1863, 'For the more Effectual Condensation of Muriatic (hydrochloric) Acid Gas in Alkali Works.' It compels every manufacturer of alkali to secure the condensation of not less than 95 per cent. of the muriatic gas evolved in his works, under a penalty not exceeding £50. This act was amended in 1874 by which copper and sulphuric acid works were placed under similar restrictions. The hydrochloric acid obtained in this process is mostly used in the manufacture of bleaching-powder.

Second Operation—The Conversion of the Sulphate of Soda into Black-ash, called also Ball Soda. This is effected by heating a mixture of sulphate of soda, carbonate of lime, and coal, in a reverberatory furnace. The proportions now used are the same as those first recommended by Leblanc—viz., sulphate of soda, 100 parts; carbonate of lime, 100 parts; carbon (charcoal), 55 parts. But as coal is employed in England instead of charcoal, the quantity used is generally 75 to 100 each of the other two ingredients. The 'balling furnace' used in this operation is shown in fig. 4.

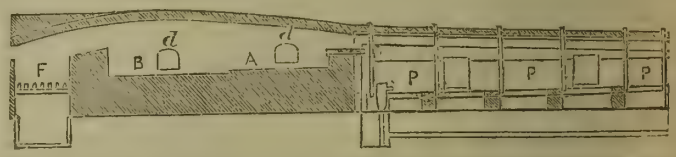


Fig. 4.—Section of Balling Furnace, showing an evaporating pan for Soda-lye in connection with it.

It has two beds, the one being raised a few inches above the other. F is the fireplace, the waste heat from which is usually employed in boiling down the soda-lye as indicated in the section. The charge is thrown into the bed, A, of the balling furnace, after it has been raised to a bright red heat, and remains till it becomes sufficiently heated throughout the whole mass. It is then transferred to the *fluxing bed*, B, which is next the fire, and exposed to a higher heat, when it shortly begins to soften and flux into a mass like dough. In about half an hour the charge is withdrawn in a red-hot state by the working door, and received into iron barrows, where it solidifies into blocks of crude soda, termed ball soda, or black ash. A new kind of balling-furnace, first introduced at the Jarrow chemical works, South Shields, is now becoming extensively used. It differs from the one shown in fig. 4 in having that portion of it for receiving the mixture of sulphate of soda, coal, and lime in the form of a brick-lined iron cylinder, large enough in some instances to decompose 50 tons of the sulphate in 24 hours. This cylinder lies in a horizontal position, and is made to revolve slowly by engine power. The materials are introduced by means of a hopper; the fire-place, which does not rotate, is placed at one

end of the cylinder; and the arrangement for evaporating the lye is somewhat similar to that shown in fig. 4. This rotary furnace admits of the work being much better done than by the older reverberatory furnace, as it not only saves labor but prevents loss of soda by volatilization.

In this process there is first a reduction of sulphate of soda to sulphide of sodium with evolution of carbonic acid; then a conversion of the sulphide of sodium and carbonate of lime into carbonate of soda and sulphide of calcium; and finally the excess of carbonate of lime is reduced by the carbon to caustic lime and carbonic oxide.

Third Operation—The Preparation of Carbonate of Soda from the Black-Ash, by Lixiviation and Evaporation.—For some purposes the crude soda, or black-ash, is used without further purification; for example, in the making of soap. Its lixiviation is effected by the use of a series of iron tanks, or vats, into which it is placed with water. The working of these vats will be most simply explained by the apparatus shown in fig. 5. Several tanks, each of

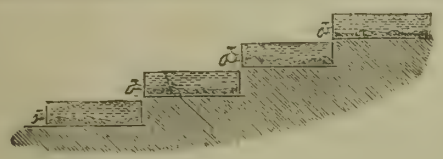


Fig. 5.—Apparatus for lixiviating the crude Soda.

the capacity of 600 gallons, rise above one another in successive stages, so that the liquor of the highest can be run into the next lower, and so on. The black-ash is introduced fresh into the lowest vat; it then passes from vat to vat, and is taken away exhausted at the highest one. The water, on the contrary, comes in fresh at the top, and in passing downwards encounters less exhausted ash in each succeeding vat, and finally passes away from the lowest a fully saturated solution. In most soda-works, the vats are now arranged differently, although the ash may be said to be exhausted in the same way. In the new arrangement, the vats are placed horizontally, and advantage is taken of the fact that solutions in becoming richer become also heavier, so that, although the tanks are all on a level, the water runs through them with what is virtually a downward flow. We have not space to describe minutely this very elegant and economical plan; it will be enough to say that it completely obviates the necessity of lifting the ash from vat to vat, because any two contiguous ones can be made at pleasure the highest and lowest points, and, therefore, those of ingress and egress for the lixiviating fluid. 'Each vat, in due rotation, is emptied and refilled; and thus each in turn successively occupies the highest, lowest, and all intermediate points of the declivity.'

The next stage is the evaporation of the soda-lye, which is conducted in a variety of ways. A common method consists in using the waste heat of the balling furnace, the flame from which passes over the surface of the liquor, as shown in fig. 4. With proper manipulation the soda falls to the bottom, and is raked out at intervals through a side-door, and drained upon a sloping surface.

The soda-salts (chiefly carbonate of soda), thus obtained by evaporation of the lye, contain caustic soda, which requires to be carbonated and a little sulphide of sodium, which it is necessary to get rid of. They are accordingly transferred to a reverberatory furnace, and calcined, at a moderate heat, along with sawdust, or sometimes with small coal, the mixture being stirred with iron paddles. By this treatment, the caustic soda is converted into carbonate of soda, the sulphur is mostly expelled, and we now obtain the *soda-ash*, or alkali of commerce, which generally contains about 50 per cent. of real soda, NaO; the other ingredients, besides the carbonic acid with which it is combined, being chiefly water, sulphur, and common salt. Sometimes it is further purified, and it is then known as *white alkali*.

Soda crystals, or what is commonly called 'washing-soda,' are obtained by dissolving the soda-ash in hot-water, then filtering the solution and boiling it till the specific gravity reaches 1·3, when it is transferred to the crystallizing coolers. Bars of wood or iron are laid across these vessels to sustain the mass of crystals which form, and in ten days at most the crystallization is complete. Crystals of soda are purer than soda-ash, but they are of much less value, weight for weight, because of the large quantity of water which enters into their constitution, amounting to 62½ per cent.

The manufacture of caustic-soda is now an important branch of the alkali trade. For soap-making, bleaching, and several other purposes, carbonate of soda requires to be rendered caustic by quicklime. Manufacturers have, accordingly, taken to the plan of treating the black-ash liquor with hydrate of lime, and so obtain caustic-soda at this stage, instead of sending it into the market as a purified carbonate of soda, for purposes where it requires to be decarbonated again. Another plan consists in mixing a small quantity of chloride of lime, or nitrate of soda, with the soda-lye from the black-ash. It is then concentrated into a strong solution, and finally brought to the state of a fused mass in round iron pots heated to redness. Great attention is now given to the recovery of sulphur from the enormous 'waste heaps' which accumulate at all large alkali works, since there is fully a ton of this 'waste' produced for every ton of common salt used. It consists largely of noxious sulphides of calcium, and is a source both of river and, in warm weather especially, of atmospheric pollution. Mond's process, or some modification of it, is usually adopted. Some chemical changes are first produced in the waste by the action of common air, and the sulphur afterwards precipitated by hydrochloric acid.

Various processes have been at different times proposed, and many have been patented, for making carbonate of soda by other methods than that of Leblanc; but only one of these has had any measure of success. We allude to what is called the 'ammonia process,' patented by Dyer & Hemming in 1838. Several improvements—some of them quite recent—have been made on the original method, and the process is now worked on the large scale at Northwich in Cheshire, and at several places on the continent. It consists in treating a solution of common salt with bi-carbonate of ammonia, by which bi-carbonate of soda is produced, and the chloride of ammonium remains in solution.

Sulphate of soda is made at Widnes, in Lancashire, by Mr. Hargreaves' process of decomposing bricks of common salt with sulphurous acid and steam. This method, by avoiding the direct use of sulphuric acid, saves the expense of nitrate of soda; and owing to the lower temperature, spares the apparatus. See Lomas, *Manual of the Alkali Trade*, 1880.

SODA-WATER. See Aerated Waters.

SO'DIUM (symb. Na, equiv. 23, spec. grav. 0·972) is one of the metals of the alkalies—its oxide being soda. Its properties closely resemble those of the allied metal, potassium. It is of a bluish-white color, is somewhat more volatile than potassium, and further differs from that metal in having a higher fusing-point (about 208°), a greater specific gravity, and in not catching fire when dropped in water (unless the water is heated), although, like potassium under similar conditions, it partially decomposes it and liberates hydrogen; and at the same time communicates a strong alkaline reaction to the solution. If, however, a piece of unsized paper is placed on the surface of cold water, and the sodium be placed on the paper, the metal takes fire, and burns with a deep yellow flame. Strictly speaking, it is the liberated hydrogen rather than the metal which burns, the yellow tint (which is characteristic of the sodium compounds) being due to a little sodium volatilized by the heat, mixing and burning with the hydrogen. When heated in the air, it burns with its characteristic yellow flame, and is converted into soda. When exposed *in vacuo* to a red heat it assumes the form of vapor, and admits of distillation. Like potassium, it must be kept immersed in naphtha, so as to exclude the oxidising action of the air. As a reducing agent, it is little inferior to potassium, and as its combining power is lower, and it is obtained much more cheaply, it may usually be advantageously substituted for potassium in reducing operations. Sodium does not occur in the metallic form in nature, but its compounds are very widely distributed. It is found by far the most abundantly in the form of chloride of sodium (or common salt), but it likewise occurs as albite or soda-felspar, cryolite (the double fluoride of sodium and aluminium, and the principal source from whence aluminium is procured), borax (the biborate of soda), trona (the sesquicarbonate of soda), and Chili saltpetre (nitrate of soda).

The methods of obtaining sodium are similar to those already described for obtaining potassium. The following procedure recommended by Deville is regarded as the best for obtaining it in large quantity. Intimately mix 717 parts of dried carbonate of soda with 175 parts of finely powdered charcoal and 108 parts of finely ground chalk, knead them into a stiff paste with oil, heat them in a covered iron pot till the oil is decomposed, and finally distil them in an iron retort with the precautions which are noticed in describing the preparation of Patassium (q. v.). The object of adding the chalk is to prevent the separation of the charcoal from the carbonate of soda when the latter fuses. This mixture ought to yield nearly one-third of its weight of sodium.

With regard to the history of sodium, it is sufficient to observe that Duhamel, in 1736, discovered that potash and soda (now known to be the oxides of potassium and sodium) were distinct bodies. Sir H. Davy first obtained the metal *Sodium* in 1807. The symbol of this metal, Na, is the abbreviation of *Natrium*, which is derived from *Natron*, one of the old names of native carbonate of soda.

Sodium combines with all the elementary gaseous bodies, and two of these combinations—viz., those with oxygen and chlorine, are of extreme importance and value.

With *oxygen*, sodium forms two compounds—viz., an oxide (NaO) and a peroxide (NaO_2). The latter being of no practical

value, may be passed over without notice. The oxide (soda) was formerly known as *fossil* or *mineral alkali*, to distinguish it from potash, which, from the source from which it was procured, was termed *vegetable alkali*. Anhydrous soda (NaO) is procured by burning the metal in dry air; it is of a yellowish-white color, powerfully attracts moisture, and retains the water so firmly that it cannot be expelled by heat. Hydrated or caustic soda (NaO,HO) closely resembles, both in its properties and in the mode of procuring it, the corresponding potash compound. It is, however, not so fusible as the latter, and is gradually converted, by exposure to the air, into carbonate of soda, which is also an infusible salt in its anhydrous state. Solution of hydrate of soda (or soda lye) is largely employed in the arts. It is prepared by boiling a tolerably strong solution of carbonate of soda in milk of lime until a portion of the filtrate ceases to effervesce on the addition of an acid.

The solid hydrate has a specific gravity of 2·13 and the quantity of anhydrous soda in any solution may be pretty closely approximated to by determining the specific gravity of the fluid at a temperature of 59°. Tables for this purpose have been constructed by Dalton (quoted in Miller's *Inorganic Chemistry*, 2d ed. p. 37), and by Zimmerman (reprinted in the article 'Sodium' in Knight's *English Cyclopædia*).

Many of the combinations of the oxide of sodium (soda) with acids—constituting soda-salts—are of great importance. Carbonic acid forms three salts with soda—viz., a normal carbonate, a sesquicarbonate, and a bicarbonate of soda.

The *Normal or Ordinary Carbonate of Soda* ($NaO,CO_2 + 10Aq$), popularly known as the *Soda* of commerce, is a colorless, inodorous salt, with a nauseous alkaline taste. It crystallizes in large transparent rhomboidal prisms, which contain nearly 63 per cent. of water, but it readily parts with all this water, on the application of heat. The crystals also lose the greater part of their water on mere exposure to the air, when they effloresce, and fall to powder. Water at 60° dissolves half its weight of the crystals, and boiling water considerably more, the solution acting like an alkali on vegetable colors. This salt occurs native in the natron-lakes of Hungary, Armenia, &c., in association with sulphate of soda and chloride of sodium. In other regions it appears in an efflorescent form on the surface of the earth. It is now, however, almost entirely manufactured from sea-salt. See SODA, MANUFACTURE OF.

Sesquicarbonate of Soda ($2NaO,HO,3CO_2 + 3Aq$) occurs native in the form of large, hard, non-efflorescent prisms, in Hungary, Egypt, Mexico, &c., under the name of *Trona* or Natron. When strongly heated, it loses one-third of its carbonic acid, and becomes converted into the preceding salt.

Bicarbonate of Soda ($NaO,HO,2CO_2$) may be formed by passing a current of carbonic acid through a strong solution of carbonate of soda, till saturation takes place, and allowing the mixture to crystallize; or it may be produced on a large scale by exposing crystals of carbonate of soda to a prolonged current of carbonic acid. The bicarbonate crystallizes in four-sided prisms, which require 10 parts of water at an ordinary temperature for their solution. This salt is used largely in medicine. See AERATED WATERS.

Sulphuric acid forms with soda a normal and an acid sulphate.

The *Normal or Ordinary Sulphate of Soda* ($NaO,SO_3 + 10Aq$) has been already described under its synonym of *Glauber's Salt* (q. v.). The acid salt, or *bisulphate* of soda ($NaO,HO,2SO_3$), is of no special interest.

The *Hyposulphite of Soda* ($NaO,S_2O_2 + 5Aq$), occurs in large colorless, striated, rhombic prisms, of a cooling and sweet taste. When strongly heated in the air, it burns with a blue flame. It dissolves readily in water, depositing sulphur if the solution be kept in a closed vessel. It may be obtained by digesting a solution of sulphide of soda on powdered sulphur. The sulphur is gradually dissolved, and forms a colorless solution, which, on evaporation, yields crystals of hyposulphite of soda. This salt is largely employed in photography, and is occasionally prescribed medicinally. Sulphurous acid forms two salts with soda—viz., a sulphite and a bisulphite. The *Sulphite of Soda* ($NaO,SO_2 + 7Aq$) is obtained by passing sulphurous acid over carbonate of soda, dissolving the resulting mass in water, and crystallizing; when the salt is obtained in efflorescent oblique prisms, which fuse at 113°, and are soluble in 4 parts of cold water, the solution having a slightly alkaline reaction, and a sulphurous taste. This compound is commercially known as *Antichlore*, and is largely used in paper-manufactories for the purpose of removing the last trace of chlorine from the bleached rag-pulp. The *Bisulphite* is of no importance.

Nitrate of Soda (NaO,NO_5), known also as *Cubic Nitre* or *Chili Saltpetre*, occurs as a natural product on the surface of the soil of certain South American districts. In most of its properties, excepting its crystalline form, and further in its being deliquescent, it resembles nitrate of potash. It is used to a considerable extent as a manure. The *Phosphates of Soda*, though comparatively numerous, do not call for notice here. See PHOSPHATES. *Hypochlorite of Soda* (NaO,ClO) is at present only known in solution, in which it occurs as a yellowish-green fluid, evolving a smell of chlorine; it has strong bleaching power, and when boiled, becomes decolorized, and evolves chlorine freely. It is formed by passing a stream of chlorine gas through a solution of carbonate of soda, the resulting solution containing the hypochlorite, together with undecomposed carbonate of soda and chloride of sodium. This solution is useful as a bleaching agent, as an oxidizing agent in analytical chemistry, and as a disinfectant agent. There are two *Borates of Soda*, of which the only important one, the *Biborate*, is already described under its ordinary name of *Borax* (q. v.). Various *Silicates of Soda* have been formed. In reference to the properties of these salts, see the articles FUCHS'S SOLUBLE GLASS and GLASS.

The *Haloid Salts* of sodium resemble, in their general characters, the corresponding salts of potash. Of these, by far the most important is *Chloride of Sodium* or *Common Salt*, formerly known as *Muriate of Soda* (NaCl). It occurs naturally in far greater quantity than any other soluble salt. See ROCK-SALT, SEA, WATER. The following are its leading properties: It crystallizes in colorless, transparent cubes, which are anhydrous, soluble in about 3 parts of cold water, and scarcely more soluble in boiling water. A saturated solution has a specific gravity of 1·205, the specific gravity of the salt being 2·125. It is insoluble in pure alcohol, is inodorous, and has a purely saline taste, unmingled with bitterness, unless chloride of magnesium be mixed with it. At a red heat, it fuses, and becomes converted into a transparent brittle mass.

The well-known decrepitation which occurs when salt is thrown on the fire, or otherwise strongly heated, results from the sudden expansion of water mechanically entangled amongst its particles. The uses of this salt have been known from the earliest times. It is an essential constituent of the food both of man and animals. From want of space, we must refer our readers to Liebig's *Letters on Chemistry* (Letter xxviii.) on this subject, in which the functions of salt in the food and in the blood are clearly pointed out. It is regarded as a necessity even by the rudest nations. 'In several countries of Africa, men are sold for salt; amongst the Gallas and on the coast of Sierra Leone, the brother sells his sister, the husband his wife, parents their children, for salt; in the district of Accra (Gold Coast,) a handful of salt, the most valuable merchandise after gold, will purchase one, or even two slaves.'—Note to Liebig's *op. cit.*, p. 413. Chloride of sodium is employed in the process of salting meat, in consequence of its powerful antiseptic properties. Meat thus prepared loses, however, a considerable portion of its nutritive juices, which pass into the brine; and is less digestible than in its natural state. Amongst the purposes for which this salt is mainly employed may be mentioned the manufacture of the various salts of soda, especially the carbonate; the preparation of hydrochloric acid; the glazing of stoneware; the preparation of soap; &c. The other haloid salts—the iodide, bromide, and fluoride of sodium—require no notice.

Sodium has been recently found to enter into various groups of organic bodies. We shall take the sodium-alcohols as an example. When sodium or potassium is gradually added to anhydrous alcohol, the temperature rapidly rises, the metal is dissolved, hydrogen is evolved, and a fusible deliquescent compound is formed, which has received the name of *Sodium-alcohol* (or potassium-alcohol), or of *ethylate of soda* (or potash), its composition being such that it may be regarded as alcohol in which one atom of hydrogen is replaced by one of the metal; as shown in the equation:

$$\overbrace{2(C_4H_6O,HO)}^{\text{Alcohol.}} + 2NaO = \overbrace{2(C_4H_6O,NaO)}^{\text{Sodium-alcohol.}} + 2H.$$

The action of sodium or potassium on the other alcohols is of an analogous nature.

The *tests* for the salts of sodium are not very satisfactory, because the metal forms scarcely any insoluble compounds. A salt of sodium is usually concluded to be present when, the absence of all other bases having been proved, a saline residue remains, which, with bichloride of platinum, yields yellow striated prisms ($NaCl,PtCl_2 + 6Aq$) by spontaneous evaporation. Before the blowpipe, the salts of sodium are known by the intense yellow which they communicate to the outer flame, and if a weak alcoholic solution of one of the salts is burned, a similar yellow tint is communicated to the flame. Spectrum analysis is too delicate to be of much practical use. Bunsen estimates the amount of soda that may be thus detected at the 195,000 000th part of a grain; and considering how universally diffused chloride of sodium is, this fractional amount is hardly likely to be absent.

In conclusion, the *medicinal uses* of the sodium compounds require our notice. They will be considered alphabetically. *Acetate of Soda* is a mild diuretic, similar in operation to acetate of potash, for which it may be substituted. It may be given in doses vary-

ing from a scruple to a couple of drachms. *Arseniate of Soda* ($2NaO,HO.AsO_5 + 14Aq$) is serviceable in periodic affections, chronic skin-diseases, and the cases in which arsenic is generally employed in medicine. It has all the advantages of arsenite of potash, and seems to cause less irritation of the stomach. It is best given in the form of *Pearson's Solution*, which consists of one grain of the crystals of this salt dissolved in ten drachms of distilled water. Dose, from 20 minims, very gradually increased to two drachms, three times daily. The *Liquor Sodæ Arseniatis* of the Pharmacopœia is much stronger; its dose being from three to ten minims. Paper impregnated with a solution of arseniate of soda sweetened with sugar is sold as a poison for flies. *Biborate of Soda*, or *Borax*, is employed principally as a tropical astringent, and is used with advantage in aphthous eruptions of the mouth and throat. *Bicarbonate of Soda* is a most popular remedy in cases of dyspepsia, but its use is highly injurious when there are phosphatic deposits in the urine. See PHOSPHATIC DIATHESIS.

Neligan strongly recommends the external application of an ointment consisting of 20 or 30 grains of the bicarbonate, with an ounce of cold cream, in cases of papular and vesicular eruption of the scalp. *Carbonate of soda* is not employed as an antacid so frequently as the bicarbonate, in consequence of its disagreeable taste; but in the dried state, when deprived by heat of its water of crystallization, it is much used as an alterative. In dyspepsia attended with acidity, a combination of the dried carbonate with blue pill and rhubarb pill is often extremely useful. As it has a very acrid taste, it should be combined, if given in powder, with some bland substance, such as Compound Tragacanth Powder. *Solution of Chlorinated Soda* (known also as *Solution of Chloride of Soda, Chlorinated Soda, Hypochlorite of Soda*, and *Labarraque's Disinfecting Liquor*) is preferable to hypochlorite of lime in destroying noxious effluvia, as the salt which is left does not deliquesce, while chloride of calcium is very deliquescent. It may be applied locally to foul ulcers, either in lotion (2 drachms to 8 ounces of water), or as a poultice with linseed meal and boiling water. *Phosphate of Soda* ($2NaO,HO,PO_5 + 24Aq$), known also as *Tasteless Purging Salt*, is a mild saline purgative, with a far less unpleasant taste than sulphate of magnesia. It is especially adapted as a purgative for persons affected with deposits of red gravel (lithic or uric acid) in the urine. The dose varies from half an ounce to two ounces, and it may be given in broth, to which it imparts only a saline taste. *Sulphate of Soda*, and *Tartrate of Soda and Potash*, have been already described under their ordinary names of *Glauber's Salt* (q. v.) and *Rochelle Salt* (q. v.).

SODOM AND GOMO'RRAH, two ancient cities of Syria, almost invariably spoken of in conjunction in the Bible, and forming with Admah, Zeboiim, and other towns, the 'cities of the plain,' which, on account of the enormous wickedness of their inhabitants (the nature of which is indicated in the term Sodomy), are said to have been overthrown—not submerged—by some terrible convulsion of nature. Modern writers on sacred topography are not agreed as to the precise site to be assigned to these cities, no trace of which now remains; the majority holding that they stood on the southern shore of the Dead Sea, near the salt hill of Usdum; while others, again, apparently with more countenance from the Scripture narrative (Gen. xiii. 10—13), maintain that Sodom, Gomorrah, and the other 'cities of the plain,' stood in the 'circle or plain of the Jordan,' east from Bethel and Ai, near where the river discharges itself into the Dead Sea. The popular belief, that the cities were miraculously overwhelmed by the waters of the Dead Sea, and that their remains may still be seen at the bottom, is an idle tale of superstitious travelers, uncountenanced either by fact or by the terms employed by Scripture to describe the catastrophe.

SODOM, APPLE OF, the name given to the fruit of a species of *Solanum* (q. v.). But it seems that the true APPLE OF SODOM, or MAD APPLE, of the shores of the Dead Sea, mentioned by Strabo, Tacitus, and Josephus, and described as beautiful to the eye, but filling the mouth with bitter ashes if tasted, is a kind of gall, growing on dwarf oaks, and produced by a species of gall-insect, which has received the name of *Cynips insana*. These galls are about 2 inches long, and 1½ inch in diameter, of a beautiful, rich, glossy, purplish-red color, and filled with an intensely bitter, porous, and easily pulverized substance, surrounding the insect. They are attached to the twigs in a curious manner, different from other galls, the narrow end 'rising upwards on each side, and bending inwards, so as to clasp the extremity of the twig somewhat like a pair of wide and curved nippers.'

SODOMY, an unnatural crime, is punishable with penal servitude for life, or any term not less than ten years, and the attempt to commit it is punishable with penal servitude from three to ten years. In Scotland it is still nominally a capital offence, but never punished except by penal servitude and imprisonment.

SODOR AND MAN, BISHOPRIC OF. See HEBRIDES and MAN.

SOEST (pronounced SHOST), a town of Prussia, province of Westphalia, 36 miles south-east of Münster by railway, was, during the middle ages, a Hanse-town and fortress, and, in point of commercial importance, one of the foremost cities of Germany, with a pop. of from 60,000 to 70,000. Now, however, it is only the shadow of its former self; but relics of its ancient splendors still survive in its numerous and magnificent churches, of which the finest is the 'Meadow Church,' restored in 1850. Its municipal law, the *Jus Susatense*, was the oldest in Germany, and served as the model for the other imperial free-towns, Lübeck, Hamburg, &c. At present, S. has some trade in corn, and extensive breweries. Pop. (1880) 13,985.

SOFA'LA, or, as the old geographers sometimes wrote it, CEFOLA, is the name given rather indefinitely to that portion of the south-east coast of Africa extending from the Delta of the Zambezi (Quama of old geographers) as far south as the Rio Maneci or Delagoa Bay, or from lat. 18° to 26° S., although some modern geographers consider Cape Corrientes as its southern limit. This stretch of coast now comprehends the Portuguese captaincies of Rio de Senna, Tetè, Sofala, and Inhambane, besides the regions round Delagoa Bay, nominally under the control of the crown of Portugal, the extent inland being generally limited by the mountain region which runs parallel to the coast of Southern Africa, and forming a belt of low country about 150 miles wide, full of swamps, densely wooded, and generally unfavorable to European life.

S., in common with the remainder of the coast of Eastern Africa, was conquered by the Arabs between the 8th and 12th c.; it was visited in 1480 by Pedra Cavalho, a Portuguese captain, from Abyssinia, before the route by sea to India was discovered. In 1500, the Portuguese, under Albuquerque, commenced making settlements on this coast, and built a strong fort on an island in the mouth of the Rio de Sofala, near a town which was founded 200 years before by the Arabs, and which still exists, although in a very decayed state. The inland region at the back of the coast district, now occupied by the Transvaal Boers towards the south, or by Moselikatse and his Amatabele to the north, and stretching away northward for an indefinite distance, formed the celebrated though mythical empire of Monomotapa, the accounts of which by the early travelers are perfectly marvelous. S. was considered by the old geographers as a very rich, gold-producing country; and was judged by some to be the Golden Ophir to which King Solomon every three years sent a fleet of ships; and, indeed, it seems to have derived its name from the Greek *Sophira*, by which Ophir is translated in the Septuagint. Lopez tells us that in his time the inhabitants related that the gold-mines of S. afford yearly two millions of metrigals—every metrigal accounted for a ducat. Whatever may have been its former reputation, S. has long ceased to be a gold-producing-country to any considerable extent.

An old writer says: 'Great wild elephants overspread the country, which the natives neither know how to tame nor manage; nor are lions, bears, stags, or harts and boars fewer; besides, sea-horses sport themselves in the Quama.' This description is pretty accurate, even at the present day, if we omit the bears, and call the stags antelopes; for the elephants, rhinoceroses, and other large game, driven away from the highlands in the interior by the pursuit of the Cape hunters, have descended into the coast lowlands, where the dense bushy nature of the country, and its extreme unhealthiness, protect them from extermination, although such keen sportsmen as M'Cabe, Chapman, and Edwards have not feared to follow them there.

The most northern regions of S. are the captaincies of Rio de Senna and Tetè, formerly called Matuka, which include the country on the right bank of the Zambezi, sloping down from the Malappo Mountains, which bound its basin on the south. The principal places are Tetè, in lat. 16° 12′ S., long. 31° 50′ E.; and Senna, in lat. 17° 30′, long. 34° 40′. The middle region comprises the captaincy of S., the seat of government being at the town or fort of that name, in the Bay of Massangane; lat. 20° 12′, long. 34° 40′. Inhambane is the name of the most southerly captaincy, in lat. 23° 51′, and long. 35° 20′. There are other inconsiderable Portuguese factories along the coast at Imhampoora, south of Inhambane, Mambone, and Lorenco Marquez, in Delagoa Bay, where a Portuguese governor resides.

Although nominally under Portuguese rule, yet the authority of that government rarely extends outside of the walls of the miserable forts held by its agents. It is computed that on the whole of the Portuguese settlements on the east coast of Africa there are not more than 500 colonists of European birth. Trading parties of Dutch Boers from the Transvaal Territory occasionally visit the factories at Inhambane, Sofala, and Lorenco Marquez, to purchase articles of European manufacture in exchange for ivory, wax, timber, &c. The natives, generally, are of the negro type, gradually approximating to the more intellectual Zulu Kaffir as we proceed from the Zambezi to Delagoa Bay.

The principal exports from this region are ivory, bees-wax, hides, and rhinoceroses' horns; while a considerable clandestine

traffic is said to be carried on in slaves. Considerable amounts of gunpowder, lead, coffee, and European clothes find their way up from the coast to the Boer settlements in the highlands of the interior. The coast-line is generally low and sandy, and dangerous on account of shoals and sandbanks. A group of islands, called Bazaruta, lie off the coast north of Cape St. Sebastian, in lat. 22° S. The best harbor is that of Imhambane, and ships may ascend to the town, about 8 miles from the mouth of the river. The harbor at the mouth of the Rio de Sofala is difficult of access on account of its bar.

SOFFIT, a small ceiling, formed into panels, as over windows, ingoings of doors, staircases, &c.

SOFTENING AND INDURATION are terms used to express a pathological diminution and augmentation of the consistence of the tissues or organs of the body. These changes may arise from inflammatory action; but softening may also be induced by causes totally distinct from inflammation, as, for example, from a deficient supply of blood, from scrofula or cancer, or from long continued functional inactivity (as in the case of paralyzed muscles). Amongst the parts liable to both softening and induration are the brain and spinal cord, the heart, the lungs, the serous and mucous membranes, the liver, the spleen, the kidneys, the uterus, and the bones and cartilages.—For further details on the subject, the reader may consult the English translation of Vogel's *Pathological Anatomy*.

SOFT-GRASS (*Holcus*), a genus of grasses having a lax panicle, two-flowered spikelets, with two nearly equal glumes. The species are not numerous. The English name is derived from the soft and abundant pubescence of the British species, which are two in number, CREEPING S. (*H. mollis*), and WOOLLY S. or MEADOW S. (*H. lanatus*), both perennial grasses, and both very common. Meadow S. is found most abundantly on damp, moorish, or peaty soils, on which it is sometimes sown, as it yields abundant herbage; but it is very inferior to some other grasses, and therefore unsuitable for rich meadows and pastures. Creeping S. is generally found on dry sandy, or other light soils; and very much resembles Meadow S., but is still more downy, and of smaller size. The roots somtimes extend 5 or 6 feet in a season. The roots contain much nutritious matter, and are a very acceptable food to horses and cattle, but especially to hogs, which grub them up for themselves when they have opportunity.

SOIGNIES, a town of Belgium, province of Hainault, 22 miles south-west of Brussels by Railway. Its church of St. Vincent Maldegaire, founded in the 10th c., if not earlier, is probably the oldest in Belgium. S. has breweries, distilleries, trade in stone and lime, and large fairs. Pop. 7000.—Some miles to the north-east, in the province of South Brabant, lies the forest of S., at whose southern extremity is situated the famous field of Waterloo.

SOILS consist of the disintegrated materials of the hard crust of the earth, mixed with decayed vegetable matter. This disintegration is effected partly by the chemical action of oxygen, carbonic acid, and the other acid or alkaline substances brought by the atmosphere to bear upon rocks, and partly by the wearing action of water in a fluid state or in the form of glaciers, or by its bursting force when frozen in deep clefts. The soils produced by running water, floods, and tides, are found along the banks or at the mouths of rivers, and are generally called *alluvial soils;* those produced by glacier-action are known as *drift soils;* and both are generally found at a great distance from the rocks of whose disintegrated materials they are composed. But by far the greater mass of soil has been produced in the other way above mentioned, by the gradual weathering of rock under atmospheric influence; and it is generally found adjoining or overlying the rocks from which it has been produced. Immediately beneath the soil or stratum of earth which affords nourishment to plants, is a mass of earth or rock, unmixed with decayed vegetable matter, to which the term *subsoil* is applied. The subsoil may or may not be similar in its geological constitution to the soil; and from the absence of vegetable matter, is generally lighter in color than the latter.

Every species of rock has produced its soil; but the older formations, from their greater hardness and power of resistance to atmospheric action, produce, in proportion to their exposed surface, less soil than do the Secondary and Tertiary groups. The fertility of soils has no relation to the chronological succession of the strata of the earth's crust; thus, igneous rocks produce a naturally fertile soil, though they seldom become thoroughly disintegrated; metamorphic or transition rocks furnish one of poor quality, as does also the greater portion of the Silurian system; while to the vast mass of the Secondary group of deposits, especially the Devonian system, with its old red sandstone, and limestone, and marl beds, the mountain limestone of the Carboniferous system, and the new red sandstone of the Permian and Triassic systems, belong some of the richest tracts in Great Britain, though numerous members of the same group supply barren and ungrateful soils.

The Lias, and Oolitic, and Wealden systems generally supply clay-soils of considerable fertility, but of the densest texture and most intractable character; soils formed from the cretaceous group are extremely variable in quality; but when the chalk is largely mixed with sand or clay, they exhibit a considerable degree of fertility; however, they have one great general defect, that of not sufficiently retaining moisture. The soils produced from the Tertiary formations possess no general characteristics, being sometimes extremely fertile, and again almost wholly barren; and, in short, we are bound to come to the conclusion, that the mere geological composition of soils affords no very reliable criterion by which their economic value can be estimated; the same rock which produces the almost barren soil of Argyleshire, weathers into the fertile soil of the Channel Islands; and to the old red sandstone is due at once the rich soil of Hereford, Monmouth, Moray, and Strathmore, and some of the most barren heaths and moors in Scotland. These apparent anomalies are no doubt largely produced by the various action of heat, moisture, and other meteorological agencies.

But however soils may vary in a geological point of view, they are all resolvable into a few elements—viz., the various compounds of aluminium, iron, manganese, the four alkaline metals, the seven alkaline earths, and the four organic elementary substances. These 18 bodies supply, singly or in combination, all the constituents necessary to the growth of plants, each of them having its own portion of the plant to sustain—the silica producing strength and rigidity in the stems; alumina giving tenacity to the soil, and so rendering it a stable support; magnesia perfecting the seeds; iron absorbing oxygen and ammonia from the atmosphere, and giving it up as required; and so on. Of these ingredients, silica, alumina, lime, along with matter derived from organic bodies, constitute the bulk of the soil; the other ingredients existing only in minute quantity, and hence is derived the common quadruple division of soils into *silicious or sandy, argillaceous or clayey, calcareous,* and *humous.*

It is not sufficient that soil possesses all the ingredients necessary for rendering it fertile, or that these ingredients are in a sufficiently comminuted state to enable them to be absorbed; there is besides a certain physical or mechanical condition necessary. Thus, for example, a soil which possesses too great a proportion of silica, is too little retentive of moisture, and has not sufficient consistency of texture to be an effective support of tall plants; one in which calcareous matter abounds is also too dry a soil; while if alumina predominates, it is generally too retentive of moisture; and a great excess of the last-named ingredient renders it so extremely tenacious, as to be almost incapable of reduction to a proper mechanical state. The soil which is physically most perfect is composed of about equal proportions of the two great ingredients, silica and alumina, and is generally known as *loam,* being distinguished into *clay loam* or *sandy loam,* according as the alumina or silica sensibly predominates. But the physical qualities of soils do not wholly depend upon their composition; they are also largely affected by the depth of the soil itself, and the quality of the subsoil. Should the soil and subsoil be both retentive, or both porous, the defects of these states as to dryness or moisture are considerably increased; if porous and retentive soils of good depth rest upon subsoils of a contrary character, the defects of the former are to a considerable degree amended. But the advantages and disadvantages of these conditions must to a very large extent be judged by the prevalent character of the climate, a somewhat porous subsoil in a cold moist district being generally preferable, and *vice versâ.* Each of these classes of soils, when possessed of the chemical ingredients in quantity sufficient for the wants of plants, and of a texture favorable to their growth, excels in the production of certain species. Thus, the clay loams are unequalled for the production of wheat and beans; the sandy loams for barley, rye, and the various root-crops; while both are well suited for the growth of the other cultivated plants, or for perennial pasture.

Besides the calcareous and marly soils which may be, according to circumstances, classed as a clayey or sandy soil, rarely the former, there is the humous soil, which possesses characteristics peculiarly its own. It is not devoid of consistency like the sandy, or retentive of moisture like the clayey soils, but in its natural state is spongy and elastic in texture, of a remarkably dark color, and when dried, becomes inflammable, and even when much improved by culture, retains these characteristics in a considerable degree. It consists wholly, or to a great extent, of vegetable matter, and is found in perfection in forests of ancient date, as the woods of America, and in the peculiar form of Peat (q. v.) in many parts of the world. In its ordinarily decomposed condition, it is at once the richest of soils; but in the state of peat it calls for long-continued drainage, and the application of decomposing agents, before it can be rendered of service in the production of crops.

Improvement of a soil must, then, as is seen from the foregoing considerations, be effected either by supplying the substances required by plants to a soil which is deficient in them, by altering its depth and texture, and by removing excess, or supplying deficiency of moisure. The first of these objects is effected by the introduction and incorporation of Manures (q. v.) with the soil, care being taken that the manure contains the requisite ingredients, and in such a condition as to be assimilable by plants either directly or indirectly through the soil, and by the more thorough exposure of the soil to the action of the atmosphere; the second is effected by the admixture of marl or clay with sandy, chalky, or peat soils, of lime, ashes, or burned clay, with tenacious clay soils, or by the mixture of the subsoil (if differing in quality) with the soil by means of the subsoil plough, or by more complete surface-tillage, and free exposure to the action of frost; and the third is accomplished by Drainage (q. v.) and Irrigation (q. v.). The fertility and chemical composition of a soil may be approximately determined by inspection of its color and texture; but more accurately, as well as its dryness or moisture, excess or defect of silica and alumina, by the predominance of certain species of wild plants or weeds.

SOISSONS, a town of France, in the dep. of Aisne, stands in a fertile vale on the banks of the river Aisne, about 65 miles north-east of Paris. S. is the key of Paris for an army invading France from the Netherlands, and is the meeting-point of six military roads. The principal building is the cathedral, founded in the 12th c., the library of which contains many rare MSS. There are also some remains of the great castellated abbey of St. Jean des Vignes, where Thomas à Becket found refuge when in exile. Quite near to S. is an institute for 'deaf and dumb,' which occupies the site of the famous abbey of St. Médard, where Clothaire and Siegbert were buried. S. has manufactures of linen, woollens, and cottons. Pop. (1876) 10,754. S. is one of the oldest towns in France, and was celebrated even in the time of the Romans, when it bore the names first of *Noviodunum*, and afterwards of *Augusta Suessionum;* hence its modern name of Soissons. It was the last Roman stronghold in Gaul that withstood the arms of Clovis, who here overthrew Syagrius, the Roman commander, in 486, and made it the seat of the Frankish monarchy, which it long continued to be.

SOKOTO, a kingdom of Africa, in Sudan, to the south-west of Lake Tchad, and separated from it by the state of Bornu (q. v.). Area, 117,000 sq. miles. The inhabitants, who are mostly of the Fulbe tribe, are numerous. A formidable military force is maintained.—*Sókoto*, the capital, stands on the Zirmie, an affluent of the Sókoto, which flows into the Quorra. Its market is of great importance; it trades in raw silk, glass-wares, and perfumery, carries on extensive and famous manufactures of leather goods, and has from 20,000 to 22,000 inhabitants.

SOLANACEÆ, or SOLANEÆ, a natural order of exogenous plants, mostly herbaceous plants and shrubs, but including a few tropical trees. The leaves are mostly alternate, undivided or lobed, without stipules. The flowers are regular, or nearly so; the calyx and corolla generally 5-cleft; the stamens generally five. The fruit is either a capsule or a berry, mostly 2-celled. The plants of this order are mostly natives of tropical countries, a small number extending into the temperate and moderately cold climates of both hemispheres; in the coldest regions they are entirely awanting. They are mostly distinguished by an offensive smell, and by containing in greater or less abundance a narcotic, poisonous substance, usually associated with a pungent principle, and some of them are amongst the most active poisons. Sometimes the narcotic substance predominates, as in Mandrake (q. v.) and Henbane (q. v.); sometimes the pungent substances predominates, or is alone present, as in Cayenne Pepper (*Capsicum*); sometimes both are present in more or less equal proportion, as in Tobacco, Thorn-apple or Stramonium, and Belladonna. The fruit is generally poisonous; but that of a considerable number of species, in which acids and mucilage predominate, is eatable as, for example, the berries of the Winter Cherry and other species of Physalis, those of the Egg-plant (q. v.) and some other species of *Solanum*, and of the Love-apple (*Lycopersicum*). The tubers, which occur in a few species, contain much starch, and serve as an article of food, of which the Potato is the chief example. The seeds of all contain a fixed oil, which in the south of Germany is expressed from the seeds of the Belladonna itself.

SOLAN GOOSE. See GANNET.

SOLA'NO. See SIMOOM.

SOLA'NUM, a genus of plants of the natural order *Solanaceæ*, containing a great number of species, which are distributed all over the world, but are particularly abundant in South America and the West Indies. Some of the species are herbaceous, others are shrubs; some of them unarmed, and some of them spiny; many covered with a down of starlike hairs. The flowers are in false umbels, or almost in panicles; seldom in racemes, or solitary. The anthers open by two holes at the top. The berries are two-celled, and contain many smooth seeds. The species of this genus almost always contain in all their parts a poisonous alkaloid, *Solanine*, in greater or less quantity, sometimes so much that the leaves or the berries cannot be eaten without danger, whilst in a few species the quantity present is so small as to be insignificant, and these parts are eaten freely, being agreeable and harmless. By far the most important of all the species is *S. tuberosum*, the POTATO (q. v.), in which, however, Solanine is found in considerable quantity, so that not only the herbage, but the juice of the raw tubers, is unwholesome. Of the species with eatable fruit, the principal is S. *melongena*, the EGG-PLANT (q. v.)—The only British species are *S. dulcamara*, the BITTERSWEET (q. v.), and *S. nigrum*, the COMMON NIGHTSHADE (q. v.), both of which possess poisonous and medicinal qualities. The berries, leaves, bark, and roots of various species are employed for different medicinal uses in the warm countries of which they are natives; but their properties have not yet been sufficiently investigated. The berries of *S. saponaceum* are used as a substitute for soap.

SOLAR, an upper chamber or loft. The only private apartment in the old baronial halls was so called. It was placed over the pantry, at one end of the hall, and served as parlor and sleeping apartment for the baron and his family.

SOLAR CYCLE. See PERIOD.

SOLAR SYSTEM. The planets and comets which circle round the sun combine with it to form a system to which is given the name of *solar* or *planetary* system. It is probable that each star is the center of an analogous system. This, however, is merely a matter of speculation, and in no way practically concerns us; but it is different with the solar system. No change of much magnitude can take place in the elements of the planets without having effect on the earth and its inhabitants, on account of the mutual attractions of the planets for each other; in fact, they appear as members of one isolated family, bound together by common ties, which could not be ruptured in the case of one individual without communicating a general shock to the others. The various members of the solar system are noticed under PLANETS, PLANETOIDS, COMET, SUN, MOON, SATELLITES, METEORS; and their motions are treated of under GRAVITATION, CENTRAL FORCES, PRECESSION, &c., so that it only remains here to give the more interesting numerical facts connected with them, which can be done most conveniently in a tabular form.

Name.	Diameter in Miles.	Density Earth's being = 1.	Mass, Sun's being = 1.	Distance from Sun in Millions of Miles.	Period of Revolution in Days.	Velocity in Orbit—Miles per Hour.	Velocity of Rotation at Equator—Miles per Hour.
Mercury	2,962	1.24	$\frac{1}{4865751}$	35	88	105,330	386
Venus	7,510	0.92	$\frac{1}{401211}$	66	225	77,050	1,010
Earth	7,912	1.00	$\frac{1}{314,760}$	91	365¼	65,533	1,040
Mars	4,920	0.52	$\frac{1}{2846247}$	139	687	53,090	628
Minor Planets.							
Jupiter	88,390	0.22	$\frac{1}{1048}$	476	4,332	28,744	27,985
Saturn	71,904	0.12	$\frac{1}{3498}$	872	10,759	21,921	21,538
Uranus	33,024	0.18	$\frac{1}{22,639}$	1754	30,687	14,963	10,921
Neptune	36,620	0.17	$\frac{1}{18780}$	2746	60,127	11,958	?
Sun	852,584	0.25	1	*	*	*	4,407
Moon	2,153	0.63	$\frac{1}{2,440,744}$	*	*	2,273	10

SOLAR MICROSCOPE, an instrument for producing magnified images of minute objects on a screen, through the agency of the sun's rays. The tube of the microscope is conical, and is fastened to the interior side of a closed window-shutter over a hole in the latter; a reflector, placed at the hole so that the rays of light may fall on it, is so adjusted as to throw them along the tube. They are then collected by a powerful double convex lens, and thrown on the object, which is inserted into the tube at the focus of the lens by a slit at the side. After passing the object, the rays again pass through a single lens, or a combination of lenses, make their exit from the tube, and fall on a screen, on which they depict a magnified image of the object. We have here supposed the object to be so translucent as to allow of the passage of rays through it. Should it be opaque, the rays of light reflected from the mirror are caught by the double convex lens, which concentrates them on another mirror near the opposite end of the tube; they are thence reflected upon the back of the object, and diverge on the system of lenses at the mouth, which form the image. Instead of the sun's rays, the oxyhydrogen lime-light (and more recently the electric light) has been employed, its rays being thrown on the double-convex condenser by means of a concave reflector, in whose focus the piece of burning lime or marble is situated. The instrument is hence often called the *Oxyhydrogen Microscope.*

SOLA'TIUM, in Scotch Law, means compensation for wounded feelings, and is something over and above the ordinary pecuniary value of the damage. In England, such a ground of damages is not in strict principle admitted, but in practice there is no substantial difference.

SOLDER, an easily fusible alloy used for joining metals. Solders are of various kinds, suited to different metals. They always require to be used with a flux, such as borax, resin, chloride of zinc, sal-ammoniac, &c. The following are the principal solders: *Pewterers' solder*—bismuth, 2 parts; lead, 4 parts; tin, 3 parts. This can be used for coarse work by the direct application of naked fire; but for fine work, requiring the protection of a muffle-furnace, the composition must be bismuth and lead, of each one part; tin, 2 parts. *Plumbers' solder* for coarse work—tin, 1 part; lead, 3 parts. For finer work—tin, 2 parts; lead, 1 part. *Spelter solder*—12 parts zinc to 16 parts of copper. *Soft spelter solder*—equal parts of copper and zinc. When solders are applied in the common work of plumbers and tinmen, a tool called the soldering-iron is used: this is made red-hot, and forms a convenient means of applying fire direct to the solder and flux Although called the soldering-iron, the portion of the tool to be heated must be of copper. In many manufactures, a flame produced by a mixture of atmospheric air and coal gas is used to melt the solder; and for fine work, such as jewelry, the common blowpipe is often used.

SOLDIER is one who enters into an obligation to some chieftain or government to devote for a specified period his whole energies, and even if necessary his life itself, to the furtherance of the policy of that chief or government. The consideration may be immediate pay, or prospective reward; or the contract may be merely an act of loyal devotion. The acknowledgment of the service by the employer constitutes the man a recognized soldier, and empowers him to take life in open warfare, without being liable to the penalties of an assassin and a robber. The fact of being mercenary, that is, of receiving wages for killing and being killed, does not render a soldier's trade less honorable. He bears arms that others may be able to do without them: he is precluded by the exigences of military training from maintaining himself by peaceful occupation; and it is therefore but fair that those whom he protects should support him, and give him, over and above actual maintenance, reasonable wages for the continual risk of his life. If a man willingly enlist himself as a soldier in what he believes to be an unrighteous cause, it is an act of moral turpitude; but when once enlisted, the soldier ceases to be morally responsible for the justice or iniquity of the war he wages; that rests with his employer. Obedience, implicit and entire, is his sole virtue. The maxim is: 'The military force never deliberates, but always obeys.' See ENLISTMENT, MARTIAL LAW, WAR, &c.

SOLDO. See SOLIDUS.

SOLE (*Solea*), a genus of Flat-fishes (*Pleuronectidæ*), of an oblong form with a roundish muzzle, which almost always advances beyond the mouth; the mouth twisted to the side opposite to that on which the eyes are situated, which is usually the right side, although individuals of the same species are found having the eyes and color on the left side; the teeth very small in both jaws, but only in the under part of the mouth (the *side* opposite to the eyes); the lateral line straight; pectoral fins on both sides; the dorsal and anal fins long, and extending to the tail, but distinct from the tail-fin.—The COMMON S. (*S. vulgaris*) is a highly esteemed fish, abundant on the British coasts where the bottom is sandy, and of which great quantities are brought to market. The London market is supplied chiefly from the south coast of England, the soles there attaining a larger size than those of more northern coasts. They are caught by trawling, very seldom with bait. The S. is in condition for the table during the whole year except five or six weeks in February and March, its spawning-time. The Common S. is found on all the coasts of Europe, except the most northern. It has been known to attain a size of 26 inches long, and almost 12 inches broad, weighing 9 pounds; but a S. of less than half that weight is reckoned very large. The

Common Sole (*Solea vulgaris*).

upper side of the body is of an almost uniform dark brown; the scales small, rough to the touch, and ciliated at the edge; the lower side is white. The S. sometimes ascends rivers to a considerable distance from the sea, and seems to thrive at least as well in fresh as in salt water, a fact of which advantage has not yet been taken for the stocking of fresh-water ponds. It breeds freely enough in fresh water.

The only other British species of true S. is the LEMON S. (*S. pegusa*), which is sometimes taken with the Common S. on the south coast of England, and more rarely in more northern parts. It is paler in color than the Common S., and broader and thicker in proportion. It is equally esteemed for the table.—The name S. is popularly extended to several genera recently separated from the true soles. In *Brachirus*, the dorsal and anal fins are united with the tail fin; but, as in *Solea*, there are pectorals on both sides. To this genus belongs the ZEBRA S. (*B. zebrinus*) of Japan, remarkable for the zebra-like stripes which cross its whole body.—In *Monochirus*, the pectoral fin is developed only on the upper side. To this genus belong the VARIEGATED S. (*M. variegatus*) and the LITTLE S. or SOLENETTE (*M. linguatulus*), both found on the British coasts, but of little importance, on account of their small size.—In the genera *Achirus* and *Plagusia*, of which there are no British species, the pectorals are wanting on both sides.

SO'LECISM. A solecism is the term applied to any violation of the grammar or idiom of a language, or of the usages of society. It is said to be derived from the city of Soli in Cilicia, whose inhabitants spoke very bad Greek, in consequence of their intercourse with the Cilician natives, and provoked the fastidious Athenians to coin the epithet.

SO'LEN, a genus of lamellibranchiate molluscs, the type of a family, *Solenidæ*, remarkable for the wide gaping of the shell at both ends, and the large and muscular *foot*. In the genus S., the shell is remarkably elongated, its apparent length being, however, more strictly its breadth. From its form, the names RAZOR-SHELL and RAZOR-FISH are often given to it. The species are

Solen, or Razor-fish (*S. siliqua*).

numerous, and inhabit the sands of all seas except in the coldest parts of the world. Some of the tropical species have shells of great beauty. The solens burrow in sand, making their hole straight down, and ascending and descending by means of their foot, which is capable of being elongated and contracted to bore a passage for the animal, and to drag it through. They are used for food, and also by fishermen for bait. To obtain them, a hooked iron implement is used. Another method is to drop a quantity of salt on the mouth of the hole, which causes them to come up, when they are quickly seized. The most common, and one of the largest British species, *S. siliqua*, is about an inch in *length*, and eight inches in breadth. It is perfectly straight. Another common British species, *S. ensis*, is curved like a sword.

SOLENHOFEN LITHOGRAPHIC STONE, a famous deposit of limestone of Upper Oolite age, which from its fine-grained and homogeneous texture is admirably adapted for lithographic purposes. It occurs near Aichstadt in Bavaria, and has been exten-

sively quarried since the invention of lithography. The quarrymen work upon the lines of stratification, which are beautifully parallel, and all the fossils are found upon the natural surfaces of the beds, and present an impression and cast in almost every instance. The rock is quarried to a depth of 80 or 90 feet. It is of special interest to the geologist from the singular assemblage of fossil remains which are preserved in it with wonderful minuteness. The most delicate tracery of the wings of the dragon-fly is often as perfect as in living specimens. The rock is of marine origin, and while lithologically it has a strong resemblance to the White Lias of Britain, its fossils correlate it to the Kimmeridge Clay. These are chiefly ammonites, nautili, crustacea, winged insects, fishes, and pterodactyles. But the most singular fossil is

Remains of Archæopteryx in Solenhofen Stone.

one which has only recently been brought to light. A single feather was first found, and some months after, the bones of a feather-covered animal, which was considered by its first describers to be a lizard; but Professor Owen showed, on incontrovertible grounds, that it is a true though very anomalous bird. The specimen, which, with the exception of the head, is almost entire, is now at South Kensington. It formed the subject of an elaborate memoir by Professor Owen. He named it *Archæopteryx macrura*. It was pronounced the oldest bird of which any remains had yet been found; though the Connecticut footprints pointed to a still earlier fowl. (For its relation to ancient American birds, see Marsh's *Odontornithes*, a monograph on the extinct toothed birds of America). Another specimen of the *Archæopteryx* was afterwards found at Solenhofen, and is now at Berlin. The *Archæopteryx* was about the size of a rook.

The anomalous structure which induced the earlier observers to make it a reptile, and some that followed to imagine it as a transition form between the reptile and the bird, is the tail, which, instead of consisting of a few shortened vertebræ united together into a coccygean bone, as in all known birds, recent or fossil, was formed of twenty elongated vertebræ, each of which supported a pair of quill-feathers. But this departure from the bird type is not so anomalous as it at first sight appears, for in the early embryonic condition of the bird, the vertebræ are distinct and separate, and the anastomosis which invariably takes place in the subsequent development of the embryo, does not occur in the *Archæopteryx*, so that it may be considered to exhibit the temporary embryonic condition of the bird as a permanent structure; and that this is the true position of this singular fossil is further established by the existence of other features which are found only in birds. These are the ornithic structure of the wings and legs, the occurrence of feathers, which are confined to birds, and the existence of a merry-thought (furculum), which is found in no other class of animals. An elevation on the surface of the slab containing the fossil is believed by many to be the cast of the interior of the skull, and it corresponds remarkably in size and form with the cast from the skull of a rook.

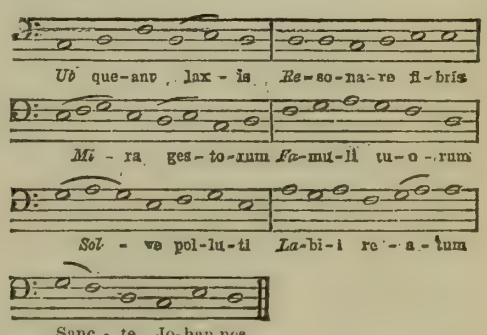
SO'LENT, the name of the western portion of the strait that intervenes between the Isle of Wight and the mainland of England. At Hurst Castle, which guards its entrance on the southwest, the S. is less than a mile in breadth; and along this narrow passage the tide flows with a rapidity which at certain times no boat can stem. The castle itself consists of a central tower or keep, surrounded by several smaller towers, and mounted with heavy guns.

SOLEU'RE (Ger. *Solothurn*), a canton in the north of Switzerland, bounded on the W. and S. by Bern, and on the N. and E. by Basel and Aargau. Area, 300 sq. m.; pop. (1876) 77,803, mostly Roman Catholics. The greater portion of the canton is fertile and well cultivated, especially along the banks of the Aar. Even the rugged and hilly districts are sources of wealth on account of their fine pasturage. Besides grain, the principal products of S. are fruit, wine, flax, and cotton. Cherry-brandy is a very important article of trade. The manufacture of iron, glass, pottery, hosiery, and recently of watches, is carried on to a considerable extent.—S. entered the Swiss Confederation in 1481 along with Freiburg. Its constitution is liberal. The legislative body, or parliament, is the Grand Council, consisting of 106 members, the whole of whom are, since 1856, chosen directly by the people, who have besides a veto on the laws passed by the council. The executive is chosen by the council, and consists of 5 members.

SOLEURE (Ger. *Solothurn*), capital of the canton, is situated on the Aar, 16 miles north-north-east of Bern by railway. The scenery in its vicinity is among the loveliest in Switzerland, The Aar flows through the town, dividing it into two unequal parts, which are connected by two wooden bridges. The most notable building is the cathedral of St. Ursinus, with a cupola and façade of Corinthian columns, reckoned the most costly cathedral in Switzerland. S. has some manufactures, but derives its chief industrial importance from its transit-trade. Pop. (1880) 7668. Near to S. are the baths of Weissenstein.

SOLFATA'RA (Fr. *Soufrière*, Ger. *Schwefelgrube* or *Schwefelsee*), the Italian name for such volcanoes as, having become less active than volcanoes in an actual state of eruption, only exhale gases. The most notable of them are found in Italy, in the Antilles, in the interior of Asia, and in Java. The S. of Pozzuoli, near Naples, is an irregular plain, 1368 feet long, and 1310 feet broad, almost surrounded by broken hills of pumaceous tufa, the ancient walls of the crater. From the crevices of the rocks, steam or noxious gases, chiefly sulphuretted hydrogen, mixed with a minute quantity of muriatic acid and muriate of ammonia, exhale. In the cracks and fissures of the rocks, sulphur, alum, and sulphate of iron abound. The vapors exhaled are used as medicinal baths, and huts, constructed of boards, have been erected in which the baths may be obtained. The Soufrière of Morne-Garou, in the isle of St. Vincent, Lesser Antilles, about three miles in circuit, and over 500 feet in depth, has in its center a cone, the summit of which is covered with sulphur.

SOLFE'GGIO, in Music, seven syllables, which are sometimes used as a nomenclature for the seven notes of the scale. In singing, the art of applying these syllables to the notes as an exercise for the learner, is called *Solmisation*. The syllables are *ut* (or *do*), *re, mi, fa, sol, la*, and *si*. The first six are the commencement of the lines of an ancient monkish hymn to John the Baptist, which had this peculiarity, that the first syllable of each line was sung to a note one degree higher than the first syllable of the line that preceded, so as to present the type of a scale:



These syllables are said to have been first made use of by Guido of Arezzo, in the 11th c.; and Le Maire, a French musician of the 17th c., added to them *si*, for the seventh of the scale. When applied to the key of C, their equivalents, in the ordinary musical nomenclature, are:

Do	re	mi	fa	sol	la	si	do
C	D	E	F	G	A	B	C.

These syllables may, however, according to the more modern practice of teachers in this country, be applied to other keys, with *do* always as the keynote, so as to express not the absolute pitch of a note, but its relation to the keynote; and thus used, they are thought to be of service to the learner in keeping prominently be-

fore him the principle that there is but one scale in music, which is raised or lowered according to the pitch of the key. Different variations in the way of using the syllables have recently given rise to various supposed short and easy modes of teaching singing, the best-known of which is Mr. Curwen's system of 'Tonic Sol-mization,' where the ordinary notation of the staff, with its lines and spaces, is entirely rejected, and a notation substituted which is formed of the solfeggio syllables, used to express not pitch but relation to the keynote. One disadvantage of this and similar schemes is the entire withdrawal of the direct indication of the pitch of the sounds to the eye, by the notes ascending as the sounds ascend, which is so beautiful a feature of the common notation. And even if it be granted that the first rudiments of music can, as has been asserted, be taken up with remarkable ease by the pupil who learns on the tonic sol-fa system, it is undeniable that as soon as he comes in contact with notes of different lengths, or begins to modulate from one key to another, he is beset with serious difficulties. There is, in addition, the further objection to the system, that the pupil thus taught is shut out from the whole world of musical literature, a disadvantage which is not compensated by having a few elementary difficulties smoothed away, which experience shows that children of the most mediocre capacity can overcome.

SOLFERI'NO, a village of Northern Italy, province of Brescia, 20 miles north-west of Mantua, with 1400 inhabitants. It stands on a hill, and has a tower called the Spy of Italy (*Spia d'Italia*), from which the whole plain of Lombardy may be seen. There, in 1796, the French conquered the Austrians. On June 24, 1859, S. was again the scene of an overwhelming victory obtained by the French and Italians over the Austrians.

SOLICITOR. See ATTORNEYS.

SOLICITOR-GENERAL, the name given to one of the law-officers of the crown. The Solicitor-general of England has powers similar to those of the Attorney-general (q. v.), to whom he gives aid in discharging his functions. During the absence of the Attorney-general, he may do every act and execute every authority of that officer. He is, *ex officio*, one of the Commissioners of Patents.

The Solicitor-general of Scotland is one of the crown counsel, next in dignity to the Lord Advocate (see ADVOCATE, LORD), and exercising all his functions along with him. His office cannot be traced further back than the Union. Like the Lord Advocate, he has the privilege of pleading within the bar. All proclamations for the observance of days of public fasting and thanksgiving are addressed to the Solicitor-general.

SOLICITOR TO THE TREASURY, an officer who acts as attorney for the government in all legal proceedings. He has also to act as solicitor for the three secretaries of state, the Privy Council Office, the Board of Trade, the Mint, the War Office, the Stationery Office, and for all the other principal departments for which no solicitor is specially appointed.

SOLIDUNGULA. See EQUIDÆ.

SOLIDUS, the name by which the old Roman 'aureus' (equivalent to £1, 1*s*. 1½*d*., according to the present value of gold) was known after the time of Alexander Severus; but during the reign of Constantine the Great, its value was diminished in the ratio of 8 : 5, and so remained till the end of the empire. The weight of these later solidi was fixed at $\frac{1}{72}$th of an ounce, the gold being 23 carats fine, and the alloy mostly native silver. The 'solidus,' or 'solidus aureus,' was adopted by the Franks under the Merovingians and Carlovingians (at 87 to the Roman pound) till the time of Pepin, who suppressed it; but another solidus of silver, or 'solidus argenteus'—the $\frac{1}{20}$th of the libra or pound—which had been used only as a money of account, was soon after made a coin. In after-times, this 'sol,' or 'sou,' like all other coins, underwent an infinity of variations in fineness and value (see LIVRE). On the introduction of the decimal system (1793) into France, the sou was abolished, and a piece of 5 centimes ($\frac{1}{20}$th of a franc) substituted, but the name continued in common use, and the old sous were retained in circulation. The solidus also appears in the *soldo*, which was a coin in use in Northern and Central Italy, and was essentially the same with the sou.

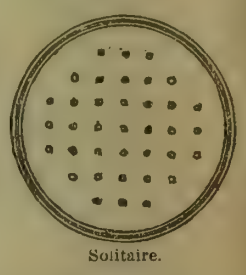
SO'LINGEN, a town of Prussia, province of the Rhine, and government of Düsseldorf, capital of a circle of the same name, is situated on a height 13 miles east-south-east of Düsseldorf, and not far from the river Wupper. It is a very old place, and has long been famous for its steel and iron ware manufactures, especially sword-blades, helmets, cuirasses, knives, scissors, which are exported to all parts of the world, and rival the excellence of English wares. In the town and circle of S. there are about 3000 workshops, employing over 10,000 hands, and producing yearly half-a-million hand-bells, knives in millions of dozens, scissors, revolvers, &c. S. hand-bells have been famous since the middle ages, and are sent to the most distant lands. Pop. (1880) 16,940.

SOLITAIRE (*Pezophaps*), a genus of birds of the Dodo (q. v.) family (*Didinæ*), but differing from the dodos in a smaller bill and longer legs. Like the dodos, the only species of this genus, of the existence of which there is any evidence (*P. soliataria*), seems to be now extinct, and to have become extinct in very recent times. It inhabited the island of Rodriguez, an island about 15 miles long by 6 broad, situated about 300 miles to the east of Mauritius, and appears to have been peculiar to that small and lonely island, where it was abundant at the beginning of the 18th century. Rodriguez was uninhabited till 1691, when a colony of French Protestant refugees settled on it, under the command of François Leguat, who, in his *Voyages et Aventures*, has left an interesting and trustworthy account of the solitaire. He describes it as a large bird, the males sometimes weighing 45 lbs.; taller than a turkey, the neck a little longer in proportion, and carried erect; the head of the male without comb or crest, that of the female with something like a widow's peak above the bill; the wings small, and the bird incapable of flying, but only using the wings to flap itself or to flutter when calling for its mate, or as a weapon of offence or defence; the bone of the wing being thickened at the extremity so as to form a round mass, about the size of a musket-bullet, under the feathers, and to increase the force of the blow given by it; a roundish mass of feathers instead of a tail. He further describes the plumage as very full and beautiful, not a feather out of its place, so there can have been no feathers with unconnected webs, as in the ostrich. He says the bird is called S. because it is very seldom seen in flocks. He tells us that the bird is with difficulty caught in the forests, but easily on open ground, because it can be outrun by a man; and that its flesh is very good to eat.—But the S. seems to have completely disappeared from Rodriguez, which is now a British settlement. Bones have been lately found in large quantities, and, since Professor Newton's visit to Rodriguez in 1865, the skeleton has been entirely reconstructed. Skeletons are preserved in the South Kensington Museum, in the Royal College of Surgeons, and in the Museum of the University of Cambridge.—The figure here given is derived from a rude cut in Leguat's work.

Solitaire (*Pezophaps solitaria*).

The name S. was originally given to a species of dodo inhabiting Bourbon, also extinct, of which the remains have never been found; and was applied by Leguat to this bird, in a mistaken belief of its being the same. See *Strickland and Melville on the Dodo and its Kindred*.

SOLITAIRE, a species of game or rather puzzle, which, as the name denotes, is played by only one person. The apparatus for the game consists of a round or octagonal flat board, indented with 33 or 37 hemispherical hollows, as in the figure, and 33 or 37 balls, one in each hollow. The process of the game consists in removing one ball from the board, and then, having created a vacancy, capturing one of the balls adjoining by causing the one behind to leap over it into the vacant hollow; there are now two vacancies, and the game is continued in the same manner by capturing ball after ball, till only one remains, when the game is *won*. Should more than one be left, and they be so isolated as not to be liable to capture by each other, the game is *lost*. This puzzle may be solved in an immense number of ways; one of the prettiest modes consists in removing the central ball, and so capturing the others that the last ball shall be in the center.



Solitaire.

SOLLE'R, a small town and seaport of the Balearic Isles, in Majorca, 14 miles north of Palma. It exports oranges and wine, and contains 7000 inhabitants.

SOLMISATION. See SOLFEGGIO.

SOLO, a term used in musical compositions of several parts, whether vocal or instrumental, to indicate those voices or instruments that are to perform alone or in a more prominent manner, as *soprano solo*, *violino solo*. The plural, *soli*, is used when two or more voices or instrumental parts are to be performed together, such parts, of course, never being doubled.—A composition for a single instrument accompanied is also termed a solo.

SOLO'FRA, a small city of Southern Italy, province of Avellino. Pop. 5376. It is situated on the Apennines, and is surrounded by wooded mountains.

SO'LOMON (Hebr. Shĕlômô, Salomon, Salomo, Suleiman, derived from *shalom*, peace = Peaceful, like Germ. Friedrich), the second son of David and Bathsheba; successor of the former on the throne of the Israelitish empire for forty years (1015—975 B C.*). Nothing is known of his youth except that he was probably educated by Nathan (or Jehiel). Equally uncertain is the age at which he succeeded to the crown of his father. That he was older than twelve or fourteen years, as some traditions tell us, seems certain. The way in which his succession to the throne during the lifetime of his father was brought about, to the exclusion of his elder brother Adonijah, is not undeserving of the name of *coup d'état*, which has been bestowed upon it (see the Scripture narrative). Having, by the execution of Adonijah and the leaders of his faction, secured his dominion against internal foes, he, with complete disregard of the Mosaic law, set himself to seek foreign alliances, and with this view married as his principal wife the daughter of Pharaoh, probably of Psusenes (Vaphres?), of the twenty-first dynasty. Besides her, however, he had a vast number of wives—700 'princesses,' and 300 'concubines'—the greatest part of whom were recruited from nations with whom an alliance had been strictly prohibited.

Having inherited fabulous wealth, and further adding to it enormously from his own multifarious revenues, so that 'silver was nothing accounted of in his days,' it became necessary that a new organization corresponding to this unheard of splendor should be introduced. Accordingly, we hear of 'Princes,' i. e., great officers of state, not before heard of. The two counsellors of David's time disappear, in order probably to make room for a whole body of legal advisers; the prophets are no longer to be found among the dignitaries of state, but new military charges are created instead. The immense accumulation of treasure also allowed the execution of a number of public works in Jerusalem, which now first assumed the magnificence and station of a capital. A new wall with fortified towers was erected around it; and the Queen's Palace—'the House of the Forest of Lebanon'—with a long hall joined to it by a cedar porch, called the 'Tower of David,' outside of which a thousand golden shields were suspended, and within which the king sat, in all his imperial splendor, to pass judgment, were built under his immediate orders. His banquets, at which all the vessels were of gold; his stables, with their four (or forty) thousand stalls; his gardens and parks and summer retreats, were such as to dazzle even eastern fancy. Twelve commissaries, distributed in the different provinces, had each in his turn to furnish the means of sustaining this prodigious household. The dominion of S. extended from Thapsacus, on the Euphrates, to Gaza on the Mediterranean. The country was in the profoundest state of peace; the treasures accumulated by David appeared inexhaustible; and the popularity of the king, who listened to the meanest of his subjects, and gave judgment according to that wisdom, for which he had asked in his vision at Gibeon, in preference to any other gift, and which has remained proverbial from his day to ours, was naturally at first very great. Everything, moreover, was done to develop and increase the national wealth and welfare. The rich internal resources were developed, and commercial relations of the most extensive nature established.

Through the port established at Ezion-Geber, at the head of the Gulf of Elath, an outlet was gained to the Indian Ocean; and the alliance with Phœnicia, then under the sway of Hiram, gave an energetic impulse to these foreign expeditions. Manned with Tyrian sailors, the Israelite fleets went to 'Ophir,' and brought back, in exchange for their own exportations, 'gold and silver, apes and peacocks, ivory and spices;' and the rest of the strange and precious produce of India, Africa, Spain, and other regions, possibly even our own coasts.

According to his promise, S., in the fourth year of his accession, commenced the building of the Temple on Moriah, after the model of the Tabernacle, wherein he was aided by Hiram, who not only sent him timber, but architects and cunning Phœnician artists in wood and stone and metals. In the eleventh year of his reign it was completed, and solemnly inaugurated in the following year—at which occasion prodigious numbers of sacrifices were slaughtered. Thirteen years more having been spent in the construction of the 'House of the Forest of Lebanon' (the royal palace), other buildings and fortifications—among them that of Palmyra—are recorded to have been undertaken by the king, who, far from wishing further to extend his dominions, was only bent upon keeping his frontier safe from the raids of the neighboring hordes, and for that purpose alone kept up an unprecedently large army.

The fame of S. could not but spread far and near. The splendor of his court and reign, heightened by his personal qualities, his wisdom and erudition—for he was not only the wisest but also the most learned of men—brought embassies from all parts to Jerusalem to witness his magnificence, and to lay gifts of tribute at his feet. The queen of Sheba's expedition and presents are well known; and as many Arab kings made him annual presents of a no less splendid nature, his income from different sources was calculated, in round numbers, at the enormous sum of 666 golden talents. That people of Moses, which was to know no other wealth than flocks and the fruits of the soil, had suddenly become a people of wealthy merchants, of soldiers, and of courtiers—and it did not profit by the change, chiefly through the bad influence of the king himself and his court. The army and the public buildings absorbed the resources of the provinces. In the Temple, erected for the purpose of the true worship of Jehovah, S. sacrificed three times a year; but nevertheless, to please his concubines, he allowed, and perhaps himself indulged in, the rites of polytheism on the heights, thereby setting the worst example to his subjects, sufficiently eager already to worship foreign deities. His exaggerated polygamy fostered immorality and licentiousness among the people; and, worst of all, the wise and gentle monarch, as his treasure got exhausted, began, toward the end of his reign, to lay the yoke, which hitherto had lain only on his Canaanite subjects, upon the Israelites themselves. And he thus became, to all intents and purposes, an eastern despot—selling part of his dominion to raise money, and trying to break the spirit of the nation by forced services and corporal chastisements.

Left by the 'prophets,' probably since his open and revolting infidelity with regard to the national worship, his advisers were chiefly insolent young courtiers, who awed even his aged counsellors into silence, and from that time forth a storm began to gather over the land. The priests were on the side of the malcontents, and a vague talk of a general rising, which actually found utterance by a 'prophet' in the face of S., was heard throughout the country. Ahijah of Shiloh predicted, as Samuel had done to David, the partial dominion to the Ephraimite Jeroboam, who had to flee for his life to Egypt. But notwithstanding these internal mutterings, and the open revolts of one or two subject chiefs, such was the prestige both of David's and S.'s name, that the king was allowed to die in peace.

S. has been supposed to be the author of Canticles (q. v.), Ecclesiastes (q. v.), Proverbs (q. v.), besides works on Science which are said to be lost. But he is also to be considered the prime cause of the final and decisive downfall of the Jewish commonwealth for all historical times. His wisdom turned into folly, his justice into tyranny, raised a smouldering discontent which only awaited his death to break out into open flames of revolt and internal wars. His character presents the lamentable spectacle of genius gone astray; and many have been the discussions on the part of learned theologians in old and late times as to whether or not there was any hope of his 'salvation.' His name and his glory, however, will, notwithstanding the shadows that fall over his latter days, remain immortal, whether we look at the striking picture of him given in Scripture, or to the more gorgeous kaleidoscope of Eastern legends revolving round the golden name of Suleiman: the Lord and Master of all animate and inanimate beings under the sun, the most beautiful, the most wealthy of all created men, and whose wisdom was as much without limits as were his riches and power.—See for such legendary accounts of S., Weill's *Biblical Legends*, the *Targums*, the *Koran*, Lane's *Arabian Nights*, D'Herbelot, Ginsburg, Fürst's *Perlenschnüre Suleiman Nameh*, in 70 books, ascribed to a Turkish poet, Firdusi, &c.

* There is some discrepancy among investigators about this date; the beginning of his reign being fixed variously at 1009, 1025, 990, &c.

SOLOMON ISLANDS, a chain of islands in the Malay or Indian Archipelago, between New Britain on the north-west and the Queen Charlotte Islands on the south-east; lat. 4° 50′—11° 50′ S. Area estimated at 10,000 sq. m.; pop. thought to be considerable, but not ascertained. The natives are partly Negrilloes, partly Malays, and are still in the condition of savages.

SOLOMON'S SEAL (*Polygonatum*), a genus of plants of the natural order *Liliaceæ*, differing from Lily of the Valley (q. v.) chiefly in the cylindrical tubular perianth, and in having the flowers jointed to their flower-stalks. There are three Brititsh species. The COMMON S. S. (*P. multiflorum*) is found in woods and copses in many parts of England, and in a few places in Scotland. It has a stem about two feet high, the upper part of which bears a number of large, ovate-elliptical, alternate leaves in two rows. The flower-stalks are generally

Solomon's Seal (*Polygonatum multiflorum*).

branched; the flowers not large, white, and drooping.—The NARROW-LEAVED S. S. (*P. verticillatum*) is a rare British plant, only found in a few places in Scotland. The leaves are whorled.—The ANGULAR, or SWEET-SMELLING S. S. (*P. officinale*) is also rare in Britain, and is found only in England. It more nearly resembles the Common S. S., but is smaller, and has greenish, fragrant flowers. All these species are common in many parts of Europe. They are very similar in their properties. The young shoots of *P. officinale* are eaten by the Turks like asparagus. The root is white, fleshy, inodorous, with a sweetish, mucilaginous, acrid taste. It contains *Asparagin*. It is a popular application to bruises, to prevent or remove discoloration, and its use is well known to those who are too apt to get a black eye now and then. A kind of bread has been made of it in times of scarcity. The berries are emetic and purgative.

SO'LON, the most famous of all the ancient Greek lawgivers, was a native of Athens (born about 638 B.C.), and belonged to one of the most distinguished families of Attica. His father, Execestides, having seriously impaired his income by improvidence, S. was obliged while still young, to embark in trade. At first, however, S. comes before us as an amatory poet. His earliest appearance in the field of politics was occasioned by the contest between Athens and Megara for the possession of Salamis. By force of artifice, S. revived the martial spirit of his countrymen, which had sunk under the effect of repeated disasters, obtained command of a body of volunteers, and conquered the island (*circa* 596 B.C.), in which, along with others, he obtained a grant of land. Henceforth his public career is conspicuously noble and honorable. He figures as a wise and unselfish patriot, seeking earnestly, and not in vain, to compose the distractions, partly social and partly political, that rent his native city. The Athenians generally had thorough confidence in his integrity; and in 594 B.C. he was chosen archon or chief magistrate, and received unlimited permission to act as he saw best for the good of the state. In short, to borrow a phrase from Roman history, he was invested with dictatorial power. The nature and extent of the Salonian legislation has been the subject of much criticism in modern times, and Mr. Grote, in particular, has made it very clear that the 'later ancients' (Plutarch and Diogenes Laërtius), on whom we are obliged to rely for almost all our information about S., are full of confusions, misapprehensions, and contradictions, and that it became a habit among them to mythically attribute to the great Athenian every bit of wise legislation whose paternity they could not discover.

In order to alleviate the wretchedness arising from the existing relations of debtor and creditor, which was no longer supportable, and was likely to create a social war, S. proposed and carried a notable measure—the *seisachtheia*, or 'disburdening ordinance' (from *seio*, to 'shake off,' and *achthos*, a 'burden')—which received its name from its design—viz., to lighten the burden of debt that weighed down the *Thetes*, or lower classes. How this was effected, is far from being correctly explained by Plutarch, and the reader who wishes to have the most rational solution of the matter must consult Grote's *History of Greece* (vol. iii.). From redressing the greivances of a class, S. proceeded, at the solicitations of his countrymen to remodel the constitution; and here, too, the qualities that are popularly associated with his name shine out conspicuously. Abandoning the semi-civilized theory which regards the nobles as alone worthy of citizenship, and of the honors of public office in the state, he introduced the timocratic, or rather the plutocratic principle—classifying citizens according to their wealth or property; the effect of which was not to wrest *all* power or dignity from the hands of the *Eupatridæ*, or well-born class, but only to give a portion of it to others who might be as wealthy, and therefore, presumably, as intelligent and cultivated as they. Such a reform has been compared to that previously effected by Servius Tullius in the constitution of ancient Rome; and there is at least a striking resemblance in the method, if not in the design, of the two reforms. See ROME. S. distributed the citizens into four classes. The first embraced all those whose yearly income reached 500 medimni; the second, those of between 300 and 500 medimni; the third, those of between 300 and 200 medimni, and the fourth, those whose income fell below 200 medimni. The first three classes were liable to *direct* taxation; the fourth not; but all were liable to *indirect* taxation.

With regard to the *Boule*, or Deliberative Assembly of Four Hundred, it would seem that S. left it the strictly aristocratical body that he found it. Its power, however, was practically limited by a new *ecclesia*, or assembly of the four classes, whose ratification was necessary to all measures originating in the *Boule*, or 'Upper House.' On the other hand, the *ecclesia* itself could originate nothing, and thus the Attic aristocracy and the Attic plebs could mutually check each other's assumptions. The part of S.'s legislation relating to the industrial pursuits of the citizens appears to have been as excellent and well considered as the rest, but the number of his special enactments is so great that we cannot afford space to mention them. It is enough to state that they embraced almost every subject of social importance; and the best testimony to their value lies in the fact, that when Peisistratos violently overthrew the political constitution established by his kinsman, he allowed his social legislation to stand. See PEISISTRATOS.

The story of S.'s leaving Athens for ten years, after he had completed his labors as a lawgiver, and traveling into foreign countries, may be, and probably is historical, but the details are untrustworthy; and in particular, the celebrated incident of his interview with Crœsus will not suit the requirements of chronology, and must be relegated to the domain of historic myths. During his absence, the old dissensions among the Athenians broke out, and when he returned, S. struggled in vain to repress them. A strong hand, as well as a wise head, was needed, and the conspiracy of Peisistratos was quite as much one against anarchy as against the constitution. After S.'s defeat, he withdrew into private life, but occasionally assisted with his advice his bold, ambitious, and able kinsman, who had so effectively crushed the Athenian 'disorderlies' of all parties. The date of his death is uncertain.

SOLO'R ISLANDS, THE, lie east of Flores, between 122° 56′ 30″—124° 25′ E. long., and belong to the Netherlands Residency of Timor. Besides several groups of smaller islands, they consist of Solor, with an area of 105 sq. m., and a pop. of 15,000; Adanara, 302 sq. m., pop. 36,000; Lomblem, 520 sq. m., pop. 120,000; and Pantar, 275 sq. m., with 60,000 inhabitants. Solor and Adanara are separated from Flores by narrow straits, Lomblem and Pantar lie in succession further east.

Solor has little cultivated land, the natives being good sailors, and chiefly employed in fishing. Much sulphur and saltpetre are found, from which gunpowder is made. The women weave coarse fabrics for clothing, and exotic cotton has lately been planted with success. Edible nests are extensively collected. In all the villages on the coast, markets are statedly held, and numerously frequented. The natives near the sea are Malays, friendly to the Dutch, a few of them Christians, the others Mohammedans. Those of the interior are Alfoors, wild and warlike, who use shield and bow, sword and firearms. Adanara is governed by an independent rajah. It is a lovely island, having hills and dales, picturesque villages, and cultivated fields. The people are Malays, partly Mohammedans and partly Roman Catholics. Lomblem is also beautiful, the native Malays; those of Pantar being Papuans.

The S. I. are mountainous; the volcano Lobetolle, in Lomblem, is 4914 feet high; and the mountains of Pantar, 3332. They are clothed to their summits with forests. In 1851, the Portuguese relinquished all claim to these islands, which are now governed by the military commander at Larantooka, in the east of Flores; a Dutch postholder being stationed at Lawajang, the chief place of Solor.

SO'LSTICE (Lat. *solstitium*, from *sol*, sun, and *sto*, I stand), that point in the ecliptic at which the sun is furthest removed from the equator, and where he is consequently at the turning-point of his apparent course. There are two such points in the ecliptic, one where it touches the tropic of Cancer, the other where it touches that of Capricorn. The former is the summer, and the latter is the winter solstice to those who inhabit northern latitudes, and *vice versâ*.—The term is also employed to signify the *time* at which the sun attains these two points in its orbit, the 21st of June and about the 21st December.

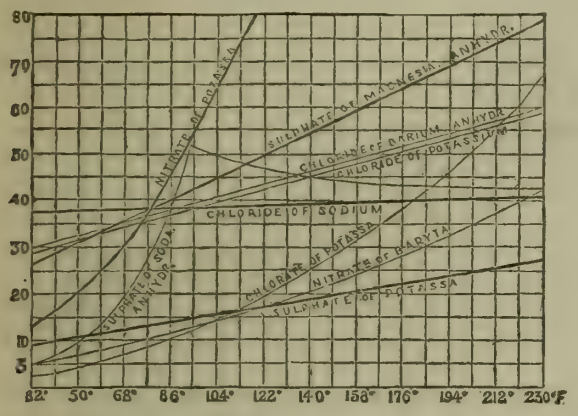
SOLT, a town of Hungary, 48 miles south of Pesth, on a branch of the Danube. Pop. (1880) 5700.

SOLU'TION. A substance is said to undergo solution, or to become dissolved, when the force of adhesion between it and a liquid in which it is immersed is sufficient to overcome the force of cohesion between the solid particles. Thus sugar or salt is dissolved by water, camphor or resin by spirit of wine, and silver by mercury. The liquid which effects the solution is termed the *solvent*, or sometimes the *menstruum;* and some solutions have special names—for example, the term *syrup* is applied to a solution of sugar in water, and *tincture* to a solution of a solid in alcohol. If a solid body be introduced in successive small portions into a definite quantity of a liquid capable of dissolving it, the first portions disappear the most rapidly, and each successive portion dissolves more slowly than its predecessor, until a point is reached at which the liquid ceases to possess any further solvent power. When this occurs, the forces of cohesion and adhesion are balanced, and the liquid is said to be *saturated*.

Solution is promoted by increasing the extent of surface in a solid, or by reducing it to powder. An elevation of temperature, by diminishing cohesion, will generally also increase the solvent power of the liquid; but there are exceptions to this rule—as, for instance, in the case of lime and its salts, water just above the freezing-point dissolving nearly twice as much lime as it does when boiling. A compound of lime and sugar, very soluble in cold

water, is separated from the solution almost completely, if heated to boiling. But the most remarkable case of the kind occurs in sulphate of soda (Glauber's salt), which in its crystalline from dissolves in about ten times its weight of ice-cold water, and rapidly becomes more soluble as the temperature rises until it reaches 91°; from this point until the solution boils, the solubility slightly decreases, the boiling liquid retaining only about four-fifths of the quantity which was dissolved at 91°. Carbonate and seleniate of soda, and sulphate of iron, exhibit the same peculiarity in a less marked degree. 'These anomalous results may be partly explained,' says Dr. Miller, 'by the consideration that heat diminishes the force of adhesion as well as that of cohesion. Generally speaking, cohesion is the more rapidly diminished of the two, although not uniformly so; and in these cases it would appear that the adhesive force decreases in a greater ratio than the cohesion of the saline particles' (*Chemical Physics*, 3d ed. 1863, p. 72).

The accompanying diagram shows the unequal solubility of various of the more common salts in water of different temperatures. The *lines of solubility* cut the verticals raised from points indicating the temperature upon the lower horizontal line, at heights proportional to the quantities of salt dissolved by 100



parts of water. For example, 100 parts of water dissolve—at 32°, 8 parts, at 122°, 17 parts, and at 212°, 26 parts of sulphate of potash. Water which has been saturated with one substance, that is, which refuses to dissolve any more of that substance, will often continue to dissolve others. In true or simple solution, the properties both of the solid and the solvent are retained. When, however, any chemical action ensues between the solid and the liquid, the resulting solution commonly presents perfectly new and distinct features; as, for example, when the metals are dissolved by acids, or oils by the alkalies (as in soap-making). For the solubility of the gases in water, we must refer to the article GASES.

The uses of solution in laboratory processes are numerous. By the difference in degree of their solubility, we can separate one substance from another; and by dissolving a body we can purify it either by filtration or crystallization. Moreover, when it is required that two bodies shall react on one another, they do so with incomparably more force in their dissolved than in their solid state.

SOLVENT. See SOLUTION.

SOLWAY FIRTH—in its upper part best regarded as the estuary of the river Esk; in its lower, as an inlet of the Irish Sea—separates the north-west of Cumberland from the south of Scotland. Its entire length, until lost in the Irish Sea, is calculated at 33 miles; its average breadth for the first 12 of these is not more than 2¼ miles, but afterwards it gradually, although irregularly, increases to upwards of 20. The principal rivers flowing into it, besides the Esk, are the Annan, Nith, Dee, and Urr, from the north or Scottish side; and the Eden and Derwent from the south or English side. The most striking feature of the S. F. is the rapidity with which its tides ebb and flow. The spring-tides are peculiarly swift and strong—the wave rushing in from 3 to 6 feet high, and at the rate of 8 to 10 miles an hour, occasionally inflicting serious damage on the shipping; while after it has retreated, great stretches of the bed of the firth are left bare, and in some places one can even cross over from the English to the Scottish shore. The salmon-fisheries of the Solway are valuable.—*Solway Moss* is a district of Cumberland about 7 miles in circumference, lying west of Longtown, and immediately adjoining Scotland. As its name implies, it was once a bog, but is now drained and cultivated. It is historically notable as the scene of a battle between the English and Scots in 1542, when the latter were defeated. Here also, on 13th November 1771, an extraordinary disaster occurred. The boggy ground, surcharged with moisture—the effect of heavy rains, rose, swelled, and burst like a torrent, sweeping along with it trees and houses, and destroying some 30 small villages.

SOLYMAN (SULEIMAN) II., surnamed 'THE MAGNIFICENT,' the greatest of the Turkish sultans, was born in 1496; and in September 1520, succeeded his father, Selim I. (q. v.), who had carefully initiated him into the secrets of Ottoman policy. At the commencement of his reign, he restored a large amount of unjustly confiscated property, and removed from office all who were unfit for the proper discharge of their duties. After having suppressed the revolt of the governor of Syria, he exterminated the Egyptian Mamelukes, and concluded a treaty with Persia. The foolish insolence of the Hungarian court next drew him thither with a powerful army, and Belgrade, the key of that country, was captured (1521). He next drove the Knights of St. John from Rhodes (1522) and for three years following, devoted himself to improvements in the administration; but his attempts at military reform provoked a rebellion of the janizaries, which he saw no other means of quelling than by engaging them in a war with Hungary. He gained the signal victory of Mohacz (1526), and continuing his resistless course, took Buda and Pesth; but he was recalled by the news of a rebellion in the east, and retreated down the Danube to Constantinople, committing frightful ravages on the way. In 1529, he was summoned to Hungary in aid of his protégé, King John Zapolya, who was contesting the crown with Ferdinand, and accordingly invaded that country with a mighty army, capturing and destroying as he went, and laid siege to Vienna, but after various unsuccessful assaults, he was compelled to retreat. Two years afterwards (1531), he again appeared in Hungary; but his progress this time was checked by Charles V. in person, who had come with the imperial army of 250,000, in aid of his brother. In 1535, he concluded with Francis I. the famous treaty which opened the commerce of the Levant to the French flag alone.

In 1540, the long and desultory contest between the Turks and Imperialists for Hungary was ended in favor of the former, who took complete possession of the country. After this, the alliance between the French and Turks began to bear fruit; the combined fleets ravaged the Italian coasts, and pillaged Nice (1542); but peace was again restored with Germany in 1547. The Turks were now supreme in the Mediterranean; Gozzo and Tripoli fell into their hands, and the conquest of the Banat of Temeswar (1551) assured them a firm hold over Hungary. A second and third war with Persia, which was now in a state of semi-subjugation, the bloodthirsty ambition of his favorite wife Roxolana, who succeeded in persuading him to put to death the children of his other wives, a brilliant naval victory (1561) over the Knights of Malta and their allies the Spaniards, an unsuccessful blockade of Valetta in Malta (1565), and a fresh expedition to Hungary (1566), were the chief events of the remainder of his reign. During this last expedition, while besieging the little town of Szigeth or Szegedin, which resisted all his attacks, he died on the 5th September 1566.

SOMA ('the moon-plant,' or *Asclepias acida*) is, in the Vedic hymns, the god who represents this plant, and one of the most popular deities of the Vedic religion. The reason for this popularity must be sought for in the important part which the juice of the Soma-plant played in the great Vedic sacrifices, and probably also in its alcoholic and invigorating properties, which the sacrificer experienced when he drunk of it in the exercise of his functions. These properties are constantly described or alluded to in the hymns addressed to Sôma. Thus, in some hymns, S. is said to exhilarate Varuṇa, Mitra, Indra, and the other gods who partake of its juice; and in another, the worshipers exclaim: 'We have drunk the Soma; we have become immortal; we have entered into light; we have known the gods. What can an enemy now do to us, or what can the malice of any mortal effect?'

In other passages, the juice of the Soma is said to be a draught of immortality, medicine for the sick, and a remedy for blindness and lameness. Thus S. became endowed with supernatural qualities and divine attributes, and gradually was exalted as one of the most powerful deities. He is the friend, helper, and soul of Indra; he is the slayer of the cloud-demon Vṛ'tra, the destroyer of foes, the dispeller of darkness, the creator of the sun, the upholder of the sky, and the sustainer of the earth, the king of gods and men; he is thousand-eyed, the most heroic of heroes; he is wise, strong, energetic, &c. See the interesting article on S. by John Muir, in his 'Contributions to a Knowledge of the Vedic Theogony and Mythology,' in the *Journal of the Royal Asiatic Society*, new series, vol. i. pp. 135, ff. In the classical period of Hinduism, S. ceases to be worshiped in the character which he has at the Vedic period; he then becomes the god of the moon. This transition from Soma, the plant and its juice, to Soma, the moon, which is perceptible even as early as in the S'atapatha Brâhmana of the White Yajurveda (see VEDA), is apparently due to the belief, that *Amṛ'ta*, the beverage of immortality, was guarded by the moon, and to the circumstance that, in the Vedic hymns, S. is frequently called or described as *Amṛ'ta*. The myths con-

nected with Soma, the moon, are wholly different from those relating to the Vedic Soma. As moon, S. was born from the eyes of Atri, a son of Brahman, the first god of the Trimûrti (q. v.); and became installed by Brahman as the sovereign of plants, Brâhman'as, and planets. But after he had acquired extensive dominion, he became arrogant and licentious, and carried off Târâ (lit., a star), the wife of Vr'ihaspati, the preceptor of the gods. Vr'ihaspati seeking to recover his bride, and some of the gods siding with him, and others with S., a war broke out, which ended in Târâ's being restored to her husband. The result, however, of her stay with S. was the birth of a son named Budha, who became the ancestor of a dynasty of kings, called the lunar dynasty. See SURYA.

SOMA'LI LAND, an extensive maritime country in the east of Africa, is triangular in shape, and is bounded on the N. by the Gulf of Aden, on the S.-E. by the Indian Ocean, and on the S.-W. by the Jub River. From the middle course of the Jub to Cape Guardafui, which forms the apex of the triangle, the distance is nearly 900 miles. The area of the country is estimated at 330,000 sq. m.; but as great part of its interior still remains unexplored, the number of its inhabitants has not been ascertained. The land is elevated and mountainous in the north, and slopes in terraces towards the south. The Jub, which forms the south-west boundary, is a large fertilizing stream, drawing its waters from the mountains of Southern Abyssinia, and flowing south-east between the territories of the Gallas on the west, and those of the Somali on the east, to its mouth on the northern frontier of Zanzibar.

The present Somali race were originally Arabs, who landed on the African shore south of the Gulf of Aden early in the 15th century. Driving back the earlier inhabitants of the country, who were Christians, the Moslem made themselves masters of the country. The inhabitants are extremely violent and quarrelsome in their disposition, are notorious for cheating and lying, and for the most part pursue a wandering, pastoral life. The chief trading-place is Berbera, on the north coast; and the products of the country are sheep, cows, ghee, grass-made mats, ostrich-feathers, and hides. These are exchanged at the ports for cloth, dates, rice, beads and iron.—*What led to the Discovery of the Nile*, by Captain Speke (Edin. 1864).

SOMBRERE'TÉ, a town of Mexico, in the state of Zacatecas, and 90 miles north-west from Zacatecas, in a mountainous district celebrated for its rich silver mines, from which S. derives all its importance. Pop. 14,000.

SOMERSET HERALD. See HERALD.

SOMERSET HOUSE, in the Strand, London, stands on the site of a palace built by the Protector Somerset about 1549, which fell to the crown on Somerset's execution. The original Somerset House was pulled down and rebuilt in 1776, after designs by Sir William Chambers, in the Palladian style. The building accommodates various government and other public offices; the general registers of births, deaths, and marriages are now kept here. The finest front is towards the river.

SOMERSETSHIRE, a maritime county in the south-west of England, is bounded on the N.-W. by the Bristol Channel, and touches Devon, Dorset, Wilts, and Gloucester. Area, 1,049,815 acres. Pop. (1871) 463,483; (1881) 469,010. Its form is oblong, its length being about 80 miles, and breadth about 36. The surface is extremely diversified, there being every variation, from lofty hills and barren moors to rich vales and marshy 'levels,' many thousands of acres of the latter being below high-water mark, and depending for security on sea-banks and sluices. The hills are divided into several ranges running from east to west. One range, known as the Mendips (q. v.), runs from near the city of Wells to the coast at Brean-down. South of these hills is a vast marshy plain, on which the Polden Hills stand out abruptly, like an island. Another conspicuous group, called the Quantocks, rise near Taunton, and attain a maximum elevation of 1270 feet. And finally, in the extreme west, is the wild district of Exmoor Forest, composed almost entirely of barren hills, the highest of which, Dunkery Beacon, is 1668 feet above the sea-level.

The rivers of the county rise chiefly in these high grounds, and are none of them of any magnitude, except the Bristol Avon, which rises in Wiltshire, and for some miles divides S. from Gloucestershire. The Parret drains the middle districts, and is a tidal stream up to Bridgwater, presenting at spring-tides the peculiar phenomenon called the 'bore.' The soil is mostly fertile, and the pasture-lands are almost unrivaled for their luxuriance. The wheat and barley grown around Bridgwater are famous; but grazing and dairy-farming form the great objects of husbandry, and the cheese of Cheddar has a great reputation. Cider is also produced in enormous quantities, but owing to the prevalence of small farms, agriculture is in a backward state. The hilly districts are rich in minerals, especially iron, with some lead and calamine; and the Radstock and Bedminster coal-fields supply the northern districts with excellent fuel. Oolite is largely developed in the neighborhood of Bath, where a beautiful building-stone is extensively produced. The principal manufactures are woollen cloth, coarse linens, lace, silk, and gloves; but these industries are not progressive, and the pop. of S. is diminishing largely in the rural districts.

The medicinal springs are an important feature of the county, having been the means of bringing into celebrity and sustaining the splendor of Bath (q. v.). Weston-super-Mare, containing at the beginning of the century a few hovels, is now one of the finest watering-places on the western coast. S. is divided into three districts for electoral purposes, and returns six members to the House of Commons. The parliamentary boroughs are Bath, Taunton, and Frome—Bridgwater having been recently disfranchised for corrupt practices. In ancient times, this part of the kingdom was inhabited by the *Belgæ*, and the Mendips appear to have formed so strong a barrier against the Roman and Saxon, that, even to this day, philologers can trace the strong Celtic element that held its ground here. British camps are very numerous on the hills; and extensive remains of stone circles are visible at Stanton Drew, near Bristol. In Saxon times, S. was one of the earliest counties to embrace Christianity; and while a church was founded at Wells in 704, on the site now occupied by the fine cathedral, a monastery was founded at Glastonbury, which eventually became one of the wealthiest in the kingdom. S. was the principal arena of the rebellion of the Duke of Monmouth, in 1685.

SOMERVILLE, MRS. MARY, a lady famed for her mastery of mathematics and physical science, was the daughter of Admiral Sir William Fairfax. She was born at Jedburgh on 26th December 1780, and brought up at Burntisland, amid somewhat narrow family circumstances. Her mother taught her to read; but besides this, she had no education till she was nine years old. At ten, she went for a year to a school at Musselburgh; and on her return, took more delight in reading whatever came in her way than in sewing, to the great discomfort of her relatives. After she was thirteen, she twice had, during a sojourn in Edinburgh, an opportunity of attending classes, studying music, drawing, and a little Latin, and of mixing with Edinburgh society. It is somewhat singular that it was in an algebraic sum in a magazine of fashions that Mrs. S. first made her acquaintance with the subject that most engrossed her attention later in life. In 1804, she married Mr. Greig, a commissioner in the Russian navy, and removed to London. Although Mr. Greig did not prevent her from continuing her studies, he himself had no interest in science, and had the usual prejudices against learned women. It was not till her return north as a widow, after three years of married life, that she was free to buy the books she wanted, and to study the subject that most interested her. She was now 33 years old, with two children.

In 1812, she married her cousin, Dr. William Somerville, who entered warmly into all her ideas. Her husband and she removed to London in 1816, where Mrs. S. went much into society, and became known as possessed of scientific interests and gifts. In 1823, Mrs. S. was invited by Lord Brougham to try to popularize, for the English public, Laplace's great work, the *Mécanique Céleste*. This she was persuaded to undertake, and published it as the *Celestial Mechanism of the Heavens*, in 1830. The work was received with the greatest admiration. Mrs. S. was awarded a royal pension in 1855. *The Connection of the Physical Sciences* was published in 1835, and has passed through nine editions. Her next work was *Physical Geography* (1848), of which there have been six English editions. *Molecular and Microscopic Science* appeared in 1866. Mrs. S., who for many years resided in Italy, died at Naples, 29th Nov. 1872, having maintained till the end the perfect use of her faculties. An autobiography, edited and supplemented by a daughter of Mrs. S., was published in 1873.

SOMERVILLE, a city of Massachusetts, U. S., 2 miles north-west of Boston. Many of its inhabitants are business men from Boston; but it has some manufactures, bricks, leather, iron, carriages, and glass. Pop. (1870) 14,685; (1880) 24,985.

SO'MMA, a town of Southern Italy, at the northern base of Mount Vesuvius. Pop. 7400.

SOMME (anc. *Samara*), a river of Northern France, rises in the dep. of Aisne, and falls into the English Channel. Its entire length is about 120 miles, of which one-half is navigable.

SOMME, a maritime dep. in the north of France, south of Pas-de-Calais, and north-east of Seine-Inférieure. It has an area of 2377 sq. m., and a pop. (1881) of 550,837. S. is for the most part quite level, and in some parts marshy. The dep. produces abundance of corn and fruits; cattle are reared; and there are manufactures.

SOMNAMBULISM (Lat. sleep-walking). Walking in sleep is the most palpable, but not the most marvelous characteristic of this condition. The person affected walks, rides, climbs, with the eyes shut or insensible; his movements are precise, cautious,

leading him into positions of difficulty and peril, which, if perfectly alive to their real nature, or if acting under the influence of ordinary motives, he would avoid; and yet there appears to be a partial consciousness of surrounding objects, and an adaptation to circumstances. Individuals have, while in this state, performed long journeys on foot or horseback, paying tolls, avoiding obstacles; they have successfully descended into coal-mines; they have ascended in safety to the roofs of houses, have climbed rocky cliffs, and successfully robbed eagles' nests, during the night; millers, saddlers, grooms, seamstresses, have all performed their customary work with perfect exactitude, but without any recollection of their exertions or industry. Notwithstanding the accuracy with which many acts are performed, that particular senses may be dormant is proved by insensibility to loud noises, and by a cook eating cabbage which had been substituted for a salad which he had carefully and artistically prepared. The senses, in relation to the idea or train of ideas present to the mind, appear to be awake, and preternaturally acute.

This fact has suggested the hypothesis, that certain faculties are wakeful, open to impressions, and actuated by volition; while others, and the mind in general, are plunged in profound sleep and unconsciousness. This may be true, and is in harmony with the opinion, that the phenomena are an acted dream or delusion, and that what is seen, heard, or done, is the mere embodiment or repetition of former impressions or impulses, at the time before the mind. This may be illustrated by the case of the student narrated by the Archbishop of Bordeaux, who composed a sermon and wrote out music while asleep; read them over, made corrections, scratched out lines, substituted others, put in its place a word that had been omitted, and continued to do all this, although a sheet of pasteboard was interposed between the writing and his face; showing that he was copying mental images, and not with the eye.

Somnambulism occurs in the sensitive and excitable, often in conjunction with other nervous affections, and is hereditary; so that it may be regarded as on, if not within, the boundary of disease.—Macnish, *Philosophy of Sleep;* Binns on *Sleep.* See also the article ANIMAL MAGNETISM, and the works there referred to.

SOMNAU'TH, or SOMNATH-PUTTEN, a town of Guzerat, in Hindustan, is situated on the south-west coast of the peninsula of Kattywar (q. v.), about 33 miles from its southern extremity, and has at present a pop. of 5000, most of whom are Mohammedans. The town is fortified by a strong stone wall 9 feet thick, strengthened by 38 towers; it contains many mosques, and the ruins of the celebrated Hindu temple of the idol Somnauth. The ruins of the temple are in a state of fair preservation, and give the idea of its having been a gloomy, massive temple in the form of an oblong hall 96 feet by 68 feet, crowned by a magnificent dome, and covered on the inside and outside with elaborate sculpture and carving illustrative of mythological subjects. The splendor of this temple has doubtless been much exaggerated by various travelers; but a thousand years ago it was so famous as a place of pilgrimage for pious Hindus, as well as for its immense wealth—the accumulations of centuries of presents—that it attracted the zealous idol-destroyer, Mahmud of Ghizni, after he had accomplished his self-imposed mission of conquest, spoliation, and conversion in the rest of Northern India. In 1024, he appeared before S., drove its defenders—who at first had been buoyed up with sanguine hopes that their favorite god had drawn the Mohammedans hither that he might blast them with his wrath—to take refuge in the temple, where they defended themselves with such valor, that Mahmud's army was forced to retreat; but the subsequent rout of two Hindu armies which had advanced to the aid of the sacred city, so dispirited the defenders, that S. was immediately surrendered, the idol destroyed, and the enormous wealth of the temple, consisting chiefly of precious jewels, carried off, along with the gates of the temple.

These gates, which are said to have been made of sandal-wood, were brought back from the entrance to Mahmud's tomb in Afghanistan by the British in 1842, and their recovery announced in a magnificent proclamation, which called upon the chiefs of Sirhind, Rajputana, Malwa, Guzerat, to transmit them 'with all honor' to the place whence, eight centuries ago, they had been violently removed. They were, however, never restored to S., as the home authorities disapproved of the tenor of the proclamation, fearing that it might stimulate religious animosity betwen the two great religious bodies of Hindustan. There was also reasonable ground of doubt as to whether the gates were really the original gates of S., and even whether (since the *Ferishta* does not mention the circumstance) Mahmud had taken away any gates. The repute of S. as a place of religious pilgrimage, and its wealth, revived some time after its spoliation by Sultan Mahmud, to such an extent as frequently to attract the various Mohammedan robber-princes of Western India; and it is still at the present day a chief resort of pious Hindus from all quarters, who pay a small tribute to the Guicowar for liberty to perform their devotions at this favorite shrine.—See Price's *Mohammedan History*, vol. ii.; Dow's translation of the *Ferishta*; Mirkhond's *Rauzat-al-safa;* Sir John Malcolm's *History of Persia*, vol. i.; and Smith's *Life of Dr. John Wilson* (1878).

SONA'TA, a musical composition for a solo instrument, sometimes accompanied by one or two other instruments, consisting of three, four, or even more movements; these movements usually consist of a subject or subjects, given out first in the key of the dominant, and after certain episodes, in which these themes are presented in a great variety of aspect, they are repeated in the key of the tonic. This form is in general most closely adhered to in the first movement of a sonata, and exhibits great room for a display of the inventiveness and musical resources of the composer. The second movement is generally slower and shorter than the rest, and often in the form of a theme with variations. The most important compositions of this kind are for the pianoforte, many of which have been written by Haydn, Mozart, Beethoven, Clementi, Dussek, and other masters.—A short sonata with two or at most three movements, less elaborately worked, is called a *Sonatina.*

SO'NCHUS. See SOW THISTLE.

SO'NDERSHAUSEN, the chief town of the principality of Schwarzburg-Sondershausen, pleasantly situated on the Wipper, 36 miles north-west of Weimar. Pop. (1880) 6110.

SONG, a short poem adapted to vocal melody. The word is generally applied to the poetical and musical composition in union, but sometimes to one or other separately. The poem generally turns on some single thought or feeling, and is divided into portions of returning measure. The term song, properly implying an air of a simple kind, is often, though not very correctly, applied to the elaborate *aria* of the opera, or the solemn air of the oratorio. A song generally implies an air for a single voice—airs for more than one voice being, however, sometimes called part-songs. England produced in the course of last century a large number of beautiful songs. Of the numerous songs which are continually appearing in this country at the present day, extremely few have musically much merit, and in a large proportion of cases the words are of a silly and insipid description. Germany has of late produced a larger proportion of beautiful songs than any other country. Amongst songs, not the least interesting are the national and popular airs of different countries, generally of uncertain date, and almost always possessed of much character.

SONG OF BIRDS. All birds have some voice or cry which they utter, and some of them various notes appropriate to various occasions. The power of producing clear and sweet musical notes is chiefly found in certain families of the order *Insessores;* some of which, as the lark, pour forth their song in the air; but the greater number, like the thrush and nightingale, sit whilst they sing. The compass and variety of notes, the power of trilling and shaking, the loudness, clearness, and sweetness of the song, differ very much in different species, each of which may be as perfectly recognized by its song as by its form or plumage. There are also, as is well known, great differences among individuals of the same species, and Mr. Jesse asserts his confidence that there are notable differences between the song of the birds of the same species generally in one district and in another, just as there are provincial dialects and modes of pronunciation in human speech. 'The song, for example, of a thrush near London, or in any of the home counties, has little resemblance, except in specific character, to that of the same bird in Devonshire or near Exeter. The same notes, I suppose, will all of them be detected, but they are arranged for the most part into a different tune, and are not sung in the same way. They are given with different values, and the singing is pitched in a different key.'

The singing of birds is chiefly connected with the love-season; although some birds sing at other seasons also, during fine weather, and when food is abundant, as if merely to utter their happiness, and by uttering, to increase it. It is during the pairing-time that they are most vocal; the singing of many is continued with frequency also during the period of incubation, but with some change of character, exhibited in a marked degree by the chaffinch. The male alone sings. Female birds have voice also, but cannot warble like their mates. The song of birds is not produced by the larynx proper, but by the *syrinx* or lower larynx, a distinct organ.

There can be no doubt that the singing of the male bird is intended to attract and please the female, and that he delights in this display of his own powers. In this respect there is no difference between the birds of most melodious song and those of harsh discordant voice. In them may be also seen an emulation which is ready further to display itself in combats. But questions of rivalry seem in part to be decided amongst some of the songsters of the groves by mere musical displays. The song of birds is accordingly made to play an important part in the theory of evolution by natural selection. Caged birds evidently often sing from emulation.

The imitative powers so remarkably possessed by the mocking-bird and a few other species, are to some extent possessed by many birds. It is said that canaries may be taught to sing a complete tune from a musical box, adjusted to play one tune only.

SONGHAY, a former kingdom of Africa, extended both east and west of the river Niger below its great bend. Its king embraced Islam in the 11th century. In 1468, the ruler of S. conquered Timbuktu and the surrounding state. Under Háj Mohammed Askia, at the end of the 15 c., the S. empire extended from Hausa almost to the shores of the Atlantic, and from lat. 12° N. to the confines of Morocco. After many years of civil war, this great empire became a province of Morocco in 1607. It is now partly independent. Gagho, its capital, was at the time of Barth's journey a mere village. S. is also spelled *Sonrhai*.

SONNET, a poem which expresses one idea, mood, or sentiment, and usually extends to fourteen decasyllabic lines, with a somewhat intricate arrangement of rhymes. It is admittedly one of the most refined and intellectual forms of poetic expression. Every sonnet should be full and complete, though terse; and be firmly but gracefully rounded off. The oldest extant specimens of the sonnet are those of Vernaccia, of the 12th, and Peter delle Vigne, who lived in the 13th c.; but it received its highest finish at the hands of Dante and Petrarch. Early in the 16th c , Sir Thomas Wyatt and the Earl of Surrey introduced the sonnet into English literature, and Sidney, Spencer, Shakspeare, Daniel, Drayton, Drummond, extended its use and scope. In the early Italian models, the first eight lines make two quatrains, and the remaining six, two tercets. The quatrains have two rhymes, usually arranged so that the 1st, 4th, 5th, and 8th lines rhyme, as also 2d, 3d, 6th, and 7th. In the tercets great liberty is allowed; but there are generally three rhymes, and they are never arranged in couplets.

There is no Italian precedent for the freedom taken by the English poets before Milton, including Spenser and Shakspeare, of making the sonnet simply a poem of three quatrains, with alternate rhymes, and a rhyming couplet (the common 'illegitimate' form). Some writers call a poem of several pairs of rhyming couplets a sonnet, and there are also so-called sonnets of thirteen or fewer lines. Most of Milton's sonnets are a close approach to the true Italian type. Gray, Warton, and Bowles revived this form of poetry, and Wordsworth contributed about four hundred sonnets to our literature. Coleridge, his son Hartley, Keats, Shelley, Procter, Mrs. Browning, C. (Tennyson) Turner, Sidney Dobell, and D. G. Rossetti, are known as sonnet writers. See *The Sonnet*, by Tomlinson (1874), and the notes in the collections named below. Anthologies of the sonnet are numerous: Henderson's *Petrarcha* (1803); Capel Lofft's *Laura*, 5 vols. (1814), in six languages; and collections of English sonnets by Dyce (1833); Lees (1867); Dennis (1873); Main (1880); Waddington (1880–82); and Caine (1882).

SONNINI DE MANONCOURT, Charles Nicolas Sigisbert, an eminent French traveler and naturalist, born in 1751. Besides a residence for some years at Cayenne, he traveled in Egypt, Greece, the Archipelago, and Asia Minor. He made many valuable researches in natural history, and published several works, the chief being *Voyage dans la Haute et dans la Basse Egypte* (1799), and *Voyage en Grèce et en Turquie* (1801). S. died at Paris in 1812.

SON OF GOD. Considered from the side of dogmatic theology, the phrase Son of God denotes the Second Person of the Trinity (q. v.). If we examine the use of the name in the Scriptures, we find it to have been applied by Jesus to himself, and given to him by his disciples, to express the mysterious relationship in which he stood to God. The phrase was one not altogether unknown to the Jews. The plural 'sons of God,' occurs several times in the Old Testament; in some cases it is applied (tropically) to angels, in others to the children of Israel, and in their collective capacity as the favored nation, they are twice called by God his 'son' (Ex. iv. 22, 23; Hosea xi. 1). The use made in the New Testament of the famous passage of the 2d Psalm ('Thou art my Son; this day have I begotten thee') is thought by some to constitute conclusive evidence that the spiritually-minded among the ancient people recognized a 'Son of God.' It has been argued, however, that if the Hebrews generally, or even their spiritual leaders, had believed the Messiah to be the 'Son of God' in any other sense than that he was prophetically filled with the Spirit of God, both the idea and the phrase would have played a far more prominent part than they do in the religion and literature of the nation. Nor does it appear that the idea of a 'Son of God' (in the divine sense) had rooted itself in the Hebrew mind. Hence, we find that the assumption of the title by Jesus provoked the bitterest opposition on the part of the great majority of his countrymen.

They did not hate him because he claimed to be the 'Messiah,' the 'Christ;' on the contrary, they were prepared to accept as such any teacher whose words or works might seem to them to justify his pretensions to the dignity; but when Jesus claimed to be the 'Son of God,' equal and one with the Father, they sought to stone him. It was, in fact, this assertion of his divinity that cost Jesus his life.

SONO'RA, a frontier state in the north-west of Mexico, bounded on the N. by the United States' territory of Arizona, and on the W. by Lower California and the Gulf of California. Area, 83,404 sq. m.; pop. (in 1873) 109,388. Several fine bays indent the coast; lagoons occur near the shore; and in the western part of the state there are several lakes. The great system of the Andes skirts the eastern frontier, and throws off branches which occupy much of the surface of the state. In the west, the surface is mostly flat, with a fertile soil, and a warm but variable climate. The chief rivers are the Rio Colorado, Sonora, Yaqui, and Mayo. Two abundant crops are gathered every year from the same land; and the principal crops are wheat, maize, peas, and beans; though tobacco, sugar-cane, and cotton are also grown. But the wealth of the state is not in its agricultural capabilities, but in its mineral treasures, which are considered inexhaustible, especially gold and silver. Cattle rearing is extensively carried on.

SONSONA'TÉ, a town of Central America, in San Salvador, and 40 miles west-north-west of the city of that name. Pop. about 10,000 inhabitants.

SONTAG, Henrietta, an eminent German vocalist, was born in 1806, and educated for the stage. After a brilliant operatic career at Vienna, Berlin, Paris, and London, she married Count Rossi in 1829, and left the stage in 1830. Compelled by pecuniary difficulties to reappear in 1849, she met with renewed success both in Europe and America. She died in Mexico in 1854.

SOO-CHOW, or SU-TCHOU, or SOO-CHOW-FOU (*fou* merely signifying *city*), a large city of China, in the province of Kiang-su, 60 miles west-north-west from Shanghai. It stands near the Grand Canal which connects Hang-chow with Nanking and Pekin, but its port is Shanghai, with which also it has water-communication. It is about ten miles in circumference, and is enclosed by fortifications, outside of which are four very large suburbs. The country around S. is level, and remarkable for its fertility, so that the Chinese speak of it as a terrestrial paradise. The city has silk manufactures, printing establishments, and a large trade in books. In 1857, S. was captured and sacked by the Taepings. In 1863, it was invested by the Imperialists, under a British officer, and the rebel chiefs having surrendered, were treacherously beheaded by the governor of the province.

SOOLOO' ISLANDS. See Sulu Islands.

SOO'SOO (*Platanista Gangeticus* or *Soosoo, Gangeticus*), a cetacean of the Dolphin family, inhabiting the Ganges, and most abundant in the sluggish waters of its delta, but found also as far up the river as it is navigable. It is supposed to be the *Platanista*

Soosoo (*Platanista Gangeticus*).

of Pliny. It is the only known existing species of its genus, and is interesting as a fresh-water cetacean. It attains the length of about 12 feet, and is not unlike the dolphins in its general form. The habits of the S. are sluggish, except that in pursuit of prey it moves with great energy and rapidity. The flesh resembles lean beef, but is never eaten by the Hindus who, however, set a great value on the fat, which lies between the skin and the flesh, as an external medicinal application. There are several fossil species of this genus.

SOOT is that portion of fuel which escapes combustion, and which is mechanically carried up by the current of hot air, either to be deposited on the sides of the chimney, or to be discharged into the atmosphere. The soot of coal and that of wood in all probability differ materially, the former containing more carbonaceous matter and more ammoniacal salts than the latter. Braconnet published an elaborate analysis of the soot of wood; but good recent analyses of both kinds of soot are still required. Both kinds are used as manure; and wood-soot, under the title *Fuligo Ligni*, was formerly contained in the British Pharmacopœias. According to Neligan, it has been found most efficacious in the latter stages of hooping-cough in children, and in some forms of hysteria; and he gives directions for the preparation of a Decoction, an Extract, a Spirit, and a Tincture. See Neligan's *Medi-*

cines, &c. (6th ed., p. 53). Contact with soot often gives rise to a peculiar form of cancer, which is consequently known as *Chimney-Sweepers' Cancer*.

SOPHI'A, a town of Bulgaria, 170 miles north-west of Adrianople, in a beautiful plain on the river Isker. Besides about 30 mosques, it contains several Christian churches, is the see of a Greek and a Roman Catholic archbishop, and carries on manufactures of cloth, leather, silk goods, and tobacco. Its hot springs and baths are highly esteemed. Pop. 24,000. S. occupies the site of the ancient Sardica.

SOPHIA, St., Church and Mosque of, a celebrated structure at Constantinople, long an object of great interest to all visitors of that city. It was originally built by the Emperor Constantine in 325—326, on occasion of the translation of the seat of empire to Byzantium; and is so called as being dedicated, not, as commonly supposed, to a saint of that name, but to the *Hagia Sophia* (Holy Wisdom), that is, to the Eternal Wisdom of God or the Logos, the Second Person of the Trinity. The building of Constantine was subsequently rebuilt and enlarged by his son Constantius; and this second church of Constantius having been destroyed in 404, was rebuilt by Theodosius the Younger in 415; and it lasted unaltered till the celebrated Nika Sedition, or Battle of the Factions of the Circus, under Justinian, in 532, in which it was totally destroyed. The present building is substantially that which was erected by Justinian in expiation of this sacrilege. It occupied less than seven years in its erection, and the history of the work and of the details of its material and construction are full of marvels. Ten thousand workmen are said to have been employed upon it. The materials were supplied from every part of the empire, and comprised remains of almost every celebrated temple of the ancient paganism. The sedilia of the priests and those of the patriarch were of silver gilt. The dome of the tabernacle was of pure gold, and was surmounted by a gold cross weighing 75 lbs., and encrusted with precious stones. All the sacred vessels and other apparatus were of gold.

The altar-cloths were embroidered with gold and pearls; and the altar itself was composed of a mass of molten gold, into which were thrown pearls, sapphires, diamonds, onyxes, and every other object which could raise its costliness to the highest imaginable degree. The total cost of the structure is stated by the ancient authorities at 320,000 *pounds*. Some regard this as pounds-weight of silver, others as of gold. One of the latest writers on the subject, Mr. Neale (*Eastern Church*, vol. i. p. 237), adopts the latter estimate, and thus computes the cost at the enormous sum of £13,000,000!

The building may be described as a square of 241 feet, forming interiorly a Greek cross, and surrounded in the interior by a woman's choir or gallery, supported by magnificient pillars, for the most part borrowed from ancient buildings. In the center rises a dome, which is supported by two great semi-domes, which in their turn rest upon smaller semi-domes, the whole presenting a series of unexampled beauty. The height of the dome is 175 feet. The building is approached by a double porch, which is about 100 feet in depth. The whole of the interior was richly decorated with sculptured marble and mosaics. Even in the reign of Justinian, a further reconstruction of the building became necessary, the dome having fallen in, on an earthquake; but this may be said to have been the last important change in the structure within the Christian period of Constantinople.

On the occupation of that city by the Turks in 1453, St. S. was appropriated as a mosque. All its purely Christian fittings and internal structures were swept away. The Christian emblems were either mutilated or covered up from view by a coating of plaster. The latter course was adopted throughout the building in the case of mosaic pictures containing representations of the human figure, which the Koran proscribes as unlawful, and thus the original mosaics of the Justinian era have in great part escaped destruction. About the middle of this century, the sultan Abdul Medjid having ordered a complete restoration of the building, these mosaics were accidentally brought to light, and, with the consent of the sultan, artists were sent out from Berlin, who, with the assistance of the architect employed by the Turkish government, made accurate copies of all these interesting relics of antiquity, which have been published at the expense of the Prussian government by Salzenburg, the artist thus employed by the king. The interior of the building at present is very judiciously restored for Mohammedan worship, the Christian decorations being again carefully covered up, coated with plaster in imitation of mosaic-work. Like all mosques, St. S. is closed against Christian visitors except upon special firman, which, however, is easily obtained. The weight of the dome has more than once threatened to crush in the substructure, rendering repairs necessary.—See Von Hammer's *Constantinopolis* (1882); Salzenburg's *Alt-Christliche Baudenkmale Konstantinopels* (1854); Hughes, *Aya Sofia Constantinople* (London, 1854); De Amicis, *Constantinople* (transl. from 7th Italian edition); W. Besant, *Constantinople* (1879).

SO'PHISTS. The Sophists were the leading public teachers in ancient Greece during the 5th and 4th centuries B.C., and their character has been a subject of much dispute. Most of the historians of philosophy—influenced seemingly by the lampoons of Aristophanes, the comic poet, and by the disparaging remarks of Socrates, Plato, and Aristotle, who stood in a quite different position from the teachers by profession—represent the Sophists as 'ostentatious impostors, flattering and duping the rich youth for their own personal gain, undermining the morality of Athens, public and private, and encouraging their pupils to unscrupulous ambition and cupidity.' Mr. Grote, in his *History of Greece*, chap. lxvii., has combated these positions, and given a much more favorable view of the Sophists.

A Sophist, in the original sense of the word (derived from *sophos*, wise or learned), was a wise man, a clever man, one who stood prominently before the public for intellect or talent. Solon and Pythagoras are called Sophists; the name was applied even to great poets. Socrates was repeatedly so designated; Plato is alluded to by the same title. By the general public, any man of intellectual eminence would be spoken of as a Sophist. With the feeling of admiration towards the intellectual class, there was mixed up a certain invidious sentiment, from whatever cause arising; and the name Sophist being often used to express the dislike as well as the admiration, came ultimately to have a predominating bad sense. Still the general public, in the use of the word, comprehended Socrates, Plato, and Aristotle, and their philosophical disciples and followers, equally with the professional teachers.

The great intellectual start made in Greece during the 5th c. B.C., led to an advanced standard of general instruction. There had been an established popular education long before—including music, reading, and recitation—but now there were found among the public teachers men of the highest accomplishments that the age could furnish, who taught whatever was known of astronomy, geography, and physics, as well as the newly started controversial discussions in ethics and in metaphysics. These men shared with the other intellectual celebrities the title of Sophist. But there was one circumstance in their case that greatly deepened the invidious sentiment—they taught for pay. This brought them under the odium of two classes; in the first place, the poor, who could not afford the fees, felt themselves in a new position of inequality with the rich; secondly, the philosophers, properly so called, who had not yet begun to receive money from their disciples, held in contempt those that did. Both Socrates and Plato had a vehement repugnance to the idea of a money-bargain between master and pupil; in their eyes, the relationship was one of pure attachment and devotion; and they considered that all the invidious part of the designation Sophist, and more, was richly deserved by the teachers for hire; and as these public teachers, by the nature of their vocation, would probably be often shallow and superficial, as compared with the great philosophers, we can understand the full definition of Sophist by Aristotle—'an impostrous pretender to knowledge, a man who employs what he knows to be fallacy, for the purpose of deceit and of getting money.'

With all the great authority of Aristotle, this charge applied indiscriminately to the body of men employed in training youth for active life, will not bear investigation. Enough is known of the lives, characters, and doctrines of the class to refute the accusation. The Sophists were a profession growing out of the circumstances, and supplying a want, of the age. The most valuable ideas and habits of any accomplished Athenian were due to his education under some teacher of the class Rhetor or Sophist. So far from the age of the Sophists being an age of corrupted public morality, Mr. Grote contends that it was the reverse. He adduces a multitude of historical facts to prove that the morality of the Athenian public was greatly improved at the end of the 5th c. B.C., as compared with the beginning of that century.

SO'PHOCLES, the great master of Greek tragedy, was born at Colonus, a village about a mile from Athens. The date of his birth is not exactly known, but is fixed at 495 B.C. Sophillus, his father, a man of good birth and fortune, bestowed much care on his son's education; insomuch that, aided by his highly prepossessing appearance, S. was selected for his skill in poetry and music to lead with dance and the lyre, after the victory of Salamis, the chorus of youths in a triumphal pæan composed by himself. In his 28th year, he is said to have *exhibited* his first play; and three years before, in a contest with rival scenic writers, one of whom was Æschylus, he gained the first prize, by the decision of the judges Cimon and his colleagues. He had, by Nicostrata, two sons, and one by Theoris, a Sicyonian woman.

Iophon, one of his two sons by Nicostrata, summoned him in his old age before the Phratores, on the charge of incapacity to manage his private affairs, but he refuted the charge by reciting to the court a beautiful chorus from his *Œdipus in Colonus*. He died at the age of 90, full of years and honors. His private char-

acter was easy and contented, but not, as has been hastily assumed, profligate. His turn of mind was devout, as is evident throughout his plays; and he evinced no taste for political or active life, although he is said to have accepted command in the Samian war. He was a prolific author. He was the reputed composer of as many as 130 plays, of which, however, 17 have been deemed spurious. He gained, according to his biographer, the first tragic prize 20 times, bearing the palm on several occasions from Æschylus and Euripides, not to mention less well-known competitors. He wrote also pæans, elegies, and epigrams, of which we have but few remains. He lived on terms of intimacy not only with his great rivals, but with Aristophanes and Herodotus. We have no knowledge of the order in which his plays, that have survived, were written. The most plausible arrangement is perhaps that of Müller, who graduates them as follows: *Antigone, Electra, Trachiniæ, Œdipus, Rex, Ajax, Philoctetes, Œdipus Coloneus.*

S. is justly accounted the most perfect of the Attic tragedians. In his hands, tragedy becomes the true and faithful reflex of human feelings, passions, impulses. His ideas are ethical, with a constant reference to a divine disposer of events. 'There has hardly,' says Müller, 'been any poet whose works can be compared with those of Sophocles for the universality and durability of their moral significance. Of all the poets of antiquity, he has penetrated most deeply into the human heart.' His versification is remarkable for its softness and fluency. The best editions are those of Wunder (1831—1846), Schneidewin, and Campbell (1874—1882). The chief translations of S. into English are those of Potter (Lond. 1788), Dale (Lond. 1824), and Plumptre (1865.) We may also mention special translations by Prof. Thompson of the *Ajax*, by Dr. Donaldson of the *Antigone*, and by Prof. Campbell of the *Antigone, Electra*, and *Dejanira.*

SOPRA'NO (Ital.), the highest species of female voice, whose range extends from to , or in some cases higher.

The highest notes generally belong to the falsetto register. Sweetness and mellowness are the characteristic qualities of a soprano voice, which is for the most part less full than an alto, but lighter, fresher, and more expressive of joyful, lively, and highly impassioned feelings. Music for soprano voices is usually written in the treble clef, but sometimes in the soprano clef with C on the first line . A voice sometimes distinguished as intermediate between alto and soprano, is the *Mezzo-soprano*, whose usual compass is from to .

SO'RA, a city of Southern Italy, in the province of Caserta, with (1871) 5100 inhabitants. It stands in a fertile plain, watered on one side by the Liris or Garigliano, which is spanned by two bridges at the town. The population is industrious and wealthy. There are manufactories of woollen cloth and of paper. S. was originally a Volscian town, passed into the possession of the Samnites, and then into that of the Romans. Remains of the cyclopean walls of the ancient citadel are still visible.

SO'RAU, a town of Prussia, in the province of Brandenburg, 60 miles south-south-east of Frankfurt-on-the-Oder. It has important bleach-fields, print-works, and color-works. Pop. (1875) 13,-191. S. is one of the oldest towns in Prussia.

SORB. See SERVICE.

SORBONNE, a celebrated academic body at Paris, which dates from the middle of the 13th c., and which, down to the French Revolution, held a prominent place in all church controversies. It derives its name from its founder, Robert de Sorbon, a canon of Cambrai, born at Sorbon, in the Ardennes, in 1201. He was selected by Louis IX. as his chaplain and confessor. At this time, the university of Paris was at the very height of its celebrity, and Robert de Sorbon resolved on opening in it an institution in which a society of secular priests, being provided with all the necessaries for their own maintenance, should devote themselves gratuitously to the teaching of theology. It was established with the sanction of King (afterwards St.) Louis in 1252, originally for the reception of sixteen scholars, four respectively from the Gaulish, Norman, Picard, and English nations, to which the German was subsequently added.

Robert was himself the first head; and in 1270, drew up its constitution, which remained in force without any substantial alteration till the French Revolution. It was not confined to the original poor scholars, but extended to the bachelors and doctors aggregated to the body of the Sorbonne. All these were of necessity graduates of the Faculty of Theology of the university of Paris, but they were only admitted to membership of the Sorbonne by the votes of that body which formed one of the four constituent parts of the Theological Faculty; and after a public disputation, technically called the 'Sorbonica,' or 'Robertina,' in which the disputant was required to sustain, against all antagonists, from the hour of five in the morning to that of seven in the afternoon, theses or propositions selected from the whole range of theological science. The first disputant was a Franciscan friar named Mayron, a scholar of John Duns Scotus; but he was followed by many of the greatest names in medieval and post-reformation history. These 'Sorbonne Acts' form in some respects one of the most characteristic chapters in medieval literary history. The disputants in some cases exceeded sixty in number. The foundation of Robert de Sorbon was approved in 1268 by Clement IV.; but the name of Sorbonne does not appear to have been appropriated to it till the 14th century. Robert de Sorbon also established another preparatory college for the study of the Humanities and Philosophy, which was called the college of Calvi, or the Little Sorbonne.

In the 15th c., the Sorbonne, as being in great measure identified with the Theological Faculty of the Paris University, holds an important place in the history of theological controversy, and in all the contests which followed the Reformation in France; there being few of the great names of the Gallican Church which are not included in its academic roll. Among the munificent works of the great Cardinal Richelieu, who was a pupil of the Sorbonne, was what may be described as a complete reconstruction of the buildings. The new Sorbonne comprised, in addition to the public academical hall, lodgings for the 36 doctors, which were assigned to the doctors successively in the order of seniority. The head of the Sorbonne institute was called Provisor, and was elected by the members, together with the Archdeacon of Paris, the four Deans of Faculty, and some other dignitaries of the university. Besides the resident members of the Sorbonne, there were also external associates, called 'Socii Hospitalitatis,' who had no share in the governmental acts of the institution. The Sorbonne continued in the enjoyment of its privileges and its revenues down to the Revolution, when it shared in the common ruin of all the ecclesiastical establishments of France. At the reorganization of the university by Napoleon in 1808, the Sorbonne was re-established as the Theological Faculty of that body; but it failed to recover its old prestige even with the clerical body. One of the conditions of membership was an oath to maintain the celebrated four 'Gallican Propositions.' See GALLICAN CHURCH. This condition deterred many; and although it was revoked by the proposed concordat of 1817, yet, on the failure of this concordat, it still continued in force down to the revolution of 1830.

After various changes, the Sorbonne is still an important theological school, with seven professors and a dean. These professors, however, are named by the Minister of Public Instruction; and the absence of control on the part of the bishops over their appointment and their teaching, has le to the general withdrawal of clerical students from their lectures. Nevertheless, the Sorbonne still possesses at least the permissive sanction of the church. But the Sorbonne is now further the seat of two other faculties of the Académie of Paris (i. e., University of Paris, see UNIVERSITY OF FRANCE), those of Letters and Sciences; there being 12 chairs in the former faculty, and 7 in the latter. (The other two of the five faculties, jurisprudence and medicine, are accommodated elsewhere). All the lectures are open to the public (except ladies) gratis, and are attended by but few regular students.

SORE'CIDÆ, a family of Mammalia, of the order *Carnaria*, and section *Insectivora* of Cuvier. They are generally small animals, covered with soft hair; under which, on each flank, is a band of stiff closely-set bristles, and among them glands which exude a peculiar odorous fluid. The legs are short, and the feet are five-toed, and generally formed for burrowing. Some species are aquatic, and their feet webbed. The S. are all plantigrade. Most of them are nocturnal animals. They generally feed on insects and worms. A remarkable characteristic of the family is the elongated muzzle. They have long incisors, and their molar teeth are generally furnished with conical points. The tail is generally scaly. To this family belong Shrews, Shrew-mice, Musk Rats or Desmans, &c. They are found both in warm and cold climates. Those which inhabit cold climates generally pass the winter in a lethargic or dormant state.

SORESI'NA, a mercantile town of Northern Italy, province of Cremona, with (1871) 8553 inhabitants. A great trade is carried on in a kind of condiment called *Mostarda*, which is prepared there, consisting of fruits, &c., preserved in vinegar and sugar, and also in a kind of liqueur called *Mistrà*, held in great repute in Italy as a carminative.

SO'RGHO GRASS AND SORGHUM. See DURRA.

SO'RIA. See NUMANTIA.

SOROCA'BA, a town of Brazil, in the province of Sao Paulo, stands on a river of the same name, 70 miles west of the city of Sao Paulo. Pop. 12,000.

SO'RREL (*Rumex*), a genus of plants of the natural order *Polygoneæ*, very closely allied to *Polygonum* (q. v.) and *Fagopyrum* (see BUCKWHEAT), but having the perianth divided into six segments, the three inner of which enlarge and cover the *achenium*. The genus is very naturally divided into two sections, the first of which is already noticed in the article DOCK. The name S. belongs only to the second, characterized by dicœcious flowers, and acidity of stems and leaves. COMMON S. (*R. acetosa*) is a perennial found in meadows and pastures throughout the whole of Europe, and is very plentiful in Britain. Its stem is from a foot to two feet high; its leaves arrow-shaped. It is an agreeable salad, and is used in soups and sauces, and as an addition to dishes of greens. It is therefore sometimes cultivated in gardens.—FRENCH S., or ROMAN S. (*R. scutatus*), a native of France and Italy, has broader and blunter leaves, and is more frequently cultivated than Common S., being considered of finer flavor. SHEEP'S S. (*R. acetosella*) is a very similar plant, but of much smaller size, and its roots run very much under-ground, so that it is a very troublesome weed in gardens and fields of poor dry soil, in which it is very common in all parts of Britain.—For WOOD S., see OXALIDEÆ.—For the RED S. of the West Indies, see HIBISCUS.

SORREL TREE (*Lyonia arborea*, formerly *Andromeda arborea*), a tree of the natural order *Ericeæ*, remarkable in that portion of the order to which it belongs for its magnitude, its near allies being generally small shrubs. It grows chiefly on the Alleghany Mountains, from Virginia to Georgia, and attains the height of 50 feet, with a trunk 12—15 inches in diameter. The wood is of little or no use. The leaves are acid, and are sometimes used for dyeing wool black.

SORRE'NTO (Lat. *Surrentum*. Gr. *Syrentum*), a maritime town in the south of Italy, province of Naples, is situated on the south-east side of the beautiful Bay of Naples, on the promontory which separates the latter from the Gulf of Salerno, about 7 miles south-west of Castellamare. Pop. (1871) 5502. It is an archiepiscopal see, and possesses a cathedral. The manufacture of silk is extensively carried on. There are still considerable remains of the walls which were erected in the middle ages, and on the landward side it is surrounded by a broad and deep ravine, the side towards the sea being protected by precipitous rocks. On the north-west of the town is a considerable plain or table-land, called *Piano di Sorrento*, about 1000 feet above the sea-level, surrounded and protected from the cold east winds by a range of hills; it is intersected by numerous gorges and ravines, studded with villas and farm-houses, and covered with orange groves and vineyards; all which combined render the vicinity of the city in a high degree picturesque.

It is celebrated for the mildness, dryness, and general salubrity of its climate, on which account it has been much resorted to both in ancient and modern times by invalids and convalescents. Among the Romans, the wine of S. was held in high reputation; it had to be kept about 25 years before it arrived at maturity. Nothing certain is known of the origin of S., but it is believed to be very ancient, and many ruins are pointed out by the *ciceroni* as being remains of Roman temples, &c. Tasso was a native of Sorrento.

SO'RTES BI'BLICÆ, SORTES VIRGILIA'NÆ. &c.—Among the ancients, a favorite kind of divination was that known as *Stichomancy*, or divination by lines of poetry. The method pursued was to select a number of verses from a poet, mix them together in an urn, draw one out at random, and from its contents to infer good or evil. As Virgil was the most popular and admired of all the Latin poets, his writings, and especially the *Æneid*, became the favorite book for this purpose, and it was undoubtedly this practice that laid the basis of the great reputation as a magician Virgil enjoyed during the middle ages. The Sibylline oracles were also much used for the same purpose. The practice did not cease with the introduction of Christianity; but instead of Virgil, or, to speak more correctly, alongside of Virgil, the Bible was employed to ascertain the future. In place however, of throwing lines into a 'heathen' urn, it was customary to open the book, as it were, accidentally, or to stick a pin between the leaves at hazard, and then open the book—the passage first catching the eye being regarded as pregnant with prophecy as to your future welfare.

Such lots drawn from Scripture were called, in the middle ages, *Sortes Biblicæ*, just as those drawn from Virgil were called *Sortes Virgilianæ*. The custom of using (or abusing) the Bible in this grossly superstitious way still lingers in England, Scotland, and other countries, but it is now more a frolic of children than aught else. The poet Hafiz is still so used in Persia.

SO'RTIE, an outrush of a beleaguered garrison, equivalent to SALLY (see SALLY-PORT).

SORUS. See FERNS.

SOSTENU'TO (Ital.), a term used in musical notation, to indicate a sustained mode of execution, continuous in respect of tone.

SOTTEVILLE-LÈS-ROUEN, a small town of France, in the dep. of Seine-Inférieure, 4 miles south of Rouen by railway. Pop. (1876) 11,278.

SOU, or SOL. See SOLIDUS.

SOUARI NUT. See CARYOCAR.

SOUDAN. See SUDAN.

SOUFFLÉ, a light and agreeable dish, consisting chiefly of the whites of eggs, to which other ingredients (chocolate, cheese, vanilla, orange-flower water, rose-water, various essences, &c.) are added, to give consistency, flavor, and variety. The materials have to be agitated with a whisk until the whole is in a creamy froth; which is then baked in a soufflé-pan, made of such a form as to fit into a dish or proper holder, that can be sent to table, and quickly handed round.

SOUKCHOU'M KALE', a seaport town of Asiatic Russia, in the government of Transcaucasia, on the east coast of the Black Sea. In 1831, a commercial port was established here, which, however, has surrendered its pre-eminence to Poti, a town about 70 miles to the S.E. S. K. was captured by the Turks at the beginning of the Russian war of 1877. Pop. (1867) 1612.

SOUL, in the language of spiritualistic philosophers, covers the whole region of mind, and is generally conceived of as a naturally imperishable entity, in relation with the body, but definable, for the most part, only in terms of the complete negation of material attributes. With this the popular conception in the main coincides, though it is less labored, and considerably less negative. In its original signification, the word appears to have stood for the principle of life both in men and in animals. The modes of conceiving it were various: it was sometimes regarded as the mere harmony of the bodily functions, and sometimes as a distinct entity of highly ethereal nature, and generally supposed to be seated in, or connected with the blood; but no essential distinction was made between the soul of man, and the soul of brutes. Very soon, however, the manifest superiority of man to the lower creation suggested difficulties, which were increased as the thought of an after-life, in a different sense from transmigration, was gradually developed. And in man, the constant war among his members, the opposition of passion and reason, as it began to be observed with the growing habit of introspection, called for some explanation which should apply to humanity only. To meet all such difficulties, a 'Trichotomy,' or three-fold division of the human constitution, was assumed, according to which a naturally immortal and rational element was supposed to make part of man, besides the animal soul (always variously conceived) which he shared with the brutes. Between the two distinct elements—the animal and the rational soul—the various mental energies were differently apportioned by different thinkers, according as those energies were thought more or less noble and divine.

Without going back upon obscure traditions regarding the beliefs of the early peoples, Plato's views may be cited as amounting to a Trichotomy, and in Aristotle there is the distinct mention of a noetic principle in man by the side of the animal soul. Later Greek schools put forward a similar view; and Philo, the forerunner of the Neo-Platonists, even spoke of *the soul of the soul*. Lucretius has the same curious expression, to which corresponds the distinction of Roman writers in general between *animus* and the animal soul, *anima*. The earliest Christian writings occasionally distinguish body, soul, and spirit (*pneuma*). Such a threefold division was unfamiliar to the Jewish mind, which appears to have rested in a kind of dualism, and was removed even from the common Greek philosophical expression, *pneuma* being the word employed by Stoic dualists to describe the fine ethereal nature of the material soul. It is hard to say whether a thorough-going Trichotomy was meant by the Christian writers, or whether the soul was not merged in either of the extreme elements—the coarse material body, or (as commonly conceived) the finely attenuated but still material spirit. Till about the 4th c., the language of Trichotomy prevailed in the Christian writings, but thenceforth the doctrine became suspect, having been specially appropriated by certain heretical sects, and soul and spirit came to be identified in substance, and distinguished only in function. Aquinas, and, later, Calvin, pronounced in favor of the dualistic rendering, after which modern popular expression has been moulded, chiefly through the predominant influence of spiritualism since the time of Descartes. This gives prominence to the word soul over spirit, except in religious and purely metaphysical aspects.

The successors of Descartes have followed him in calling the single soul at once both rational and sensitive; but in rejecting, almost without exception, his description of the lower animals as mere mechanical automata, they have ignored, without an attempt to explain, the real difficulty that he sought to get rid of, and that the Trichotomy sought to meet. The ancient doctrine has been

revived in various shapes by Paracelsus, Van Helmont, the anatomist Willis, De Maistre, and others.

The Egyptian doctrine of the soul is one of the most important, as it is the most ancient, for this nation appears to have been the first to declare that the soul was immortal. The genesis of the soul itself, however, is not defined by the monuments, although the existence of a cosmic soul, from which the others proceeded, is mentioned by ancient authors. The following may be gathered from a comparison of the papyri and monuments with the traditions handed down by the classical writers :—The soul itself, once separated from the cosmic or mundane soul, was supposed to undergo numerous transmigrations, passing from one animated body to another till its cycle of existence was fulfilled. The soul was considered to be essentially distinct from the body, and only connected with it through the link of life. It was represented in the hieroglyphs by several signs, as a basket of fire, a heron, a hawk with a human face, and a ram. Its nature was divine, but after death it passed to the great judgment in the hall of the Two Truths, where it was tried before Osiris and the forty-two assessors or demons of the dead, whose verdict determined its future destiny. This depended upon the sins it had perpetrated during life, and which more or less interfered with its transmigration through the necessary cycle of existence till its ultimate union with the deity, and reception into the Egyptian heaven. In the judgment, it was accused by the enemy or accuser; and after the judgment, it was either devoured or annihilated, passed to the reign of the Egyptian hell, or to the place of the metempsychosis, from which it entered some body of man or animal on the point entering into existence.

The great desire of the dying, indeed, was, that his soul should pass off the earth, its detention here preventing its ascent to the moon or heaven. The souls of the wicked passed into the Egyptian Hades, which the sun was supposed to traverse during the hours of the night. There they were subjected to punishments of a corporeal rather than spiritual nature—burned in brasiers, plunged into streams, kept in utter darkness, and deprived of the presence of the sun-god, uttering fearful howls and wails in the prisons within which they were confined. After the passing of the great judgment, the soul underwent a series of transformations and adventures in the future state. It was justified, as Osiris had been, against the accusations laid to its charge by evil spirits. It assumed the form of a hawk, heron, swallow, and of a snake with a human head—that of the cosmic soul. In the fields of the Aah-en-ru, or Ahlu, the Egyptian Elysium, it sowed and reaped the harvest of gigantic grain which grew in that happy plain. It ascended the *makhen*, or mystical bark, and rowed through the winding of the celestial Nile, passed the fiery caldron of the Hades, revisited the body, entered the boat of the Sun, and passed through different regions of the Egyptian hell, in which the damned were detained, arriving at last at the manifestation to light.

To preserve the body, in order that the soul might revisit and probably reanimate it at a future period, not only was it embalmed with the greatest care, but amulets were attached to it which were supposed to have the power of retaining the vital warmth, and of protecting it from destruction or decay. The period after which the soul was supposed to enter again into a human body was 3000 years, during which it transmigrated through other orders of animated nature. The principal dogmas, indeed, of the soul amongst these people were its creation or emanation from the cosmic soul, its transmigrations, and its final reception into heaven, where it lived in the boat of the Sun, and traversed the liquid ether in company with that luminary. The Pythagorean and Platonic schools seem to have drawn extensively from Egyptian sources in regard to the nature and destiny of the soul. The Brahmanical and Buddhistic notions of the soul have also much in common with the Egyptian. See BUDDHISM, TRANSMIGRATION.—Herodot. ii. 23; Plutarch, *De Isid.* c. 29; Hermes, *Clavis;* Prichard, *Egypt. Mythol.;* Rheinisch, *Denkm. in Miramar* (Wien, 1865); Tylor's *Primitive Culture* (1871).

SOULOUQUE. See FAUSTINUS I.

SOULS, CURE OF (Lat. *cura animarum*, care of souls), the technical phrase by which the canon law describes the charge which is given to a pastor, no matter of what degree of dignity, over the spiritual concerns of a flock; and the words especially imply the right of administering the sacraments. In this sense, the phrase is used to mark an important distinction between two classes of benefices or church livings—'benefices with,' and 'benefices without,' the cure of souls. Of the latter class are canonries, prebends, and the whole class known in the canon law as 'simple benefices.' Of the former are parochial cures, vicarial cures, and still more the higher charges of archbishop, bishop, &c.

SOULT, NICOLAS-JEAN DE DIEU, Duke of Dalmatia, and Marshal of France, the son of a notary, was born at Saint-Amens-la-Bastide, in the dep. of Tarn, March 29, 1769. In 1785, he enrolled himself as a private in the Royal Infantry regiment; and so distinguished himself by his steady obedience to discipline, indomitable *sang-froid*, and general intelligence, that in 1792 he became adjutant-major. His behavior at Fleurus gained for him (October 11, 1794) the brevet of general of brigade. From 1794 to 1799, he was employed on the eastern frontier, and in the retreat after the defeat of Stockach (March 25, 1799), his able handling of the rear-guard alone prevented the annihilation of the French army.

Appointed general of division (April 21, 1799), and put under Massena, whom he ably seconded in Switzerland and Italy, he was afterwards, on the warm recommendation of Massena, appointed by Napoleon to one of the four colonelships of the consular guards, and now became an ardent Napoleonist. This devotion, doubtless, was a great means of his obtaining the bâton of Marshal of France; but he most certainly justified his appointment by his brilliant achievements in the subsequent campaign against the Austrians, closed by the battle of Austerlitz, which he decided by piercing the Russian center. He also did good service in the Prussian campaign; and took an important, though not a prominent part, in the Russian campaign of 1806—1807, after which he was appointed governor of Berlin, and created Duke of Dalmatia. S. was next placed at the head of the second corps in Spain, pursued the retreating British, attacked them at Coruña, and though repulsed, forced them to leave all their matériel behind. He then conquered Portugal, and exercised vice-regal authority over it, but the sudden arrival of Wellesley at Coimbra, and of Beresford at Chaves, made him retreat rapidly to Galicia. In September 1809, he became commander-in-chief in Spain, gained a brilliant victory at Ocana (18th November); and at the commencement of the following year, overran and subdued Andalusia, continuing to command in person the southern army.

In attempting to succor Badajos, which he had captured and garrisoned (March 11), he was defeated by Beresford at Albuera (May 16, 1811). After the battle of Salamanca, and the advance of the British on Madrid, S. became thoroughly disgusted at the rejection of his admirable plans for transferring the theater of war to Andalusia, and demanded and obtained his recall; but on the news of Vitoria (q. v.) reaching Napoleon S., whom alone he considered capable of turning the tide of ill-fortune, was, in all haste, restored to the command-in-chief of the army of Spain. Now, however, it was not in Spain but in France that the contest had to be waged, and the advantage of numbers, discipline, and prestige were all on the enemy's side; nevertheless, by a system of military tactics which has been universally admired, he completely neutralized the consummate strategy of Wellington, and reduced the campaign, during the seven months it lasted, to a mere trial of strength, the defeats which he sustained at Orthez and Toulouse being due to the superiority of the British soldiers, not of their general. With his usual suppleness of character, he became an ardent royalist after the abdication of Napoleon; but on the return of the latter from Elba, he abandoned Louis XVIII., and became major-general of the imperial army.

After Waterloo, he rallied the army at Laon; and on July 3d, at the council of war, coincided with Carnot as to the uselessness of further resistance. To avoid the punishment due to his treachery, he published a memoir traducing Napoleon in the basest manner, and lauding the 'lawful princes' (i. e., the Bourbons); but in spite of this he was banished, and not recalled till May 1819; however, in the course of a few years more, he was restored to all his former honors, and took an active part in politics, and in the development of French industry. In 1838, he was sent as ambassador to England, and, as the great antagonist of Wellington, was received with the utmost enthusiasm. In 1845, he retired from active duty, was honored with the appointment of 'Marshal-general of France' and retired to his residence of Soultberg, where he died, November 26, 1851. In the following year, a statue of him, in white marble, was placed in the galleries of Versailles. See S.'s *Mémoires;* also, Napier's *History of the Peninsular War;* Theirs's *Histoire de la Révolution et de l'Empire;* and Salle's *Vie Politique du Maréchal S.* (1834).

SOUND (Lat. *sonitus*) is the impression produced on the Ear (q. v.) by the vibrations of the elastic medium, such as air or water, in which it is plunged. That this is the case, is proved, *first*, by the fact, that a bell or tuning-fork *in vacuo* gives no sound when struck; *second*, by the fact, that mere currents, as such (winds, running water, &c.), do not produce the sensation of sound until they are frittered down into vibratory motions by obstacles.

The most untutored ear distinguishes at once between a mere *noise* and a *musical note*. It of course distinguishes a *loud* sound from a faint one. Moreover, it distinguishes musical notes from one another by their shrillness or gravity, or, as it is technically called, their *Pitch*. Again, as in the case of vowel-sounds sung to the *same* musical note, or as in the case of different instruments (flute and violin, for instance) playing the same note, it distinguishes something further—which is called the *Quality* of the

note. It is on the pitch of notes that the Theory of Music (q. v.) is based, for the quality is only of importance in giving variety, as in orchestral music—or in giving richness of tone in a solo. The most perfect *music*, so far as theory goes, may be executed on the poorest instrument, but it gives little pleasure from the want of richness or quality. In the same way, a singer may possess faultless intonation, yet the performance, though *musically* perfect, may, from the harsh quality of the voice, be unpleasant. We intend, in the present article, to avoid everything connected with music, and have made these remarks to show that there is something in the theory of sound more profound than is contemplated in the theory of music.

The questions we have now to discuss are:

1. What constitutes the difference between a mere noise and a musical note?
2. On what does the pitch of a note depend?
3. On what does its quality depend?

The answers to these queries are all contained in the following statement:

Every musical note consists in the repetition, at equal small intervals of time, of some definite noise; the pitch depends on the rate of repetition; and the quality upon the nature of the fundamental noise.

Rough experimental illustrations of the parts of this statement are easily given, more refined ones will be afterwards alluded to. If, for instance, the edge of a card be held to a revolving toothed-wheel, a definite noise is produced as each tooth bends the card and allows it to spring back. While the wheel revolves slowly, we can distinguish these successive noises; but when it is revolving so fast that they are no longer separately distinguishable, the character of the sound changes completely. It now becomes continuous, and so far as the ear can detect, uniform, and thus becomes a musical note (with such an apparatus, not a pleasing one). As the wheel is made to revolve faster and faster, the pitch of the note rises, till it becomes a sort of shriek, and finally becomes inaudible. The *Sirène* (q. v.) gives another excellent illustration. In this case, the fundamental noise is produced by a puff of air escaping from an orifice; and we observe, just as before, that the greater the number of such puffs per second, after they have become so frequent as to be separately undistinguishable, the higher is the pitch of the musical note produced.

Now, if by machinery we arrange matters so that the sirène and the toothed-wheel give the number of puffs and the number of impacts on the card the same per second, the musical note produced by each has the same pitch. But the notes differ greatly in quality, the one being exceedingly soft and pleasant, the other harsh and grating. The pitch, therefore, depends on the number of noises per second, and the quality upon the nature of the fundamental noise. We shall find a complete theoretical proof of this later.

The general nature of the mechanical process by which sound is propagated in the air will be illustrated, and compared with other cases of wave-motion, in our article on WAVES. Meanwhile, it is only necessary for us to observe that, as the velocity of sound is ten times greater than that of wind in the most violent hurricane, it is not *air* itself which is transferred from place to place, but a *state of disturbance* (condensation or rarefaction) of the air. Each successive layer of air in the path of the sound suffers this disturbance in turn, and by virtue of its Elasticity (q. v.), passes it on to the next.

Newton was the first who attempted to deduce from mechanical principles the velocity of sound, but only for the particular case in which each particle of air, in the path of the sound, is supposed to move backwards and forwards according to the same law as the bob of a Pendulum (q. v). He showed that this species of motion is consistent with the elastic properties of air, as given by Boyle's or Mariotte's Law (q. v.), viz., that the pressure of air is proportional to its density. The velocity of sound in this case is of course to be found from the time which elapses between the commencement of the motion of any one particle of air, and that of another at a given distance from it, in the direction in which the sound is moving. The numerical result deduced by Newton with the then received experimental data for the compressibility of air, was 979 feet per second. This investigation was very defective, applying, in fact, solely to the special case of a pure musical note, continually propagated without lateral divergence; yet the solution obtained by Lagrange from a complete analysis of the question, gave precisely the same mathematical result.

But, by direct measurements, carefully made, by observing at night the interval which elapses between the flash and the report of a cannon at a known distance, the velocity of sound has been found to be considerably greater—in fact, about 1090 feet per second, at the temperature of freezing water.

Newton seeks for the cause of this discrepancy between theory and observation in the idea that the size of the particles of air is finite compared with their mutual distance; and that sound is instantaneously propagated through the particles themselves. Thus, supposing the particles to have a diameter $\frac{1}{9}$th of the distance between them, we must add $\frac{1}{9}$th to the space traveled by sound in a second, i. e., to the velocity—which will thus be brought up to $(1 + \frac{1}{9})$ 979 feet = 1088 feet nearly, which is a very close approximation to the actual value given above.

This is not one of Newton's happiest conjectures—for, independent of the fact that such an assumption would limit definitely the amount of compression which air could undergo, and, besides, is quite inconsistent with the truth of Boyle's law for even moderate pressures, it would result from it that sound should travel slower in rarefied, and quicker in condensed air. Now, experiment shows that the velocity of sound is unaffected by the height of the barometer; and, indeed, it is easy to see that this ought to be the case. For in condensed air the pressures are increased proportionally to the increase of condensation, and the mass of a given bulk of air is increased in the same proportion. Hence, in a sound-wave in condensed air, the forces and the masses are increased proportionally, and thus the rate of motion is unaltered. But the temperature of the air *has* an effect on sound, since we know that the elastic force is increased by heat, even when the density is not diminished; and therefore the velocity of sound increases with the temperature at the rate of about $4\frac{1}{2}$ feet per Fahrenheit degree, as is found by experiment.

Newton's explanation of the discrepancy between theory and experiment being thus set aside, various suggestions were made to account for it; some, among whom was Euler, imagining that the mathematical methods employed, being only approximate, involved a serious error.

The explanation was finally given by Laplace, and is simple and satisfactory. When air is *suddenly* compressed (as it is by the passage of a sound-wave), it is heated; when suddenly rarefied, it is cooled, and this effect is large enough to introduce a serious modification into the mathematical investigations. The effect is in either case to *increase* the forces at work—for, when compressed, and consequently heated, the pressure is greater than that due to the mere compression—and, when rarefied, and consequently cooled, the pressure is diminished by more than the amount due to the mere rarefaction. When this source of error is removed, the mathematical investigation gives a result as nearly agreeing with that of observation as is consistent with the unavoidable errors of all experimental data. It is to be observed that, in noticing this investigation, nothing has been said as to the pitch or quality of the sound, for these have nothing to do with the velocity.

It must, however, be remarked here that, in the mathematical investigation, the compressions and rarefactions are assumed to be very small; i. e., the sound is supposed to be of moderate intensity. It does not follow, therefore, that very violent sounds have the same velocity as moderate ones, and many curious observations made during thunder-storms seem to show that such violent sounds are propagated with a greatly increased velocity. (See a paper by Earnshaw in the *Phil. Mag.* for 1861.) It is recorded that in one of Parry's arctic voyages, during gun-practice, the officer's command 'Fire' was heard at great distances across the ice *after* the report of the gun.

Since sound consists in a wave-propagation, we should expect to find it exhibit all the ordinary phenomena of Waves (q. v.). Thus, for instance, it is *reflected* (see ECHO) according to the same law as light. It is *refracted* in passing from one medium to another of different density or elasticity. This has been proved by concentrating in a focus the feeble sound of the ticking of a watch, and rendering it audible at a considerable distance, by means of a lens of collodion films filled with carbonic acid gas.

Sounds *interfere* to reinforce each other, or to produce silence; just as the crest of one wave in water may be superposed on the crest of another, or may apparently destroy all motion by filling up its trough. The simplest mode of showing this is to hold near the ear a vibrating tuning-fork and turn it slowly round its axis. In some positions, the sounds from the two branches reinforce, in others they weaken, each other. But if, while the sound is almost inaudible, an obstacle be interposed between the ear and one of the branches, the sound is heard distinctly. Beats, which will shortly be alluded to, form another excellent instance.

To give an idea of the diminution of loudness or intensity of a sound at a distance from its source, let us consider a series of spherical waves diverging from a point. The *length* of a wave, as we know from the theory, does not alter as it proceeds. (Indeed, as we shall presently see, the pitch of a note depends on the length of the wave; and we know that the pitch is not altered by distance.) Hence, if we consider any one spherical wave, it will increase in radius with the velocity of sound, but its thickness will remain unaltered.

The same disturbance is thus constantly transferred to masses of air greater and greater in proportion to the *surface* of the spherical wave, and therefore the amount in a given bulk (say a cubic inch) of air will be inversely proportional to this surface. But the surfaces of Spheres (q. v.) are as the squares of their radii

—hence the disturbance in a given mass of air, i. e., the loudness of the sound, is inversely as the square of the distance from the source. This follows at once from the law of conservation of energy (see FORCE), if we neglect the portion which is constantly being frittered down into heat by fluid friction. All sounds, even in the open air, much more rapidly in rooms, are extinguished ultimately by conversion into an equivalent of heat. Hence sounds really diminish in intensity at a greater rate than that of the inverse square of the distance; though there are cases on record in which sounds have been heard at distances of nearly 200 miles. But if, as in speaking-tubes and speaking-trumpets, sound be prevented from diverging in spherical waves, the intensity is diminished only by fluid friction, and thus the sound is audible at a much greater distance, but of course it is confined mainly to a particular direction.

As already remarked, the purest sounds are those given by a tuning-fork, which (by the laws of the vibration of elastic solids) vibrates according to the same law as a pendulum, and communicates exactly the same mode of vibration to the air. If two precisely similar tuning-forks be vibrating with equal energy beside each other, we may have either a sound of double the intensity, or anything less, to perfect silence, according to their relative *phases*. If the branches of both be at their greatest elongations simultaneously, we have a doubled intensity—if one be at its widest, and the other at its narrowest, simultaneously, we have silence, for the condensation produced by one is exactly annihilated by the rarefraction produced by the other, and *vice versâ*. But if the branches of one be loaded with a little wax, so as to make its oscillations slightly slower, it will gradually fall behind the other in its motion, and we shall have in succession every grade of intensity from the double of either sound to silence. The effect will be a periodic swelling and dying away of the sound, and this period will be longer the more nearly the two forks vibrate in the same time. This phenomenon is called a *beat*, and we see at once from what precedes, that it affords an admirable criterion of a perfect *unison*, that is, of two notes whose pitch is the same. It is easy to see, by the same kind of reasoning, that if two forks have their times of vibration nearly as 1 : 2, 2 : 3, &c.—i. e., any simple numerical ratio—there will be greater intervals between the beats according as the exact ratio is more nearly arrived at.

We must now consider, so far as can be done by elementary reasoning, the various simple modes of vibration of a stretched string, such as the cord of a violin. Holding one end of a rope in the hand, the other being fixed to a wall, it is easy (after a little practice) to throw it into any of the following forms, the whole

Fig. 1.

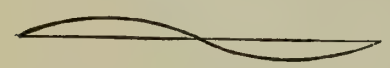


Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

preserving its shape, but rotating round the horizontal line. If the tension of the rope be the same in all these cases, it is easy to see that the times of rotation must be inversely as the number of equal segments into which the rope is divided; for the various parts will obviously have the same form; and the masses and distances from the axis of rotation being proportional to their lengths, the Centrifugal Forces (q. v.) will be as the squares of the lengths, and inversely as the squares of the times of rotation. But these centrifugal forces are balanced by the components of the tensions at the extremities, in directions perpendicular to the horizontal line; which are, by hypothesis, the same for all the figures. Hence the time of rotation is directly as the length of each segment.

Now (see PENDULUM) any such rotation is equivalent to two mutually perpendicular and independent pendulum vibrations of the cord from side to side of the horizontal line. Thus, a violin-string may vibrate, according to the pendulum law, in one plane, either as a *whole* (fig. 1), as *two halves* (fig. 2), as *three thirds* (fig. 3), &c.; and the times of vibration are respectively as 1, $\frac{1}{2}$, $\frac{1}{3}$. . . . . Nay, more, any two or more of these may coexist in the same string, and thus, by different modes of bowing, we may obtain very different combinations of simple sounds: a *simple sound* being defined as that produced by a single pendulum motion, such as that of a tuning-fork, or one of the uncomplicated modes of vibration of a string.

The various simple sounds which can be obtained from a string are called *Harmonics* of the fundamental note; the latter being the sound given by the string when vibrating as a whole (fig. 1). For each vibration of the fundamental note, the harmonics have two, three, four, &c. Of these, the first is the octave of the fundamental note; the second the twelfth, or the fifth of the octave; the third the double octave; and so on. Thus, if we have a string whose fundamental note is C, the series of simple sounds it is capable of yielding is :

$$C, C_1, G_1, C_2, E_2, G_2 (B\flat_2), C_3, D_3, E_3, \&c.$$

Of those written, all belong to the ordinary musical scale except the seventh, which is too flat to be used in music. This slight remark shows us at once how purely artificial is the theory of music, founded as it is, not upon a physical, but on a sensuous basis.

To produce any one of these harmonics with ease from a violin-string, we have only to touch it lightly at $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, &c. of its length from either end and bow as usual. This process is often employed by musicians, and gives a very curious and pleasing effect with the violoncello or the double-bass. The effect of the finger is to reduce to rest the point of the string touched; and thus to make it a point of no vibration, or, as it is technically called, a *Node*.

In the case of a pianoforte wire, a blow is given near one end, producing a displacement which runs back and forward along the wire in the time in which the wire would vibrate as a whole. The successive impacts of this wave on the ends of the wire (which are screwed to the sounding-board), are the principal cause of the sound. But more of this case later.

The theory of other musical instruments is quite as simple. Thus, in a flute, or unstopped organ-pipe, the sound is produced by a current of air passing across an orifice at the closed end. This produces a wave which runs along the tube, is reflected at the open end, runs back, and partially intercepts the stream of air for an instant, and so on. Thus the stream of air is intercepted at regular intervals of time, and we have the same result as in the Sirène (q. v.). In this case, there is *one* node only, viz., at the middle of the pipe. If we blow more sharply, we create two nodes, each distant from an end by $\frac{1}{4}$ of the length of the tube. The interruptions are now twice as frequent, and we have the first harmonic of the fundamental note. And so on, the series of harmonics being the same as for a string.

We may easily pass from this to the case of an organ-pipe closed at the upper end. For if, while the open pipe is sounding its fundamental note, a diaphragm be place at the node, it will not interfere with the motion, *since the air is at rest at a node*. That is, the fundamental note of a closed pipe is the same as that of an open pipe of double the length. By examining the other cases in the same way, we find that the numbers of vibrations in the various notes of a closed pipe are in the proportions 1 : 3 : 5 : 7 : &c., the even harmonics being wholly absent.

There is another kind of organ-pipe, called a reed pipe, in which a stream of air sets a little spring in vibration so as to open and close, alternately, an opening in the pipe. If the spring naturally vibrates in the time corresponding to any harmonic of the pipe, that note comes out with singular distinctness from the combination—just as the sound of a tuning-fork is strongly reinforced by holding it over the mouth-hole of a flute which is fingered for the note of the fork. If the spring and the tube have no vibration in common, the noise produced is intolerably discordant. The Oboe, Bassoon, and Clarionet are mere modifications of the reed-pipe; and so are Horns in general, but in them the reed is supplied by the lip of the performer. Thus, a Cornet, a Trumpet, or a French Horn, gives precisely the same series of harmonics as an open pipe.

The statements just made as to the position of the nodes in a vibrating column of air are not strictly accurate, for the note is always found to be somewhat *lower* than that which is calculated from the length of the tube and the velocity of sound. Hopkins showed experimentally that the distance between two nodes is always *greater* than twice the distance from the open end to the nearest node. The mathematical difficulties involved in a complete investigation of the problem were first overcome by Helmholtz in 1859, in an admirable paper published in *Crelle's Journal*. The results are found to be in satisfactory accordance with those previously derived from experiment.

We have now to consider the subject of the quality of musical sounds; and one of its most important branches, what constitutes the distinction between the various vowel-sounds. It had long been recognized that the only possible cause of this distinction between sounds *musically identical* must lie in the nature of the fundamental noise, or, to express it differently, the nature of the periodic motion of each particle of air. But it appears that Helmholtz was the first to enter upon a complete examination of the point, both mathematically and experimentally, and the results

he has arrived at form by no means the least remarkable of the contents of his excellent work, *Die Lehre von den Tonempfindungen*, recently published.

It was established by Fourier, that any periodic expression whatever may be resolved into the sum of a number of simple harmonic terms, whose periods are, respectively, that of the original expression, its half, its third part, &c. Hence any periodic motion of air (i. e., any musical sound) may be resolved into a series of simple pendulum vibrations (i. e., pure musical sounds, such as those of tuning-forks), the first vibrating once in the given period, the second twice, and so on. These notes are, as we have seen, the several harmonics of the lowest. Hence the quality of a musical sound depends upon the number and loudness of the harmonics by which it is accompanied.

Two experimental methods were employed by Helmholtz, one analytical, the other synthetical. In the first he made use of resonance-cavities fitted to the ear, and giving scarcely any indication of external sounds until one is produced which exactly corresponds in pitch with the note which the cavity itself would yield. With a series of such cavities, tuned to the several harmonics of some definite note, the note was examined when played on various instruments, and when sung to different vowel-sounds. It was thus ascertained which harmonics were in each case present, and to what extent, producing the particular quality of the sound analyzed. The second method was founded on the fact, already noticed, that a tuning-fork gives an almost pure musical sound (i. e., free from harmonics). A series of tuning-forks, giving a note and its harmonics, were so arranged as to be kept constantly in vibration by an electro-magnetic apparatus.

Opposite to each was fixed a resonance-cavity, exactly tuned to it, and capable of being opened more or less at pleasure. When all the cavities were shut, the sound was scarcely audible; so that by opening them in various ways, any combination of harmonics might be made to accompany the fundamental note. These combinations were varied by trial, until the quality of the resultant sound was brought to represent as nearly as possible that of some vowel. The results of this second series of experiments coincided with those of the first. It appears from these investigations that the German U is the quality of a simple sound, though it is improved by adding faintly the two lowest harmonics; that O depends mainly on the presence of the third harmonic; and so on with the other sounds. It also appears, and it is well known by experience, that different vowel-sounds, to be sung with accuracy, require to be sung to different notes, the proper note being that for which the cavity of the mouth is adapted for the production of the accompanying harmonics which determine the quality of the particular vowel.

In strings and pipes, as we have seen, the higher notes are strictly harmonics of the fundamental note, and therefore the sounds of instruments which depend on these simple elements are peculiarly adapted for music. On the other hand, when as in masses of metal, &c., the higher notes are not harmonics of the fundamental note, the mixed sound is always more or less jarring and discordant. Such is the case with bells, trumpets, cymbals, triangles, &c.; and, in fact, these sounds are commonly characterized as 'metallic.' To produce from such instruments a sound as pleasing as possible, they must be so struck that as few as possible of the higher notes are produced, and these as feebly as possible. Thus, for instance, to get the most pleasing sound from a pianoforte-wire, it should not be struck at the middle, as in such a case the first, third, fifth, &c. harmonics of the fundamental note will be wanting. If, however, it be struck at about ⅛th of its length from one end, the harmonics produced will be mainly the first five; and these all belong to the chord of the fundamental note. A valuable recent work is Lord Rayleigh's *Theory of Sound* (2 vols. 1878).

SOUND (A.S. and Ger. *Sund;* according to Grimm, for *Suumd*, from the root of *Swim*), a word signifying generally a strait or narrow sea-way, but applied specially to the strait which leads from the Cattegat into the Baltic Sea, between Sweden on the east, and the Danish island of Seeland on the west. It forms the usual passage from the north to the Baltic Sea, is 40 miles long, and nearly 3 miles broad at its narrowest part, between the towns of Helsingborg and Elsinore. Its entrance is defended by the strong castle and fortress of Kronborg. See ELSINORE.

SOUND DUTIES, certain dues formerly payable to the Danish government by all vessels passing the Sound or strait separating Sweden from Seeland. These duties originated in an agreement between the king of Denmark and the Hanse Towns in 1348, by which the former undertook to maintain the light-houses in the Cattegat, and the latter to pay duty for them. England became bound to pay duty by a treaty of date 1450, and other countries followed. The Sound Duties were abolished on 14th March 1857, by a treaty between Denmark and other powers. A pecuniary compensation of £3,386,528 (the share contributed by Great Britain being £1,125,206) was stipulated to be paid to Denmark, which was to be held bound to maintain the light-houses and superintend the pilotage of the Sound.

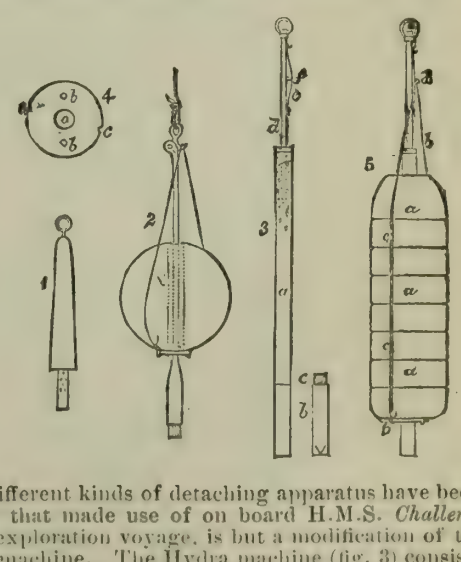
SOUNDING is the act of ascertaining the depth of the water. This is done either for purposes of navigation in piloting a ship among shoals or rocks, for ascertaining her position where the depth and nature of the bottom is previously known, or constructing a chart, &c. It is generally effected by means of a marked line, to which is attached a tapered lead, the bottom or foot of the lead being hollowed to receive some grease or tallow to which a portion of the soil at the bottom of the sea will adhere. Other methods have been devised for ascertaining depth, such as by a rotating fan-wheel, &c.; but the first method is that still most generally used for ordinary depths.

Sounding Lead.

SOUNDING, DEEP-SEA. Until within a few years, past, the term *deep sounding* was understood to be that in which a ship sounded to ascertain her position, and where the depth exceeded that which could be obtained with the lead thrown by the hand, or hand-lead; but the necessities of telegraphic communication across the ocean, by means of cables containing insulated wires, have caused the ocean to be measured at depths which were never before considered necessary, or even practicable.

The act of obtaining a deep-sea sounding may be said to consist of two parts—1. To get the sinkers to the bottom as quickly as possible with the line straight up and down; and 2. To bring a portion of the soil of the bottom, as a proof, to the surface; this necessitates the use of a small but strong line, with heavy sinkers and a detaching apparatus for freeing the sinkers when they reach the bottom, as from the smallness of the line and the great friction of all passing through the water, the strain of bringing the sinkers up would be too great for its strength. It may be stated that there is no difficulty whatever in obtaining a sounding, and regaining the sinker, with bottom specimen, up to a depth of 1000 to 1200 fathoms (1½ miles), by means of a heavy lead fitted with a valved tube (fig, 1); but when the depth exceeds 2000 fathoms, the difficulties in obtaining a correct sounding increase in a compound ratio with the depth.

The first detaching apparatus (fig. 2) was devised by Mr. Brooke, a midshipman of the United States navy: it is extremely simple and efficient. It consists of a rod with a movable hook at the upper end, and a tube at the lower end. The sinker is a perforated shot, through which the tube passes, and by means of a ring below the shot the weight is suspended to the hook by wire, the hook being kept up by the sounding line; the tube is filled with cut quills. When the weight touches the ground, the line is slackened, the hook falls, and the suspending wire being freed, the shot slides off, while the quills, being thrust into the soil, secure a small portion, which is brought up with the rod.



Many different kinds of detaching apparatus have been invented since, but that made use of on board H.M.S. *Challenger*, in her deep-sea exploration voyage, is but a modification of the original Brooke's machine. The Hydra machine (fig. 3) consists of a tube of iron, 2½ inches in diameter and 4½ feet in length, *a*; the lower 12 inches, *b*, is separate from, but screws to the upper part at *c*; it is fitted with a butterfly valve at the lower end, to retain the bottom specimen. At the upper end of the tube is a piston-rod *d*, which moves freely in the tube. To the upper part of this rod is fixed a steel spring, bent in a bow *e*; a slit in the spring is adapted to the hook *f*, which protrudes beyond the spring when the latter is forced back. The sinkers (fig. 4) are cast-iron discs of half a cwt., each, the hole through the center, *a*, being sufficiently large for the sounding-tube to pass through. They are made to fit each

other by means of small conical protuberances on the one side, and corresponding hollows on the other, *b*; so that when placed one on another, the groove *c* in the one weight corresponds to that on the other. The upper and lower sinkers differ a little in form.

When a sounding is to be taken, the machine is prepared as in fig. 5, a wooden stand being used for the purpose. The sinkers, *a*, *a*, are piled to the required weight, say 4 cwt.; the tube is then passed through them, and an iron ring (with a bight of iron wire attached), *bb*, is passed on the lower end of the tube, and the wire led along the continuous grooves on each side of the sinkers *c*, and the bight passed over the hook *d*, the spring being pressed back. When the weight of the sinkers rests on the ring, and is supported by the wire, the weight keeps the spring pressed in; but as soon as the sinkers touch the ground, and the weight is relieved from the wire, the spring throws it off the hook, and the tube is drawn clear through the sinkers.

When the tube, with sinkers complete, is ready, it is carefully hoisted over the side, lowered gently into the sea, and eased down one or two hundred fathoms before being let go. It is then let go, and the passing of each 100-fathoms mark is timed and recorded in a printed form made to contain all the particulars of the sounding.

Sir William Thomson, F.R.S., has invented a mode of deep-sea sounding by using piano wire instead of hempen lines, which promises to obviate much of the present difficulty in deep-sea sounding.

Many very deep soundings are on record, but the two deepest well-authenticated soundings are among those obtained by H.M.S. *Challenger*. The first was about 80 miles to the northward of the Virgin Islands, the depth being 3875 fathoms, or nearly 4½ miles. Unfortunately, not thinking that so near the islands so great a depth would be found, only three cwts. of sinkers were used (the usual quantity for such extreme depths being 4 cwts.); this weight, with a one-inch line, took an hour and twelve minutes to reach the bottom. As the ascertainment of the sinkers reaching the bottom depends on the time intervals, it may be stated that the line let free to run with this weight would take about 43 seconds running out the first 100 fathoms, and the time increases as nearly as possible three seconds for each successive 100 fathoms; so that when the interval is prolonged beyond this rate, the sinker has reached the bottom. On this occasion the last 50 fathoms ran out at the rate of 2 minutes 36 seconds per 100 fathoms. The other was to the north of New Guinea, where the depth was 4475 fathoms, or more than five miles.

An idea of the average depth of the North Atlantic Ocean may be had from the fact that of 108 soundings obtained by the *Challenger*, 48 were between 1000 and 2000 fathoms, 56 between 2000 and 3000, whilst only the other 4 exceeded 3000.

SOUP (A.-S. *sup-an*, to sip or sup) is a well-known form of food, obtained either from flesh and vegetables, or from vegetables alone. Before noticing the most important varieties of soup, it is expedient that we should have a clear idea of what soup really is, or, in other words, what relation soup bears to the solid ingredients which enter into its composition. The researches of Liebig have thrown much light upon this point. When finely-chopped muscular flesh (or butcher-meat) is lixiviated with cold water, and exposed to pressure, there is left a white fibrous residue consisting of muscular fibres, of connective or areolar tissue, and of vessels and nerves. This lixivated flesh is of precisely the same quality from whatever animal it is obtained, communicates no flavor to water in which it is boiled, cannot be masticated, and as Liebig observes, 'even dogs reject it.' When the cold water has taken up all that it is capable of extracting, it is found that it has dissolved from 16 to 24 per cent. of the dry chopped flesh.

This watery infusion contains all the savory and much of the nutriment matter of the flesh, and is usually of a reddish tint, from the presence of a little of the coloring matter of the blood. On gradually heating it to the boiling-point, it is observed that the albumen of the flesh (varying in amount from 2 to 14 per cent., according as the animal was old or young) separates in nearly colorless flakes when the temperature has risen to 133°, while the coloring-matter of the blood does not coagulate till the temperature rises to 158°. The liquid is now clear, and of a pale yellowish tint; and as it reddens litmus-paper, it must contain a free acid. The infusion of flesh thus prepared has the aromatic taste and all the properties of a soup made by boiling the flesh. When evaporated, it becomes darker-colored, and finally brown; and on ceasing to lose weight, there is obtained a brown, somewhat soft mass of 'Extract of Flesh,' or 'Portable Soup,' amounting to about 12 per cent. of the weight of the original flesh, supposed to be dried. 'This extract,' says Liebig, 'is easily soluble in cold water, and when dissolved in about 32 parts of hot water, with the addition of some salt, gives to this water the taste and all the peculiar properties of an excellent soup. The intensity of the flavor of the dry extract of flesh is very great; none of the means employed in the kitchen is comparable to it in point of flavoring power.'

The soup thus made of the flesh of different animals (as, for example, the ox and the fowl) possesses, along with the general flavor common to all soups, a peculiar taste, which distinctly recalls the smell or taste of the roasted flesh of the animal employed. In order to obtain the strongest and best-flavored soup, chopped flesh should be slowly heated to boiling with an equal weight of water; the boiling should only be continued for a few minutes (for prolonged boiling only gives rise to the formation of gelatine, a substance of no nutrient value, from the connective tissue of the flesh), and the soup should be then strained off from the solid residue. As a matter of economy, it is often desirable that the meat should be left in an eatable state, which is not the case with soup made according to the preceding directions. To attain this end, the joint or mass of flesh should be set on the fire with cold water, which should be gently heated to boiling; the flesh thus undergoes a loss of soluble and savory matter, while the soup becomes richer in them. The thinner the piece of flesh is, the greater is the loss which it experiences. Hence the method of boiling which yields the best soup, gives the driest, toughest, and most tasteless meat. 'The juice of flesh,' says Liebig, 'contains the food of the muscles; the muscular system is the source of all the manifestations of force in the animal body; and in this sense we may regard the juice of flesh as the proximate condition of the production of force. Soup is the medicine of the convalescent, and as a means of restoring the exhausted strength, it cannot be replaced by any article of the Pharmacopœia. Its vivifying and restoring action on the appetite, on the digestive organs, the color and the general appearances of the sick, is most striking.'

Most soups contain an admixture of meat and vegetables in their preparation; but many good soups can be made either entirely without the use of flesh, or with fish in place of flesh. In the former class may be placed pea-soup (which is, however, much improved if a piece of bacon enters into its composition), green-pea soup, carrot-soup, potatoe-soup, asparagus-soup; while for fish-soup, pike, tench, and eels are specially used. Recipes for such soups will be found in many of the best cookery-books, and for the vegetable soups especially in the vegetarian cookery-books. The basis of all good soups, excepting those in the preceding category, is *stock*, or broth made from all sorts of meat, bones, remains of poultry or game, &c., put together, and stewed in the *stock-pot*.

Public attention was some time ago called to Liebig's *Soup for Children*. This preparation, which is hardly entitled to be called a soup, as the word is generally understood in this country, is made as follows: Take 1 oz. (one large table-spoonful) of seconds flour, and mix it very slowly and carefully with 10 oz. of cold skimmed milk, until the whole is smooth; add 7½ grains of bicarbonate of potash, dissolved in a tea-spoonful of water (if 60 grains of the potash be dissolved in 1 oz. of water, 1 tea-spoonful must be used at a time), and then heat it gently to the boiling point, and keep it boiling for five minutes. Stir it well while it is being heated; add to the whole fluid 1 oz. (1 large dessert-spoonful) of malt flour (malt ground in a coffee-mill and sieved), mixed with 2 oz. of water, and stir it well. Cover the pan, and let it stand for half an hour in water which is nearly boiling, so as to keep the fluid warm; then strain through a fine sieve, and bottle it. This quantity is sufficient for a day's supply for a child under two ysars of age, and a quart of milk should be added to it.

SOUTANE (Ital. *sottana*, Fr. *soutane*, Lat. *talaris*, i. e., *vestis*, 'a garment reaching to the ankles'), the name usually given in France and Italy to the outer garment worn in civil life (commonly with a flowing over-dress or robe) by Roman Catholic ecclesiastics, when the strict law of clerical costume is in force; and also ordered to be worn under the priestly robes used in the public ministerial offices of the clergyman. In England, it was called cassock. It is not peculiar to bishops, priests, or even to clerics in holy orders, but may be worn by all who have received even the TONSURE (q. v.). Indeed, the Council of Trent (*Dic. de Reform.*, sess. 23, c. vi.) declares that no cleric shall be held entitled to the 'privilege of clerics,' unless he shall wear the soutane. The ordinary material of the soutane is serge or woollen cloth; but it is often of more precious stuffs. The color for the secular clergy is commonly black; but dignitaries wear other colors. Thus, the pope wears a white—cardinals, a red—bishops, a violet—many canons, a blue soutane; and in religious orders and collegiate bodies, the color is regulated by special laws, which need not be particularized. Its use, as obligatory, was very general in former times, but it has gradually fallen off since the French Revolution. It is but little worn in Germany, even in the southern provinces; and in Italy, except in the former Papal States, it is much less universal than it was 30 years since. In all places, however, it is strictly required to be worn under the sacred vestments by a priest administering the sacraments, or otherwise officiating publicly.

SOUTH, ROBERT, D.D., the son of a London merchant, was born at Hackney in 1633. His earlier education he received at

Westminster School, of which Dr. Busby was then master; and in 1651, he became a student at Christchurch, Oxford. In 1655 and 1657 successively, he took his degrees of Bachelor and Master of Arts; he was ordained in 1658; and in 1660, he was appointed University Orator. In this function he was fortunate enough to please the Lord Chancellor Clarendon on his installation as Chancellor of Oxford, and in reward of his complimentary periods, S. was made his domestic chaplain. In 1663, he took his degree as Doctor of Divinity; the same year saw him promoted to a prebendary stall at Westminster; and in 1670, he became a canon of Christchurch, Oxford. In 1677, Laurence Hyde, son of the Chancellor, being sent to Poland as ambassador, he was accompanied thither by S., who had been his tutor, and was the object of his warm regard. Shortly after his return, the rectory of Islip, in Oxfordshire, was conferred upon him, and he was made chaplain-in-ordinary to Charles II. He might readily now have become a bishop, but through this and the succeeding reign, he steadily continued to decline the offers of higher preferment pressed upon him.

The designs of James II., tending to a Roman Catholic revival, he regarded with deep disapproval and alarm; but so strong was his sense of the duty of submission to the reigning monarch, that he declined all share in the conspiracy to oust him in favor of the Prince and Princess of Orange. When, however, the Revolution was accomplished, he gave in his adhesion to it. But, to his honor, he refused to profit in the way of preferment, by the deprivation of such of the higher dignitaries of the church as could not conscientiously go along with him in recognition of the new order of things. A stanch and even bigoted adherent of the Church of England, he continued to wage unsparing war from the pulpit, and with his pen, against Puritanism and every other form of dissent, occasionally occupying himself with discussions more strictly theological, till in July 1716, death came to conclude his controversies. He is now chiefly remembered by his sermons; they are masterpieces of vigorous sense and sound English, and abound in lively and witty turns, not always in severely decorous consonance with the seriousness of the subject matter. As a man, S. seems to have been of sound and estimable character; of pure life, and unblemished integrity. His entire works were sent from the Clarendon press in 7 vols. (1823), 5 vols. (1843). An edition in 2 vols. appeared at London in 1850.

SOUTHA'MPTON, a municipal and parliamentary borough, important seaport, and county of itself, in the south of Hampshire, 78 miles south-west of London by the London and South-western Railway. It occupies a peninsula at the head of Southampton Water, and between the estuary of the Test or Anton on the west and south, and the mouth of the Itchen on the east. The High Street, which is the principal thoroughfare, extends from the waterside to the Bargate, and thence to the outskirts of the town. Crossing the High Street at right angles, are many important streets, and handsome lines of new houses are found in the northern and western suburbs. S. is furnished with the usual municipal and other institutions common to all thriving towns. St. Michael's Church, the oldest in the borough, contains Norman tower arches, and several of the private houses are of Norman architecture. The *Domus Dei*, or God's House, dates from the end of the 12th c., and is one of the earliest hospitals in England. The docks can float the largest steamers, and have been greatly extended and improved; the revenue of the Dock Company in 1875 was £103,426. S. is the place of departure and arrival of the West India and Brazil, the Mediterranean, East Indian, China, and Australian, and the South African mail steam-packets.

There is considerable traffic between S. and the Channel Islands and French coast, and also a large cattle-trade with Spain and Portugal. Its harbor is perhaps the most motley and picturesque in England, being frequently crowded with Lascars, Creoles, Arabs, &c., and on the arrival of mail-steamers, with Indian and American planters, East Indian nabobs, foreign dignitaries, naval officers, and other British and foreign officials in every variety of costume. In 1880, 9221 vessels, of 1,416,352 tons, entered, and 8838, of 1,344,366 tons, cleared the port. Yacht and ship building and engine-making are actively carried on. S. is also a fashionable resort in summer. It returns two members to the House of Commons. Pop. (1871) 53,741; (1881) 60,235.

S. supplanted the ancient *Clausentum*, which stood about one mile to the north-east, and its foundation is ascribed to the Anglo-Saxons. It is called Hamtune and Suth-Hamtun in the Saxon Chronicle. After the Conquest, S., from which there was ready transit to Normandy, began to prosper rapidly, and in early times it traded with Venice and Bayonne, Bordeaux and Rochelle, Cordova and Tunis. A great part of it was burned by the combined French, Spanish, and Genoese fleets in 1338, and in the following year its defences were strengthened. S. is the birthplace of Isaac Watts (to whom a monument has been erected in the West Park), and of Thomas Dibdin.

SOUTHAMPTON WATER, a fine inlet, stretching north-west from the point at which the Solent and Spithead unite. It is eleven miles long and about two miles wide. The Isle of Wight, which intervenes between the S. W. and the Channel, forms a magnificent natural breakwater, and occasions a second high-water two hours after the first. S. W. receives the Test, or Anton, Itchen, and Hamble.

SOUTH AUSTRALIA. Recent legislation has rendered this name a misnomer, by extending the boundaries of the colony so as to include the entire center of the Australian continent comprised between the Southern and Indian Oceans, and between the 129th and the 141st degrees of E. long.—an area of 914,730 sq. miles.

Character of the Soil, &c.—The northern portion of this vast territory enjoys an abundant rainfall, and is watered by numerous streams and rivers, some of them, as the Victoria and the Adelaide, navigable for a considerable distance by ships of burden. The soil is fertile, and suitable for the cultivation of tropical productions of every description. In connection with the construction of the overland telegraph across the center of the Australian continent, this region has become better known as being suitable for settlement, already commenced.

The great central region opened up by the explorations of Stuart and M'Kinlay, and the country to the north of lat. 33°, may be described as suited only for pastoral purposes, on account of the irregularity of the rainfall and the scarcity of permanent water; and with the exception of a few patches along the coast, the same description will apply to the country to the westward of Gulf of St. Vincent, in 138° E. long. The south-eastern division of the colony, comprised between lat. 33° and the Southern Ocean, and between Gulf St. Vincent and the eastern boundary of the colony, includes every variety of soil, ranging from absolute sterility to the highest degree of fertility, great portion of it being probably unsurpassed by any region in its adaptability both in soil and climate for the growth of wheat, the vine, and the olive. This region is moderately timbered, the principal varieties being the gum, the stringy bark, and the pine, all extremely useful for fencing and building purposes.

Climate.—A country extending over 27° of latitude must necessarily embrace great varieties of temperature; but the climate, owing to prevailing aridity, appears to be, upon the whole, healthy, and remarkably free from epidemic diseases. The average annual mortality during ten years has been found, in the settled districts, to be 15 per 1000 as compared with 22 per 1000 in England. Nearly half of the deaths are those of children. The hottest months are December, January, February, and March. During these months, hot winds occasionally blow. But the same dryness of the air which accounts for the great exaltation of the temperature, renders it more endurable than might at first be supposed, and Europeans are able in the hottest weather to carry on harvest-labor without danger. Careful observations, taken in the agricultural part of the colony (i. e., south of lat. 33°), and extending over a series of years, show the mean temperature during the four hot months to average 73·60°, and during the eight cold months, 56·3°, the extreme range being from 117° to 32°. The rainfall in the north, or purely pastoral district, is as low as 7·947 inches; whilst in the south, or agricultural district, it averages as much as 48·59 inches.

Physical Aspect.—The surface of the country alternates between open plains and wooded ranges of moderate elevation, which enclose many beautiful and fertile valleys. The principal ranges are the Flinders range, which trends northward from the east coast of Spencer Gulf to the neighborhood of Lake Torrens, in lat. 30°, where it branches out into numerous spurs; and the Mount Lofty range, running nearly parallel with Gulf St. Vincent from its head-water in lat. 34° to its termination at Cape Jarvis. The Mount Lofty ranges rise to a height of about 2600 feet, running about north-east and south-west, having a breadth of over 15 miles. This district abounds in picturesque scenery, the summits being well wooded and the slopes of great beauty and fertility, affording eligible building-sites, and producing in the highest perfection many English fruits and vegetables, which fail to thrive on the hotter and more arid soil of the plains.

Throughout S. A., the deficiency of running water is remarkable; in fact, for nearly 1200 miles, following the indentations of the coast from the western boundary of the colony to the estuary of the Torrens, in Gulf St. Vincent, not even a brook of permanent fresh water finds its way into the sea. To the eastward, this deficiency is to some extent compensated, partly by the streams which take their rise in the Mount Lofty range, the principal of which are the Torrens, the Onkaparinga, the Gawler, and the Sturt, but mainly by the Great Murray. See AUSTRALIA, VICTORIA.

Unfortunately for the complete utilization of this magnificent stream, its embouchure in long. 139° E. is exposed to the full force of the Southern Ocean, which, meeting the current, throws

up a shifting bar, rendering the entrance from seaward dangerous, and practicable only for steamers drawing under 7 feet. To counteract this drawback, a tramway has been constructed from Goolwa, connecting the river with Victor Harbor, a small but well-sheltered haven situated in Encounter Bay. Another railway connects North-West Bend, 150 miles up the river, with Port Adelaide; while a northern extension runs to Terowie, 140 miles inland.

Divisions, towns, &c.—The colony naturally falls into three sections—South Australia proper, Central Australia, and the Northern Territory. The 36 counties serve for electoral purposes; the most important division is into districts, of which there were 112 in 1882. Besides Adelaide, the capital, with its 38,000 inhabitants, Glenelg had in 1881, 2724; Burra, 2647; Kapunda, 2290; and Gawler, 1811. Port Adelaide (pop. 3013), 7½ miles from the capital, is the chief harbor; but there are several excellent minor ports.

Mineral Wealth, &c.—The mineral wealth of S. A. is great, the principal metals being copper, lead, and iron; the last is of the finest quality, but in the absence of coal, cannot be profitably worked. There were 12 copper-mines at work in 1880, the principal being the Burra-Burra and the Kapunda, to the north-east of St. Vincent Gulf; the Wallaroo and Moonta, on York's Peninsula. Four gold-fields were being worked in 1880; and mineral oil and marble have been found in paying quantities.

Colonization.—The country, the conformation and physical conditions of which we have above described, was selected in 1837 as the site on which to test what was then a new principle in colonization, known as the Wakefield Theory, from the name of its author, Edward Gibbon Wakefield. The principle may be expressed in a single sentence thus: 'The waste lands of the crown, though entirely valueless prior to the application of labor and capital, acquire value according as these elements of wealth are applied to them in due proportions or otherwise; and the proceeds of the sale of these lands, if properly administered, will suffice to defray the cost of transporting the labor required for their cultivation, at the same time relieving the mother-country from the pressure of able-bodied pauperism.' A second and scarcely less important problem in economic science was put to the test on the same occasion—viz., 'The future revenues of a new colony, supplemented, if necessary, by a lien upon the lands, afford a basis of credit available for raising funds adequate to defray the cost of outfit and first settlement, and therefore the appropriation of the taxes of this country for such purposes is unnecessary and inexpedient.' Owing partly to an unfortunate delay in putting the first settlers in possession of the lands which they had paid for, but mainly to a monopoly by the government of the labor imported by the purchase-money of those lands, production was retarded during the first three years of the settlement; and the necessaries of life, which, but for this mistaken policy, might have been produced on the spot in profuse abundance, had to be imported at enormous cost, and paid for out of capital, by which means the colony was reduced to the verge of bankruptcy.

In 1841, the sound principles to illustrate which the colony was founded, were, for the first time, allowed to come into play. Government interference with the labor-market ceased; and within three years from this change of policy, breadstuffs and other agricultural products were exported from S. A. in such quantities as to glut the markets which previously supplied her necessities. From that date, the progress of the colony, notwithstanding the attractions of the adjacent gold-fields, has been remarkable. The traveler may drive for many hundreds of miles over excellent roads, amidst corn-fields and vineyards cultivated by yeomen proprietors. S. A. has become the granary of the Eastern settlements; and the subjoined statements, compiled from statistics published by government, exhibit a degree of prosperity probably unsurpassed in any country or in any age.

The waste lands are disposed of in fee-simple by public auction at the upset price of 20*s.* per acre, and lands once passed the hammer, may be purchased at that price without further competition. For pastoral purposes, lands are granted to the first applicant for a lease of 14 years at an almost nominal rent. The system of free selection within certain surveyed districts now obtains in S. A., whereby land to the amount of 640 acres can be purchased on credit, at the ordinary upset price, on a written application to the Land-office, and on the signing of an agreement, of which the main conditions are—the immediate payment of 10 per cent. of the purchase-money, and its payment in full in six years, or optionally, of half, on further interest on the remaining half, and the full payment in ten years; personal occupancy of the land; and the executing of improvements to the value of 7*s.* 6*d.* per acre before the end of the third year, and of 10*s.* before the end of the fourth.

Land, open to the public for one year, without being sold, may be leased in blocks of not more than two square miles for twenty-one years, with the right of purchase at the upset price during the lease. Under an act known as the Torrens Act, the difficulties, delays, and expenses attendant on the English system of conveyancing are removed, and land is rendered as easy of transfer, mortgage, and settlement as property in shipping. The great advantages secured by S. A. under this act have caused it to be adopted throughout the Australian colonies.

Government, &c.—The Legislative Council and the House of Assembly are both elective. Members to the Council are chosen by electors with a low property franchise, for a period of 12 years; 6 members retire every 4 years. Members of the Assembly are elected by universal suffrage for 3 years. Voting for both houses is by ballot. The executive government is dependent on parliamentary majorities, as in England. No pecuniary aid is given by government to any religion, and all churches are placed on a footing of perfect equality. The system of education is modelled on the Irish national system. Attendance is compulsory.

In 1881, the population of S. A. was 279,865; in 1876, it was 213,271, besides 3593 aborigines in the settled districts. The imports for 1880 were of the value of £5,581,497; and the exports, £5,574,505. The exports consisted chiefly of corn, wool, and copper. In the same year, the total export of breadstuffs, grain, &c., amounted in value to £2,469,720; wool weighed 43,390,566 lbs., of the value of £1,716,171; and copper 79,730 tons, valued at £346,147. The revenue derived principally from the sale of crown lands and customs dues, amounted in 1881 to £2,010,681; the expenditure, to £1,979,425; and the public debt spent in reproductive works, to £11,196,400. In 1881, the land under cultivation amounted to 2,574,489 acres, of which 1,733,542 were wheat; 13,074 barley; 4355 oats; 4337 vineyards; 4406 peas; 5587 potatoes: 10,212 gardens and orchards. There were 148,219 horses, 283,315 horned cattle, and 6,443,904 sheep in the colony in 1881. Including lines approaching completion, S. A. had in 1880, 821 miles of railway. The proposal to carry a line across the continent from Port Augusta to Port Darwin, has been favorably received. The colony has an extensive system of electric telegraphs. An overland line constructed at the expense of the S. Australian government, and opened in 1872, runs from Adelaide to Port Darwin, across Central Australia, a distance of 2000 miles, and through junction with the Anglo-Indian line, connects Australia with all the great centers of civilization. The places of worship in the colony in 1880 numbered upwards of 850. The number of schools in 1880 was given as 370; scholars, 40,578; teachers, 837. See an elaborate descriptive work on the colony, *South Australia*, by William Harcus (1876); Silver's *Handbook to A.*; and the annual issue of the *Australian Handbook*.

SOUTH BEND, a city of Indiana, U. S., on the south bank of the St. Josephs River, near the border of Michigan, on the Southern Railway, 85 miles east of Chicago. It contains a handsome court-house, the Catholic university of Notre Dame, Female Academy and Convent, Northern Indiana College, bank, 2 newspapers, 6 churches, and large manufactories. Pop. (1870) 7206; (1880) 13,280.

SOUTH CAROLINA. See CAROLINA, SOUTH.

SOUTHCOTT, JOANNA, a curious specimen of the religious visionary, was born in Devonshire, England, of humble parentage, about 1750. In her youth she was a domestic servant, chiefly in Exeter; joined the Methodists, and becoming acquainted with a man named Sanderson, who laid claim to the spirit of prophecy, made similar pretensions herself. She received encouragement from some weak-minded clergymen of the Church of England. In 1792, she declared herself to be the woman driven into the wilderness, the subject of the prophecy in Rev. xii. She gave forth predictions in prose and verse, and although very illiterate, wrote numerous letters and pamphlets, which, as well as her prophecies in verse, or rather in doggerel, were published, and found many purchasers, and many received her pretensions as genuine. One of her productions was the *Book of Wonders*. She also issued sealed papers to her followers, which she termed her *seals*, and which, she assured them, would protect them from the judgments of God both in this and the other world, assuring their salvation.

Thousands of both sexes received them with implicit confidence, among whom were men of good education and respectable position in society. At length she imagined herself to have symptoms of pregnancy, and announced that she was to give birth, at midnight on the 19th October, 1814, to a second Shiloh, or Prince of Peace, miraculously conceived, she being then more than 60 years of age. The infatuation of her followers was such that they received this announcement with devout reverence, prepared an expensive cradle, and spent considerable sums, that all might be suitable for so great an occasion. The expected birth did not take place, but on 27th December, 1814, the woman died. On a post-mortem examination, it was found that the appearance of pregnancy which had deceived others, and perhaps herself, was due to dropsy. She was privately buried in London. Her followers, however, were not to be undeceived, and continued to believe that she would rise again from her 'trance,' and appear as the mother of the promised Shiloh. In 1851, according to the census

returns, there were still four congregations of Southcottians in England. Unfortunately, later census returns afford us no information on such subjects. Some passages in her absurd prophecies are of rather a practical character, as the following: 'I am the Lord thy God and Master: Tell I—— to pay thee five pounds for expenses of thy coming up to London; and he must give thee twenty pounds to relieve the perplexity of thy handmaid and thee, that your thoughts may be free to serve me the Lord, in the care of my Shiloh.' This was published in 1820. The Lord is also made to inform his people somewhere, anxious to go to meet the Shiloh at Manchester, that traveling by the new cut is not expensive.

The history of Joanna S. herself has not much in it that is marvelous; but the influence which she exercised over others may well be deemed so, and the infatuation of her followers is hard to be understood, particularly when it is considered that some of them were men of some intelligence and of cultivated mind. Probably the secret of her influence lay in the fact that the poor creature was in earnest about her own delusions. So few people in the world are really so, that they are always liable to be enslaved by others who have convictions of any kind, however grotesque. On her deathbed, Joanna said: 'If I have been misled, it has been by some spirit, good or evil.' She knew that she was not 'herself' (as the Scotch say), when she prophesied; but she was of too mean an order of intelligence to understand that she was mad, and therefore preferred to attribute her delusions to the Deity, or as she said at the last moment with pathetic half-penitent vacillation, to 'some spirit, good or evil.' Poor Joanna never suspected that the spirit which played such vagaries was her own.

SOUTHERNWOOD. See ARTEMISIA.

SOUTHEY, ROBERT, was born 12th August 1774, at Bristol, in which city his father was a linen-draper. In 1788, he was sent to Westminster School by his maternal uncle, the Rev. Herbert Hill, chaplain to the English factory at Lisbon, who undertook the charge of his education, his father's pecuniary affairs having become much embarrassed. At Westminster, he much distinguished himself; but in 1792 a trivial insubordination led to his expulsion; and next year he was entered at Balliol College, Oxford, with a view to his taking orders. This, however, he ultimately declined to do, having been led by his sympathy with the French Revolution, into a considerable departure from the orthodox civil and religious standards. In 1794, he left Oxford, having published the year before, in conjunction with his friend Robert Lovell, a small volume of poems, the first literary venture of a life thenceforward to be almost wholly devoted to literature. Shortly after, he received from Cottle, for his first poem of any length, *Joan of Arc*, the sum of £50; and in November 1795, he was married to a Miss Fricker of Bristol; Coleridge, with whom he had become intimate, on the same day marrying a sister. After passing some little time with his uncle in Portugal, engaged in a diligent study of the language and literature of that country and of Spain, he became a student of Law at Gray's Inn. Here he worked at his new poem of *Madoc*, and learned nothing whatever of law, a pursuit which he speedily relinquished as hopeless. In 1801, he accepted a situation as secretary to Mr. Corry, Chancellor of the Exchequer for Ireland; but finding its duties distasteful to him, he very soon threw it up, and finally betook himself to literature as his sole source of livelihood.

In 1804, he settled himself at Greta Hall, near Keswick in Cumberland, where he spent the remainder of his life, working with the regularity of a machine, happy in his family relations and his unremitting daily round of congenial, though continuous toil. His biography thence onward for forty years, till the pen dropped from his fingers, might be summarized in the list of his works, which of itself would fill a page or two. In addition to these formal publications, he wrote largely for various periodicals, notably for the *Quarterly Review*, to which, from its establishment in 1809—having now become as violently conservative in his views as in youth he had been revolutionary—he was a most constant and valued contributor.

In 1807, in consideration of his services to literature, a pension of £160 per annum was awarded him; and in 1813, on the death of Mr. Pye, he succeeded him as Poet Laureate. Through Sir Robert Peel, in 1835, he received a further pension of £300, and along with it the offer of a baronetcy, which, however, he decided to decline. His first wife dying in 1837, he, two years after, was married to Miss Caroline Bowles. On March 21, 1843, he died, his few last years having for the most part been passed in a state of painful mental stupor, which incapacitated him for literary exertion.

S.'s poetry—except in a few of his shorter ballad pieces—can at no time be said to have been popular, and is now nearly forgotten. His chief works are *Madoc*, *Thalaba*, *The Curse of Kehama*, and *Don Roderick*, of which the last two are reckoned the best. In all of them are to be found noble passages, in which an ample and stately rhetoric counterfeits with surprising success the pure instinct of music; but they rather skilfully illustrate the art and technic of poetry than breathe its essential life. As a prose writer, he ranks high; his style is easy, lucid, agreeable, nicely modulated throughout, and readily rising into eloquence on suggestions of sentiment and subject. But of all his multifarious writings in this kind, his little *Life of Nelson* seems most likely to survive as a classic. The most popular of his works when produced, it continues to be admired as, within the assigned limits, an almost perfect model of biography. Other very excellent biographies, however, are those of the poet Cowper, of Bunyan, and Wesley. His Life and Correspondence, edited by his son, was published in 6 vols. (1849); a Selection from his Letters (1856); his *Correspondence with Caroline Bowles* (1881).

SOUTH ISLAND, the southern of the two large islands which, with the small Stewart's Island, form the British colony of New Zealand (q. v.).

SOUTHMO'LTON, a municipal borough in the north of Devonshire, 11 miles east-south-east of Barnstable. Woollen goods are manufactured. Pop. (1871) 3978; (1881) 3340.

SOU'THPORT, a fashionable bathing-place in Lancashire, on the south shore of the estuary of the Ribble, 19 miles north of Liverpool. It is a handsome town, and is almost wholly of recent erection. There are assembly-rooms, libraries, large hotels, &c.; the sands are good, and there is an iron pier nearly a mile long. The rapidity with which S. has risen in public favor as a watering-place, is the best evidence of its salubrity and beauty. Pop. (1851) 5391; (1881) 32,164.

SOUTH SEA SCHEME, THE, commonly designated the SOUTH SEA BUBBLE, a term peculiarly expressive of its hollow and ephemeral splendor and sudden collapse, was originated by Harley (q. v.), Earl of Oxford, in 1711, with the view of restoring public credit, and providing for the extinction of the floating national debt, which at that time amounted to £10,000,000. This debt was taken up by a number of eminent merchants, to whom the government agreed to guarantee for a certain period the annual payment of £600,000 (being 6 per cent. interest), a sum which was to be obtained by rendering permanent a number of import duties. The monopoly of the trade to the South Seas was also secured to these merchants, who were accordingly incorporated as the 'South Sea Company,' and at once rose to a high position in the mercantile world. The wondrously extravagant ideas then generally current respecting the riches of the South American continent, were carefully fostered and encouraged by the Company, who also took care to spread the belief that Spain was prepared, on certain liberal conditions, to admit them to a considerable share of its South American trade; and, as a necessary consequence, a general avidity to partake in the profits of this most lucrative speculation sprung up in the public mind.

It may be well to remark in this place, that the Company's trading projects had no other result than a single voyage of one ship in 1717, and that its prominence in British history is due entirely to its existence as a purely monetary corporation. Notwithstanding the absence of any symptoms of the carrying out of its great trading scheme, the Company had obtained a firm hold on popular favor, and its shares rose day by day; and even when the outbreak of war with Spain in 1718 deprived the most sanguine of the slightest hope of sharing in the treasures of the South Seas, the Company continued to flourish. Far from being alarmed at the expected and impending failure of a similar project—the Mississippi Scheme (q. v.)—the South Sea Company believed sincerely in the feasibility of Law's scheme, and resolved to avoid what they considered as his errors. Trusting to the possibility of pushing credit to its utmost extent without danger, they proposed in the spring of 1720, to take upon themselves the whole national debt (at that time £30,981,712), on being guaranteed 5 per cent. per annum for 7¼ years, at the end of which time the debt might be redeemed if the government chose, and the interest reduced to 4 per cent.

The directors of the Bank of England, jealous of the prospective benefit and influence which would thus accrue to the South Sea Company, submitted to government a counter-proposal; but the more dazzling nature of their rival's offer secured its acceptance by parliament—in the Commons by 172 to 55, and (April 7) in the Lords by 83 to 17; Sir Robert Walpole in the former, and Lords North and Grey, the Duke of Wharton, and Earl Cowper in the latter, in vain protesting against it as involving inevitable ruin. During the passing of their bill, the Company's stock rose steadily to 330 on April 7, falling to 290 on the following day. Up till this date, the scheme had been honestly promoted; but now, seeing before them the prospect of speedily amassing abundant wealth, the directors threw aside all scruples, and made use of every effective means at their command, honest or dishonest, for keeping up the factitious value of the stock. Their zealous endeavors were crowned with success; the shares were quoted at 550 on May 28, and 890 on June 1. A general impression having by

this time gained ground that the stock had reached its maximum, so many holders rushed to realize, that the price fell to 640 on June 3. As this decline did not suit the personal interests of the directors, they sent agents to buy up eagerly; and on the evening of June 3, 750 was the quoted price. This and similar artifices were employed as required, and had the effect of ultimately raising the shares to 1000 in the beginning of August, when the chairman of the Company and some of the principal directors sold out. On this becoming known, a widespread uneasiness seized the holders of stock, every one was eager to part with his shares, and on September 12 they fell to 400, in spite of all the attempts of the directors to bolster up the Company's credit.

The consternation of those who had been either unwilling or unable to part with their scrip, was now extreme; many capitalists absconded, either to avoid ruinous bankruptcy, or to secure their ill-gotten gains, and the government became seriously alarmed at the excited state of public feeling. Attempts were made to prevail on the Bank to come to the rescue by circulating some millions of Company's bonds; but as the shares still declined, and the Company's chief cashiers, the Sword-blade Company, now stopped payment, the Bank refused to entertain the proposal. The country was now wound up to a most alarming pitch of excitement; the punishment of the fraudulent directors was clamorously demanded; and parliament was hastily summoned (December 8) to deliberate on the best means of mitigating this great calamity. Both Houses, however, proved to be in as impetuous a mood as the public; and in spite of the moderate counsels of Walpole, it was resolved (December 9) to punish the authors of the national distresses, though hitherto no fraudulent acts had been proved against them. An examination of the proceedings of the Company was at once commenced; and on Walpole's proposal, nine millions of South Sea bonds were taken up by the Bank, and a similar amount by the East India Company. The officials of the Company were forbidden to leave the kingdom for twelve months, or to dispose of any of their property or effects. Ultimately, various schemes, involving the deepest fraud and villainy, were discovered to have been secretly concocted and carried out by the directors; and it was proved that the Earl of Sunderland, the Duchess of Kendal, the Countess Platen and her two nieces, Mr. Craggs, M.P., the Company's secretary, Mr. Charles Stanhope, a Secretary of the Treasury, and the Sword-blade Company, had been bribed to promote the Company's bill in parliament by a present of £170,000 of South Sea stock.

The total amount of fictitious stock created for this and similar purposes was £1,260,000, nearly one-half of which had been disposed of. Equally flagrant iniquity in the allocation of shares was discovered, in which, among others, Mr. Aislabie, the Chancellor of the Exchequer, was implicated. Of these offenders, Mr. Stanhope and the Earl of Sunderland were acquitted, through the unworthy partiality of the parliament; but Mr. Aislabie and the other directors who were members of the House of Commons, were expelled; most of the directors were imprisoned, and all of them suffered confiscation of their possessions. The chairman was allowed to retain only £5000 out of £183,000 and others in proportion to their share in the fraudulent trapsactions of the Company. At the end of 1720, it being found that £13,300,000 of real stock belonged to the Company, £8,000,000 of this was taken, and divided among the losers, giving them a dividend of 33⅓ per cent.; and by other schemes of adjustment, the pressure of loss was so fairly and widely distributed, that the excitement gradually subsided. Contemporary with this great gambling scheme were numerous other 'bubbles,' most of them based upon the most shadowy foundations, and projected for the achievement of the most frivolous and even absurd ends; but none of them rose to such importance as the South Sea Scheme, though collectively they added greatly to the general distress of the period, till they were suppressed by act of parliament, 12th July 1720.—See Coxe's *Walpole*, *Bubbler's Medley*, published by Carrington Bowles, Mackay's *Popular Delusions*, and the various histories of England during this period.

SOUTH SHETLANDS, New, a group of islands in the South Atlantic, about 600 miles S. of Cape Horn, in lat. 61°—63° 50′ S. The islands are destitute of vegetation, with the exception of a species of moss. The chief are Smith, Livingston, Nelson, King George, Clarence, and Elephant Islands. Ice and snow lie at the sea-level all the year.

SOUTHWARK. See London.

SOUTHWELL, a small market-town of considerable antiquity in Notts, 12 miles north-east of Nottingham. At S., Charles I. surrendered himself to the Scotch commissioners. S. has a noble minster, Norman and Early English in style; a church was built here by Paulinus in 627. An act of parliament in 1878 provided for founding a new bishopric at S., when certain conditions (as to endowment, &c.) should have been fulfilled. Pop. (1871) 2400.

SOUVALKY, chief town of the government of the same name, in Poland, on the left bank of the river Charnagarche, a tributary of the Niemen, 538 miles S.W. of St. Petersburg. Pop. (1880) 21,040.

SOUZDAL, a town of Russia, in the government of Vladimir, is one of the oldest towns in Russia, dating, it is said, from 606 B.C. Pop. (1880) 9000.

SO'VEREIGN, the name applied in politics to the person or body of persons in whom the legislative power of a state is vested. In limited monarchies, sovereignty is in a qualified sense ascribed to the king, who, though the supreme magistrate, is not the sole legislator. A state in which the legislative authority is not trammeled by any foreign power, is called a sovereign state. The states of the German Emplre were designated *mi-souveraines*, because their sovereignty was qualified by their subordination to the imperial authority; and the same term may be applied to the states of the American Union.

SOVEREIGN, an English gold coin of the value of twenty shillings sterling, the standard weight of which is 123·374 grains troy. The name was first applied to a gold coin issued in the reign of Henry VIII., otherwise called the double royal or rial, on which the king was represented in the royal robes. The name disappeared after a few reigns, and was revived as applicable to the gold piece of George III., issued in 1817, of the value of twenty shillings, which was substituted for the guinea, which had previously been current, of the value of twenty-one shillings.

SOWBREAD. See Cyclamen.

SO'WERBY BRIDGE, a small manufacturing town in the West Riding of Yorkshire, three miles south-west of Halifax. It contains iron-works, malting-houses, corn-mills, worsted and cotton factories, chemical works, and dye-works; but the woollen manufacture is the principal branch of industry. Pop. (1871) 7041; (1881) 8721.

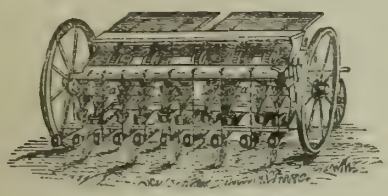
SOWING and SOWING-MACHINES. Sowing is the deposition in the ground of the *seeds* of cultivated plants, and while agriculture was yet in a rude condition, was always performed by scattering the seeds from the hand over the prepared surface of the soil. This mode, distinguished as *hand-sowing*, is still employed in the Highlands and in garden husbandry; but in the more extensive operations of the farm, it has been very much superseded by the use of sowing-machines of various kinds—the broadcast sowing-machine, the drilling-machine, and the dibbling-machine; the first being employed exclusively for cereals and grasses, the other two for any kind of crop. The preparation of the soil for the reception of the seed consists in the thorough removal from it, or destruction, of weeds; in its reduction to as fine a state of division as possible by means of the plough, grubber, harrow, and roller, and in the application of the fitting manures. Attention must also be paid to the seed to be sown, that it be mature, unmixed, and each seed perfect in itself. A frequent change of seed from different soils and climates is beneficial. Strong, vigorous seed should be used. Imperfection of seed can be remedied by 'steeping' the seed previous to sowing it.

The 'steeps' employed are of two sorts, acid and alkaline; the former acting directly on the fungoid sporules and the bruised grains, and destroying their vitality; the latter converting the oily matter which attaches the sporules to the grains into soap, and so detaching them by the aid of a little stirring. Of the acid steeps, blue vitriol or sulphate of copper (SO_3,CuO + 5HO) in the proportion of ¼ lb.—1 lb. to as much water as will cover 4 bushels of grain, is the best of all steeps, and is the one most commonly employed; the others are green vitriol or sulphate of iron (SO_3, FeO + 7HO), and various arsenical preparations. The alkaline steeps, which are inferior to the former, being more limited and less certain in their action, are putrid urine, lime-water of maximum strength, and Glauber's Salts or sulphate of soda. After the seed had been steeped, it ought to be spread out on a floor in thin layers to dry, after which it should be at once sown.

Cereals.—As above mentioned, cereals may be sown either broadcast, drilled, or dibbled. If the first method is to be adopted the land receives what is called the seed-furrow; or if rough, it gets a single stripe with the harrows, and the seed is then sown either by hand or by the broadcast machine. This machine consists of a triangular frame with the apex to the front, supported on three wheels, and carrying a long wooden box of the form of a triangular prism, set with a flat side—the lid—uppermost. This box, which is placed at right angles to the line of draught, is furnished with a row of small holes, at the bottom, about 7 inches apart; and a little above this row is placed a longitudinal spindle, carrying a set of hard circular brushes, one opposite each hole, and deriving a rotatory motion from the axle of the hind wheels.

The size of the apertures can be adjusted to the desired quantity of seed per acre, by means of a movable plate outside provided with holes corresponding to those of the box. When the box is supplied with seed, and the machine set in motion, the grain drops through the holes, which are kept from clogging by

the rapid rotation of the brushes. The box is made of such a length (16 to 20 feet) that 30 to 35 acres may be sown in a day. The seed is then covered by harrowing. This machine was much used in Scotland, being rather better suited to hilly and uneven surfaces, and from its more rapid execution, to a climate which more frequently interferes with agricultural operations. In England, where the climate is more favorable, and the surface more level, the drilling-machine is the favorite. So it is now in Scotland, where the amount of seed deposited by drilling has increased immensely during the last 10 years. Even in the far inland glens, drill-machines are rather growing in popularity. The land is prepared for sowing by as complete pulverization as possible, and its surface is made quite even by the harrow and roller. The drill (fig.), which in the arrangement of some of its essential parts



Corn-drill.

corresponds to the broadcast-machine, differs from it in being furnished with a set of coulters, which are hollowed behind to enclose the lower ends of a corresponding set of tin tubes, whose upper ends are fixed opposite to the holes in the seed-box.

By this machine, a series of furrows of uniform depth are made by the coulters; into these furrows the seed is conveyed by means of the tin tubes. The modern drill machine covers the seed most uniformly. The harrowing is generally completed before drilling begins. The spindle inside the seed-box is provided with grooved cylinders or pinions in place of brushes, and the seed-rows are generally made from 4 to 10 inches apart. The advantages of this machine over the former consist in the greater regularity of deposition of the seed, which admits of hoeing and other cleaning operations during the early period of growth; in the uniform depth at which the seed is planted, so that none of it is lost by being buried, while it is all covered; in the protection of the operation from the disturbing influence of winds; in the saving of seed and greater yield of grain, it being often found that if drilled seed be to broadcast, in quantity, as 2 to 3, their respective yields are nearly as 5 to 4; in the free access of sun and air during growth; and in the less liability of the crop to 'lodge' flat at the root. But it has one disadvantage: an ordinary drill cannot sow more than 10—12 acres per day, and employs more men and horses than the broadcast-machine. From 2 to 3 bushels of seed per acre suffices with the drill, whereas from 3 to 4 is necessary with the broadcast-machine, and from 5 to 6 bushels with the hand. The great saving of seed and other advantages thus fully atone for the extra work involved by the drill.

The third method of sowing, by dibbling, is employed chiefly on the light soils in the south of England, and even there not generally, at least in the case of cereals, so that a minute description of the machines by which the operation is effected is unnecessary. Suffice it to mention that dibbling only requires about one-third of the seed which is necessary in drilling, and presents still greater opportunities for weeding and stirring the soil in the early stages of growth; but is attended with various important defects, and is more expensive.

When a cereal crop is to be followed by grass, the grass seeds are sown a few days after the other crop, by a broadcast-machine or by the hand.

Beans.—The sowing of this crop (see BEAN) is performed by means of the *bean harrow*, a machine the same in structure as the drilling-machine for corn, but wanting the coulters, and having only three tubes, through which the seeds fall. Peas are frequently sown along with beans, the latter acting as a support to the former, and the two together better preventing the growth of weeds. The hand is also sometimes adopted.

Turnips.—For this crop the ground must be more thoroughly cleaned and broken down than for any other; after which it is formed into drills from 26 to 29 inches apart, which are then supplied with manure, and covered with the drill-plough, splitting the original drills. The new ridges thus formed being directly above the manure, the seeds are sown on the top of each ridge by means of the *turnip-drill*. This machine, instead of a seed-box of the ordinary form, has two tin or tinned-iron barrels, placed on a spindle. Each cylinder has a row of holes round its middle circumference, the row being covered by a circular sliding collar of thin metal, perforated with corresponding holes. Each seed-box has its corresponding seed-tube and hollow coulter, as in the corn-drill; but the turnip-machine has in addition a roller in front of the coulters, for compressing the crests of the ridges, and some machines have two light rollers attached behind, which slightly compress the earth raised by the coulters, and cover the seeds. The quantity of seed sown is about 2 lbs. of globe or yellow, and about 3 lbs. of Swedish turnips to the acre. The proper time to sow swedes is from the 12th to 25th of May, and yellows from the 26th May to the 12th June.

SOW THISTLE (*Sonchus*), a genus of plants of the natural order *Compositæ*, suborder *Cichoraceæ*, having an imbricated involucre, swollen at the base, with two rows of unequal scales, which at length bend inwards; a naked receptacle; the fruit transversely wrinkled and without a beak, the pappus hairy and without a stalk. The COMMON S. T. (*S. oleraceus*) abounds in Britain and in most parts of Europe, as a weed in gardens and cultivated fields. It is an annual plant, delighting in rich soils, grows to the height of two or three feet, with somewhat branching stem, and small yellow flowers almost in umbels. The tender tops and leaves are much used in the north of Europe as greens.—The CORN S. T. (*S. arvensis*) is a perennial with large yellow flowers, frequent in corn-fields in Britain, and throughout great part of Europe.—Nearly allied to the genus *Sonchus* is *Mulgedium*, to which belongs the ALPINE BLUE S. T. (*M. alpinum*), the beautiful blue flowers of which adorn some of the most inaccessible spots of the mountains of Switzerland and of Scotland.

SOY is a thick and piquant sauce, made from the seeds of the SOY BEAN (*Soga hispida*), a plant of the natural order *Leguminosæ*, suborder *Papilionaceæ*, so nearly allied to the genus Dolichos (q. v.) as to be often included in it. It is a native of China, Japan, and the Moluccas, and is much cultivated in China and Japan. It is also common in India, although, probably, not a native of that country. The seeds resemble those of the Kidney Bean, and are used in the same way. The Japanese prepare from them a substance called *Miso*, which they use as butter.

Soy is made by mixing the beans softened by boiling with an equal quantity of wheat or barley roughly ground. The mixture is covered up, and kept for 24 hours in a warm place, to ferment. The mass is then put into a pot, and covered with salt, the salt used being in quantity about equal to each of the other ingredients. Water is poured over it; and it is stirred, at least once a day, for two months, after which the liquor is poured off and squeezed from the mass, filtered, and preserved in wooden vessels. By long keeping, it becomes brighter and clearer. A Chinese sauce, called *Kitjap* (Ketchup), is often sold in Britain as soy, but is very inferior to the true soy.

SPA, a town of Belgium, and a watering-place of world-wide celebrity, stands in a romantic valley amid hills which form part of the Ardennes chain, 27 miles south-east of Liége, and 22 miles south-west of Aix-la-Chapelle by railway. The prettily-built town consists almost entirely of inns and lodging-houses. The chief edifices are the *Redoute*—plain outside, but handsome within, and including under one roof a theater (open four times a week), a ball-room, &c.—and the *Vauxhall*, a second Redoute, but now little used. Gaming, which figured prominently among the amusements, was suppressed in 1872. The mineral springs, seven in number, are all chalybeate, and contain minute quantities of iron, so combined with alkaline salts and carbonic acid gas as to be both easily digested and agreeable to the palate. They are cold, bright, and sparkling, and are efficacious in complaints of the liver, nervous diseases, &c. Spa-water is exported to all quarters of the globe. The other springs are near the town, and most of them are situated amid picturesque plantations. S. is also famed for the manufacture of wooden toys, which are stained brown by being steeped in the mineral waters. Pop. (1870) about 5900. The number of visitors during the season is about 20,000, of whom half are Belgians. S. was frequented as a watering-place as early as the 14th c., and has given its name to many mineral springs.

SPACCAFO'RNO, a city of Sicily, in the province of Syracuse, with 8035 inhabitants. Opposite S., Roger, king of Sicily, gained a signal victory over the Saracens in 1092.

SPACE AND TIME. Space and Time being the most general conditions, forms, or attributes of all existing things, their discussion is linked with the highest problems of philosophy. Space is co extensive with, and inseparable from, the sensible, external, or ObjectWorld; time is a property both of the Object World and of the Subject Mind.

Of the so-called Innate Ideas maintained by one school of philosophy, Space and Time are the foremost examples. (Other examples are Number, Infinity, Being, Substance, Power, Personal Identity, &c.) Accordingly, it is held, on the one side, that these notions are underived, or intuitive to the mind; and, on the other side, that they arise in the course of our education or experience, like our ideas of heat, sound, color, gravity, &c.

To begin with Space. The supporters of the innate or intuitive origin of the idea allow that it does not arise in the mind until actual objects, or extended things, are presented to the senses—until we see the visible, and touch the tangible things around us;

but they declare that this contact with the sensible world is only the *occasion* of our becoming conscious of what was already in the mind. Thus, Mr. Mansel says: 'Space is not properly an *innate idea*, for no idea is wholly innate; but it is the innate element of the ideas of sense which experience calls into consciousness.' It is, in short, the superadding of some independent activity of the mind to the passive sensation.

The reasons usually given for assuming an intuitive element in the idea of Space are, in the main, the reasons given for innate ideas generally; they chiefly resolve themselves into affirming the attributes of *universality* and *necessity* in such ideas, and the inadequacy of mere sensible experience to reveal these high attributes of things. Whatever is got by experience can be thought away; Space and Time cannot. Thus, it is impossible for us to receive any sensible impression of an outward object—the sun, for example—without conceiving that thing as existing in space. To use the language of Kant, Space is a form of our sensibility, or sensible perception; and as the perception itself cannot, he thinks, give this universal and inseparable form—it must be contributed by the mind. Sir W. Hamilton supposes that we may have an 'empirical' notion of Space—i. e., a notion from experience; but that Space as a 'form' is not obtained from experience, but from intuition. He does not, however, explain clearly wherein consists the difference between these two notions.

According to the opposite view, Space is an abstraction from our experience of extended things, exactly as gravity is an abstraction from gravitating bodies, and justice from just actions. We first obtain from experience a variety of impressions, in the concrete, of things possessing extension; and, next, from all these, by the usual process of abstraction, we gain a notion of extension in the abstract, or Space. A few remarks may be made on these two distinct operations, as both involve matters of controversy.

1. Before the Muscular Feelings were distinctly recognized as something superadded to the proper sensations of the senses—or the feelings of mere light, sound, &c., it was not easy to show that, by sensible experience alone, we could perceive objects as extended, or as occupying space. The pure optical sensibility of the eye is for color solely; the pure tactile sensibility is for softness and smartness, roughness and smoothness, &c. When, however, we make full allowance for the whole range of feeling connected with the exercise of muscular energy, there is no difficulty in accounting for the origin of such notions as Resistance (Force or Power) and Extended Magnitude. The element supposed, by the *à priori* philosophers, to be contributed by the mind itself, is, according to the other school, Muscularity, or the feeling of the putting forth of inward energy. The two senses related to our cognizance of Space—Sight and Touch, are compound senses; they involve an active energy, with its peculiar consciousness, as well as a passive sensibility; and all that is characteristic of Extension, or Space, arises through these muscular accompaniments.

2. Having perceived a great number of things as extended, with the intervals of unoccupied extension that separate these, we form an idea of extension in the abstract. The distinguishing peculiarity of this abstraction is related to *unoccupied* extension, or empty space, where we seem to have extension without anything extended; rendering the idea of Space unlike other abstract ideas, as Gravity, or Justice, which are conceivable only as embodied in gravitating things, or just actions. Still, empty space is a reality to us, inasmuch as it expresses cessation of resistance, and free scope for movement. To the senses alone, without the muscular accompaniments, Space would be a nonentity, an inconceivability; but the feeling of the sweep of the arm, or of the locomotion of the body, in passing from one point of resistance to another, is a genuine mental experience—the filling up of the interval between two tactile encounters, or between two optical pictures, with conscious activity.

The idea of TIME, continuance, or endurance, applies both to our feelings of energy put forth, and also to our sensations, emotions, and the flow of our ideas; in other words, it attaches both to the extended or Object World, and to the unextended or Subject Mind. In our muscular feelings, which represent the universe of matter and space, we discriminate a dead strain, or effort of resistance, lasting a short time, from the same strain lasting a longer time; and also a more persisting movement from a less. So in the sensations; a sound enduring a second is different to us from a sound enduring two seconds: a transitory odor is not confounded with one of greater continuance.

We distinguish two bursts of wonder, terror, love, or anger, if they have been unequal in their duration. Abstracting from all these experiences of continuance in the concrete, we obtain the idea of Time; which idea, however, like other abstractions, must be conceived by us under some individual continuing thing. If we were to imagine the whole outward universe annihilated, we should still have, in our own consciousness, an instance of the continuing, and upon that we could sustain the conception of Time. See GENERALIZATION.

Time is measured by Space, and Space by Time. The one is often expressed by the other, but with a certain limitation; we say 'a space of time,' but not a 'time of space.' Movement is common to both. Of passive sensations, the best for indicating time are those of Hearing.

SPADE-HUSBANDRY, COTTAGE-FARMING, AND FIELD-GARDENING, are phrases of synonymous meaning, and denote the cultivation of farm-crops on a small scale by means of the spade. This system has long been in operation in Belgium and Flanders, where the holdings average little more than five, though a few are as large as forty acres; and by steady industry and economy, even the smallest of them is capable of maintaining a family in comfort. In this country, cottage-farming is chiefly practised among the miners in Cornwall, who at first received leases of their coarse unreclaimed land at 2s. 6d.—5s. per acre, the lease to last for three lives. These patches of from three to five acres number over 6000, and have increased greatly in value. In Orkney and Shetland, some of Sutherlandshire, and much of the Western Isles of Inverness and Argyleshire, spade-culture is quite common, and when properly done is a thorough means of cultivation. In Lincolnshire, especially on the isle of Axholme, the same system exists.

The success of small-farming depends on two causes—the inexpensiveness of the stocking and implements, and the superior fertility of the soil when dug. The implements required are—spades and digging-forks of different sizes, hoes, rakes, scythe, reaping-hooks, flail, hayfork, wheel-barrow, and a few other implements equally inexpensive; the steading consists of the cottage, a cow-shed (for one or two cows), and a pig-sty; the stock, of cows, pigs, and poultry, besides household furniture. The superiority of the spade over the plough rests on its deeper cultivation; on its not forming a hard impermeable crust on the surface of the subsoil, as the plough does; on its more thorough subdivision of the soil; and on its more effective burying of weeds. Besides the treading of the land by the horses' feet is avoided. As a conclusive instance of this, may be given a sketch of the system pursued by the Rev. Mr. Smith of Lois-Weedon, Northamptonshire, with its results. Mr. Smith drilled wheat in the usual manner, dug the intervals two spits deep, so as gradually, year by year, to bring up more and more of the subsoil, and by careful keeping down of weeds, repeated stirring of the soil, and sowing the next crop in the intervals between the rows of the former, he succeeded at a total expense of £3, 14*s.* per acre, in obtaining a profit of £8 per acre.

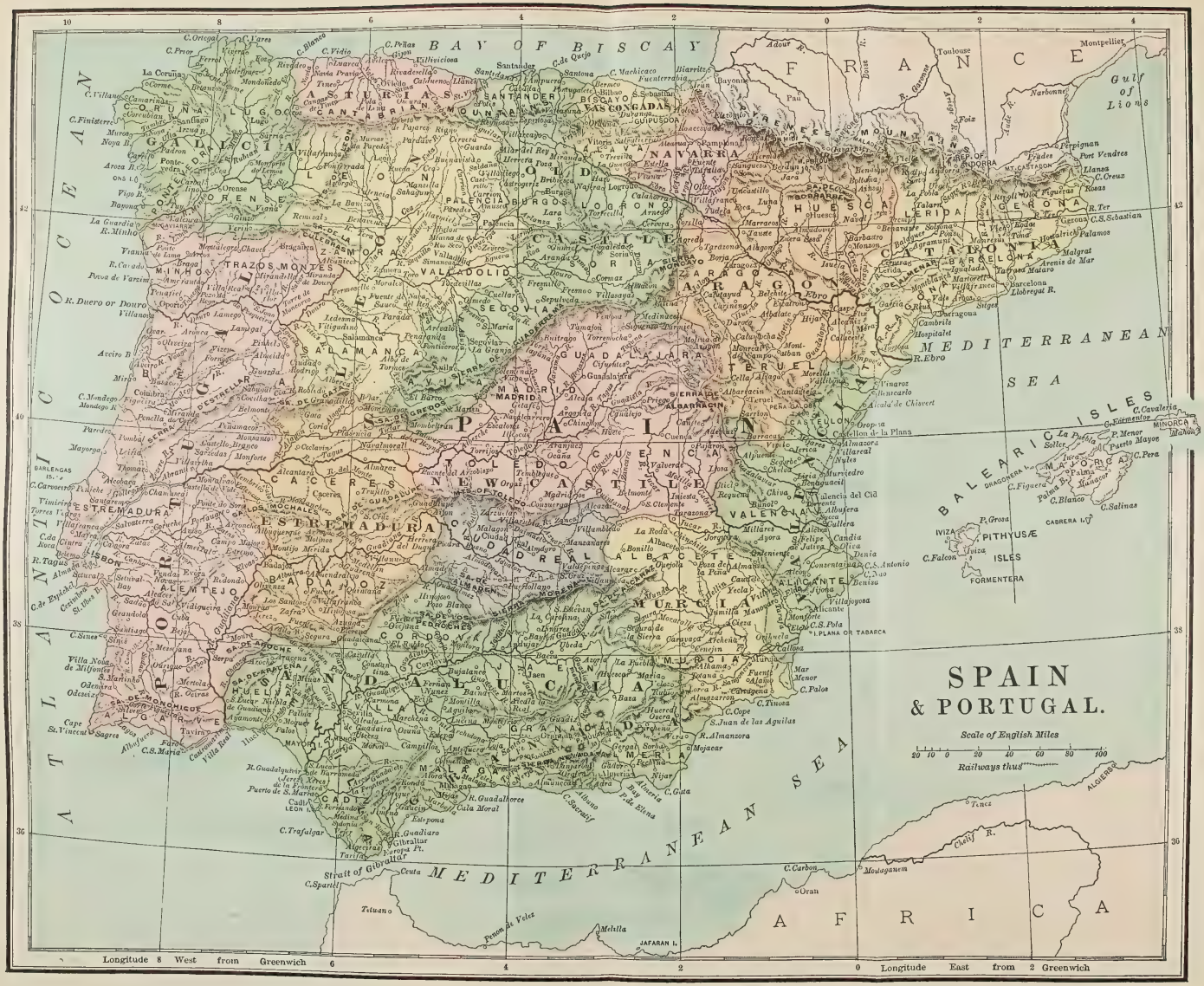
Mr. Smith also sowed wheat in strips of three rows, with twelve inches between the rows, and intervals of three feet between the strips; and by dint of thorough digging and trenching between the rows with the spade, he succeeded for 14 successive years in producing 36 bushels of wheat annually, without the application of a particle of manure. Similar experiments have been made with success at Rothamstead in Herts, by Mr. Lawes, who found, however, that proper and sufficient manuring almost doubled the crop. The subject of cottage-farming deserves serious attention in connection with the movement for ameliorating the condition, and preventing the decrease, of the rural population of the country. It is receiving such; there is a growing feeling among landlords in favor of increasing the number of crofts, and thereby inducing the best laborers to remain in their native country, instead, as has been too much the case, of emigrating.

SPA'DIX. See SPATHE.

SPAGNOLE'TTO. See RIBERA.

SPA'HIS (the same with *Sipahi*, or Sepoy, q. v.) were the cavaliers furnished by the holders of military fiefs to the Turkish army, and formed the élite of its cavalry. The S., along with the Janizaries (q. v.), owe their organization primarily to Orchan, the second of the Ottoman sultans, finally to Sultan Amurath I.; and when levied *en masse*, could number 140,000, but such a levy was very seldom called for. In the field, they were divided into two classes, distinguished by the color (red and yellow) of their standards; one class had pistols and carbine, the other a bow and arrows, and both carried a sabre, lance, and *jerid*, or javelin. They were excellent irregular troops; but when European organization was introduced into the Turkish army, they were replaced (1826) by regular horse. At the present time, the French have numerous regiments of Spahis, raised from among the native tribes of Algeria and from France in about equal proportions; the dress, especially of the indigenous soldiers, partakes very much of the Arab character. The natives are allowed to rise to any grade below that of captain; but all the superior officers are of French descent. See ZOUAVES.

SPAIN (Span. *España*), a kingdom of Europe, occupying the larger portion of the great peninsula which forms the south-west corner of the European continent, reaching further south than any other European country, and further west than any except Portugal. It is bounded on the N. by the Bay of Biscay and by France, from which it is separated by the mountain ridge of the Pyrenees; on the


SPAIN
& PORTUGAL.
Scale of English Miles
20 10 0 20 40 60 80 100
Railways thus
BAY OF BISCAY
FRANCE
ATLANTIC OCEAN
MEDITERRANEAN SEA
AFRICA
Gulf of Lions
BALEARIC ISLES
MINORCA
MAYORCA
IVIZA
FORMENTERA
PITHYUSÆ ISLES
GALICIA
ASTURIAS
CANTABRIA
NAVARRA
CASTILE
ARAGON
CATALONIA
LEON
ESTREMADURA
ANDALUCIA
MURCIA
VALENCIA
PORTUGAL
Longitude 8 West from Greenwich 6 4 2 0 Longitude East from 2 Greenwich

E. and S., by the Mediterranean and Atlantic; and on the W. by the Atlantic and Portugal. Greatest length, from Fuenterrabia on the north to Tarifa on the south, 560 miles; greatest breadth, from Cape Finisterre (Land's End), the extreme point on the west, to Cape Creuze, the extreme point on the east, about 650 miles; average breadth about 380 miles. Area, including the Balearic (q. v.) and Canary Isles, 195,738 sq. m.; pop. (1877) 16,623,384. The country, including the Balearic and Canary Isles, was divided in 1834 into 49 modern provinces, though the former division, into 14 kingdoms, states, or provinces is still sometimes used. The following is a table of the ancient states, and of the modern provinces into which they have been divided, with their areas and populations, according to the census of 31st December 1877:

Ancient Provinces.	Modern Provinces.	Area in Eng. Sq. Miles.	Pop. in 1877.
New Castile	Madrid	2,997	593.775
	Toledo	5,586	334,744
	Guadalajara	4,869	201,288
	Cuenca	6,725	237,497
La Mancha	Ciudad-Real	7,840	260,641
Old Castile	Burgos	5,651	332.461
	Logrono	1,945	174,425
	Santander	2,112	235,299
	Soria	3,836	153,654
	Segovia	2,713	149,961
	Avila	2,981	180,457
	Palencia	3,126	180,785
	Valladolid	3,042	247,453
Leon	Leon	6,166	350,210
	Zamora	4,135	250,004
	Salamanca	4,940	285,500
Asturias	Oviedo	4,091	576,352
Galicia	Coruna	3,078	595,585
	Lugo	3,787	410,387
	Orense	2,738	388,835
	Pontevedra	1,739	451,946
Estremadura	Badajoz	8,687	432,809
	Caceras	8,013	306,594
Andalucia	Seville	5,295	505,291
	Cadiz	2,809	430,158
	Huelva	4,122	210,641
	Cordova	5,190	385,582
	Jaen	5,184	422,972
	Granada	4,937	477,719
	Almeria	3,302	349,854
	Malaga	2,823	500,231
Murcia	Murcia	4,477	451,611
	Albacete	5,971	219,122
Valencia	Valensia	4,352	679 030
	Alicante	2,098	408,154
	Castellon de la Plana	2,446	283,961
Aragon	Zaragoza	6,607	400,266
	Huesca	5,878	252,165
	Teruel	5,494	242,296
Catalonia	Barcelona	2,985	835,306
	Tarragona	2,451	330,105
	Lerida	4,774	285,297
	Gerona	2,271	299,002
Basque Provinces	Navarre	4,045	304,184
	Biscay	848	189,954
	Guipuzcoa	727	167,207
	Alava	1,205	93,191
	Total	191,082	16,053,961
Islands	Balearic	1,853	289,035
	Canaries	2,797	280,388
	General Total	195,738	16,623,384

Colonies.	Area in Eng. Sq Miles.	Population.
I.—America.		
Cuba	45,700	1,394,516
Porto Rico	3,580	661,494
II.—Asia.		
Philippine Islands	65,610	6,163,632
Caroline Island and Palaos	570	28,800
Marian Islands	420	8,000
III.—Africa.		
Fernando Po, Annobon, &c.	850	35,000
Total	116,730	8,291,445

Coast-line.—The entire perimeter of the country is 2080 English miles, and the coast-line, exclusive of windings, is 1317 miles long, of which 712 miles are formed by the Mediterranean, and 605 miles by the Atlantic. The north coast, from Fuenterrabia west to Cape Ortegal, is unbroken by any considerable indentation. A wall of rocks, varying in height from 30 to 300 feet, runs along this shore; but the water, which retains considerable depth close to the beach, is not interrupted to any unusual extent by islands or rocks. The north-west coast, from Cape Ortegal south to the mouth of the River Minho—which separates the Spanish province of Galicia from Portugal—though rock-bound, is less elevated, and is much more broken than the shores washed by the Bay of Biscay; and the indentations, the chief of which are Noya Arosa and Vigo Bays, form secure and spacious harbors. From the mouth of the Guadiana, on the south, to the Strait of Gibraltar, the coast-line, though well defined, is low, sandy, and occasionally swampy. From Gibraltar to Cape Palos the shores, which are backed in part by the mountain-range of the Sierra Nevada, are rocky and high (though flats occur at intervals), are unbroken by indentations, and comprise only two harbors, those of Cartagena and Malaga. A low, and for the most part sandy, coast extends north from Cape Palos, rising into rocky cliffs and bluffs in the vicinity of Denia, but extending in sandy flats from Denia to the mouth of the Ebro. From the mouth of this river, north to the frontier of France, the coast is alternately high and low, and its principal harbors are Barcelona and Rosas.

Surface and Hydrography.—The compactness and the isolation of this country, and its position between two seas, the most famous, and commercially the most important in the world, are not more in its favor than the character of its surface, which is more diversified than that of any other country in Europe of equal extent. An immense plateau, the loftiest in the continent, occupies the central regions of S., and is bounded on the N. and W. by mountainous tracts, and on the N.-E. by the valley of the Ebro; on the E. by tracts of land frequently low, but in some parts traversed by hill-ranges; on the S. by the valley of the Guadalquivir, which intervenes between it and the Sierra Nevada (q. v.). This great plateau rises to the height of from 2000 to 3000 feet, and occupies upwards of 90,000 sq. m., or about half of the entire area of the country. The whole of the Pyrenean peninsula is divided by Spanish geographers into seven mountain ranges, of which the chief are: 1. The Cantabrian Mountains (q. v.), and the Pyrenees (q. v.), forming the most northern range; 2. The Sierra de Guadarrama, separating Leon and Old Castile from Estremadura and New Castile, and rising in the peak of Penalara 7764 feet above sea-level; 3. The Montes de Toledo, forming a part of the watershed between the Tagus and the Guadiana; 4. The Sierra Morena (q. v.), between the upper waters of the Guadiana and Guadalquivir; 5. The Sierra Nevada (q. v.), running parallel with the shores of the Mediterranean, through southern Murcia and Andalucia, and rising in its chief summits to loftier elevations than are found in any mountain-system of Europe, except that of the Alps. The several mountain-ridges, or as they are called, *Cordilleras* of S., have a general east and west direction, and between them run, in the same direction, the nearly parallel valleys or basins of the great rivers of the country, the Douro, Tagus, Guadiana, and Guadalquivir, each of which is described in its proper place.

Climate and Soil.—The climate of S., owing to the extent and configuration of the country, is exceedingly various. In the north-west (maritime) provinces, it is damp and rainy during the greater part of the year; at Madrid, which is situated about 11° south of London, and only 5° north of the shores of Africa, winters have occurred of such severity, that sentinels, while on duty, have been frozen to death; while the south and east provinces are warm in winter, and are exposed to burning winds from the south, and to an almost tropical heat in summer. Both ancient and modern geographers have adopted difference of climate as the rule for dividing the Peninsula into tracts distinct as well in soil and vegetation as in temperature. Of these tracts or zones the first and most northern may be considered as embracing Galicia, Asturias, the Basque Provinces, Navarre, Catalonia, and the northern districts of Old Castile, and Aragon. In this tract, the winters are long, and the springs and autumns rainy, while north and north-east winds blow cold from the snow-covered Pyrenees. The country, which alternates with hill and dale, is plentifully watered by streams rich in fish, and meadows yielding rich pasturage abound. Corn scarcely ripens in the more exposed districts, but grain crops of all kinds are produced in others, as well as cider, wine, and valuable timber. The middle zone is formed mainly by the great central plateau, and embraces Northern Valencia, New Castile, Leon, and Estremadura, with the south parts of Old Castile and Aragon. The climate of the great part of this region is pleasant only in spring and autumn.

Throughout the chilly winter, the treeless table-lands are overswept by violent tempests, and in summer are burned up by the sun. The soil is generally fertile, and corn and wine are most

abundantly produced. The southern or Bætican zone, comprising the rich country that extends between the southern wall of the central plateau and the Mediterranean shores, includes Andalucia, Murcia, and Southern Valencia. The stony rampart on the north protects it from the chilly winds of the central zone; but it is unprotected against the hot winds (the Solana, see SIMOOM) which in summer blow north from Africa, and render this season intolerable to northern Europeans. Here the winter is temperate, and the spring and autumn delightful beyond description. The descent from the cold and mountainous central regions to this tract of tropical heat and fertility affords a most striking contrast. The soil, which is artificially irrigated, is well adapted to agriculture and the cultivation of heat-loving fruits. The products comprise sugar, cotton, and rice, and the orange, lemon, and date.

Material Revival of Spain; Population; and Distribution of Land.—Owing to a number of causes, S., at one time the most opulent kingdom in Europe, had, in the 18th c., lapsed into a state of complete stagnation; the spirit of enterprise seemed extinct, and ease and squalor to be preferred to labor and affluence. Before the commencement of the present century, however, the country began to throw off its lethargy, and since that time the rate at which it has been advancing toward a healthy condition of active life has become gradually accelerated. Since 1851, the onward movement of the nation has been as rapid as that of any of the great European powers. The population has greatly increased, and is increasing; agriculture, previously stagnant, is now carried on with activity and success; manufactures are multiplying rapidly; and railways, of which, in the beginning of 1848, not a mile had been constructed, are now in process of being laid out between all the great centers of population—over 4000 miles having been completed in 1880. A view of the increase of the population, the first basis of power, will afford an index of the growing prosperity of the country. The estimates of the population of S. for various periods between the beginning of the 16th c. and the middle of the 18th c. vary considerably; but it is certain that there was a gradual decrease of from 2,000,000 to 3,000,000 of inhabitants between the years 1500 and 1700. With regard to later times, we have the following authentic statement:

Year.	Population.
1768	9,159,999
1797	10,541,221
1857	15,464,340
1860	15,673,536
1870	16,835,506

It thus appears that in about a century the population of S. has increased over 7,000,000. Comparing the census of 1870 with that of 1877, we find that the provinces in which the population has most largely increased are Madrid, Barcelona, Cadiz, Valencia, Jaen, Tarragona, Murcia, Avila, Valladolid, and Salamanca. These are for the most part maritime provinces, or such as have railway facilities for communication with the sea. In 1877, there were in Spain one town of near 400,000 inhabitants (Madrid); one of 250,000 (Barcelona); three between 150,000 and 100,000 (Valencia, Seville, Malaga); and three between 100,000 and 75,000 (Murcia, Zaragoza, Granada). In agriculture, as well as in population, the onward movement has been remarkable. The vast mountains of the country affording for the most part only scanty crops of herbage, are utilized as pasture-grounds, and are divided into large farms. But in the warm and fertile plains, especially in localities where water is abundant, the farms are small. Recently it was estimated that there were about 3,426,000 farms of all sizes, of which 750,000 were occupied by tenants, and the others by proprietors. Over 40 per cent. of the whole surface of the kingdom is still uncultivated.

Origin of the People.—The Spaniards are a mixed race, and have sprung from a greater variety of stocks than any other European nation. The bulk of the people is doubtless descended in the main from the ancient Celtiberian occupants of the peninsula. At an early time, however, there were extensive Phœnician and Carthaginian settlements in S., especially on the eastern seaboard. Later, the country was penetrated with Roman elements, and was Romanized throughout, save in the Basque (q. v.) country, where the ancient speech still lives on intact. Gothic invasions left a large Germanic strain in the blood of Spain, which may yet be plainly traced in the hill-country of the north-east. The Arab conquerors of S. planted themselves too firmly on Spanish soil to be utterly expelled; and the Moriscoes (see MOORS) are still, to the number of 60,000, easily distinguishable by their tongue and other peculiarities. In the south and center Gypsies (*Gitanos*) are numerous, and there are some Jews. One result of this commingling of races may be seen in the strongly marked provincial peculiarities of Spain, extending not merely to dialectal differences, but to physique, character, and amusements. The Castilian is the literary language of Spain; the Andalusian diverges somewhat broadly from it; in Catalonia, Valencia, and on the Balearic Isles, the prevailing dialect is closely allied to Provençal; while in the Basque provinces the old tongue is still in universal use among the people. Until lately (see FUEROS), the Basques enjoyed quite peculiar privileges as to local government and administration. In spite of great local differences of character, the Spaniard is generally temperate, and his few wants are easily satisfied. He requires a daily siesta, is not very energetic by nature, loves music, dancing, and the bull-fight, and is not averse to intrigue and the use of weapons. Even amidst poverty and squalor, native dignity never forsakes him. The houses are generally poorly furnished and uncomfortable, and often far from cleanly.

Religion.—Till very lately, the Roman Catholic faith, to which almost all the nation adheres, was the only creed tolerated by law. There are 9 arch-bishoprics, 51 suffragan bishoprics, and 4 unattached bishoprics. Before the suppression of the monasteries in 1836, about one-fifth of the whole nation was engaged in the service of the church.

Occupations of the People.—Agriculturists, laborers, miners, artisans, shepherds, and sailors constitute two-thirds of the population; one-seventh is composed of merchants and tradesmen; another seventh of officials, the army, the nobility, the clergy, nuns, beggars, and prisoners. The nobility is very numerous; the lower nobility, mostly quite poor, counting near 1,000,000 *hidalgos*. Beggars are almost as numerous, owing partly to the large number of benevolent institutions. In 1860 nearly 500,000 persons were maintained in 1028 charitable institutions.

Productions, Commerce, Exports and Imports, &c.—The total imports of Spain, including bullion and specie, in the years 1868—1874, averaged 19 millions sterling per annum; while the exports averaged 12 millions sterling. The countries with which S. trades most extensively are France, Great Britain, Cuba, British possessions, and the United States; and of these countries, Great Britain receives the great bulk of its exports, while France (owing, probably, to the vicinity of that country) supplies more of the imports of S. than any other state. The foreign trade of the country is carried on most extensively at the following ports, which are set down in the order of their importance: Barcelona, Cadiz, Santander, Alicante, Malaga, Valencia, Bilbao, Cartagena, San Sebastian, Elizondo, and Irun. The principal articles imported are, in the order of their importance, raw cotton, timber, wool manufactures, machinery, brandy, coal, dried fish, sugar, iron, linen, mineral oil, cocoa. The value of the wine exported is more than a third of that of the total imports; the chief articles exported are—wine, metals, dried fruit, flour, bullion, green fruits, olive oil, minerals, wool, grain, vegetables and seeds, esparto grass, cork, salt, and live animals. About 5,000,000 gallons of olive oil are annually produced in the country, of which quantity the half is exported.

Between 1870 and 1880, the annual value of the total imports into Spain varied from £15,500,000 to £21,600,000; of the total exports, from £15,700,000 to £23,200,000. In the same period the imports from the United Kingdom ranged from £2,950,000 to £4,070,000; the exports thither, from £7,800,000 to £10,975,000. The annual value of the wine exported varies from £6,000,000 to £9,000,000. Of this Great Britain absorbs from £1,500,000 to £2,800,000 worth—Spain contributing about two-fifths of all the wine imported by Britain.

The cotton manufactures of S. have been making considerable advance, and silk stuffs are largely fabricated. The principal cotton factories are at Barcelona. Excellent paper is made at Tolosa and Valladolid, and in the last-named town there are a few minor manufactures. All the manufactures of tobacco, arms, and gunpowder are carried on by the government exclusively. Though neither the agricultural nor the mineral resources of Spain are properly developed, much progress has been evident of late years, chiefly in mining. Lead, copper, and tin are abundant; quicksilver is wrought; and there are large deposits of good coal and iron ore. The last, however, are so imperfectly worked, that great quantities of iron and coal are imported from Belgium and England.

In 1880, the mercantile marine of Spain consisted of 2031 seagoing vessels (of which 226 were steamers), with a total burden of 596,664 tons. The number of Spanish vessels that entered British ports in 1880 was 797, of 285,166 tons.

Railways and Roads.—In October 1848, the first Spanish railway, 18 miles in length, from Barcelona to Mataro, was thrown open to the public; and by the beginning of 1880, 4067 miles of railway were open for traffic, and in the same year 1242 miles were in course of construction. The Spanish railways are the property of private companies; but in most cases the companies have received extensive 'subventions' from government. The number of letters that passed through the post-office in 1857 was 38,704,788; in 1879, the number of letters and post-cards had increased to 85,210,000. In 1880, there were 9000 miles of telegraphs in operation in Spain.

Army.—The effective of the Spanish army on the peace-footing was, in 1879–80, 90,000 men (of whom 60,000 were infantry, 13,000 cavalry, and 10,000 artillery); not including the *guardia civil, car-*

abineros, or reserve. On the war-footing, the effective is officially stated to comprise 450,000 men.

Navy.—In 1880, the navy consisted of 121 steam-vessels (including 5 ironclads and 11 other men-of-war of the first class) with 525 guns; besides training-ships and vessels for harbor defence.

Revenue and Expenditure.—The entire revenue of S. for the financial year 1879–80, was 778,478,388 *pesetas*, equivalent to about £31,139,135. The expenditure for the same year was 806,590,940 pesetas, or about £32,263,638. The public debt amounted in 1880 to £436,367,240.

Education.—Education is still very backward in Spain, though matters have greatly improved since 1845, when public instruction was first organized. Of the total population in 1860, only 3,130,000 could read and write, and 705,000 could read. In 1870, there were 26,500 public schools, with 1,500,000 pupils; and about 70 *institutos* or upper schools. There are ten universities in S.—in Madrid, Barcelona, Granada, Oviedo, Salamanca, Seville, Santiago, Valencia, Valladolid, and Zaragoza. Of these, five have five faculties, and two have four faculties. The universities are attended by above 12,000 students. There are besides numerous schools of art, of navigation, and mining. There are ten academies or learned societies, and a few large libraries.

History.—S., the *Spania*, *Hispania*, and *Iberia* of the Greeks, and known to the Romans by the same names, was inhabited at the period at which it first receives historical mention, by a people deriving their origin from different races. It is supposed to have been originally inhabited by a distinct race called Iberians; upon whom, however, a host of Celts are supposed to have descended from the Pyrenees. In the earliest times of which we have any record, these two races had already coalesced and formed the mixed nation of the Celtiberians, who were massed chiefly in the center of the Peninsula, in the western districts of Lusitania, and on the north coasts. In the Pyrenees and along the east coast, were to be found pure Iberian tribes, while unmixed Celtic tribes occupied the north-west.

In Bætica (Andalucia) there was a large admixture of the Phœnician element, and on the south and east coasts, numerous Phœnician, Carthaginian, Rhodian, and other colonies. A portion of the south coast, called Tartessus by the Greeks, the Tarshish of Scripture, was much frequented for its mineral riches by the Phœnician merchantmen, and the 'ships of Tarshish' were as distinct a section of the Tyrian mercantile marine, as were the Spanish galleons of the 16th c., or our own Indiamen of more recent times. But the bond which connected the Iberians and the Phœnicians was purely of a commercial character. About the middle of the 3d c. B.C., the Carthaginian influence began to be much felt in Iberia, and a considerable tract of territory was brought under subjection to Carthage by Hamilcar, (q. v.) who founded the city of Barcelona. During the next eight years, the Carthaginian interest was advanced, and its power further strengthened by Hasdrubal (q. v.—died 220 B.C.), son-in-law of Hamilcar, who founded Carthago Nova (the modern Cartagena), and concluded a treaty with the Romans, whereby it was stipulated that he should not advance his standards north of the Iberus (Ebro). Hannibal (q. v.), son of Hamilcar, and the greatest of all the Carthaginian generals, now assumed the command in the peninsula. He attacked and destroyed Saguntum (q. v.), and thus violated the treaty made between his father and the Romans. The destruction of Saguntum was the cause of the Second Punic War, for the principal incidents of which see CARTHAGE, ROME, HANNIBAL, and the SCIPIOS.

After the Romans had driven the Carthaginians from the peninsula in 206 B.C., the country was erected into a Roman province, consisting of two political divisions—*Hispania Citerior* (Hither S.) including the eastern and northern districts, or those nearest to the center of the Roman Empire; and *Hispania Ulterior* (Further S.) including the districts furthest from Rome, or the southern and western districts. It was not, however, till 25 B.C. that the Cantabri and Astures in the extreme north of the country laid down their arms to Augustus. After the country had been reduced to subjection, it was divided into the three provinces of Tarraconensis (embracing the northern and eastern provinces), Bætica (Andalucia), and Lusitania (Portugal and certain of the western provinces). This division of the country lasted till the reign of Constantine the Great (q. v.), (306—337). From the time of the complete supremacy of the Romans till the death of Constantine, the condition of S. was eminently prosperous.

The inhabitants, when brought under the iron rule of the empire, were forced for the time to desist from the intestine wars in which it had been their habit to indulge, and adopting the language, laws, and manners of their conquerors, they devoted themselves to industrial pursuits, and increased remarkably both in wealth and in numbers. Everywhere throughout the country, towns of a purely Roman character sprang up, among the chief of which were Leon, Emerita Augusta (Merida), Pax Julia (Beja), Cæsar Augusta (Zaragoza); and numerous aqueducts, bridges, amphitheatres, &c., were built, the ruins of which are the wonder of the modern traveler.

S., though obtained at enormous cost both in treasure and in human life, was for three centuries the richest province of the Roman Empire. Its fertile fields formed for a considerable time the granary of Rome, and from its metal-veined sierras, an immense amount of treasure in gold, silver, &c., flowed into the Roman coffers. 'Twenty thousand pound-weight of gold,' says Gibbon, 'was annually received from the provinces of Austria (Asturias), Galicia, and Lusitania.' This amount of wealth was not the voluntary offering of the natives, who were compelled to labor in their mines for the benefit of strangers; and thus S., in the early ages, was the type of Spanish America in the 15th and succeeding centuries, with the single difference that in the first case the Spaniards were the slaves, and in the second they were the slaveholders. In 409 A.D., hordes of barbarians, Alans, Vandals, and Suevi, crossed the Pyrenees and swept over and desolated the peninsula—the Vandals for the most part settling in Bætica, the Alans in Lusitania, and the Suevi in Leon and Castile. About 412, the Visigoths invaded the country, and their king, Athaulf, who acknowledged a nominal dependence on the Roman emperor, established the Gothic monarchy in Catalonia. See GOTHS. Of the Visigoths—by whom the Suevi were subjugated (584), the Vandals and Alans expelled (427) from the country, and large portions of Gaul annexed to their Spanish dominion—the most remarkable kings were Wallia (415—418), who greatly extended the Gothic monarchy; Euric (466—483), who, besides increasing his territory, introduced and enforced a body of laws, and did much for the advancement of civilization in S.; Wamba (673—680), who built a fleet for the protection of the coasts; and Roderic (q. v.), who was killed at Xeres de la Frontera in 711, in battle with the Moors.

The battle of Xeres gave the Moors almost undisputed mastery of nearly the whole of S., as well as of the outlying Gothic province of Septimania (Languedoc) in France; for the remnant of the Goths betook themselves to the highlands of Asturias, Burgos, and Biscay, where, in a region which throughout had enjoyed more liberty than any other part of S., they maintained their independence.

Dynasty of the Moors.—The Arabs, or, as they are more properly termed, the Moors (q. v.), held S. for the first few years of their rule, as a dependency of the province of North Africa; but after the downfall of Muza (q. v.), and his son Abd-el-aziz, who had been the deputy-governor of Spain, the country was governed (717) by *emirs* appointed by the calif of Damascus. The favorite scheme pursued by the Spanish emirs was the extension of their conquests into Gaul, to the neglect of the rising power of the Goths in Asturias; they also took the Balearic Islands, Sardinia, Corsica, and part of Apulia and Calabria; the Mediterranean was infested by their fleets, but their northward progress was most signally checked on the plain of Tours by Charles Martel (q. v.). Anarchy and bloodshed were prominent features of the first 40 years of Mohammedan rule in Spain. The *walis*, or local governors of districts and provinces, frequently rebelled against the emir, and drew sword against each other according as ambition or animosity dictated. Within this period of 40 years, no fewer than 20 emirs had been called to the direction of affairs; but a revolution at Damascus, which unseated the Ommiades, and placed the Abbasides in possession of the califate, put an end to this state of misrule in S.

The last of the *emirs*, Jussuf, was in favor of the Abbasides, but the *walis* and *alcaydes* being chiefly of the Ommiade faction, invited one of this family, who was in concealment among the Zeneta Arabs in Barbary, to become an independent calif in Spain. See OMMIADES. Thus was founded the *califate of Cordova*, from which, in 778, the Franks wrested all its possessions north of the Pyrenees, and North-eastern S. to the Ebro; the latter acquisition, subsequently denominated the *Spanish March*, being alternately in the hands of the Moors and dependent upon France.

Christian Kingdoms.—During this period of Moorish domination, the small independent kingdom of Asturias, founded by Pelayo (q. v.), had been growing in power and extent. It was increased by Galicia in 758, and by parts of Leon and Castile towards the close of the century. In 758, a second independent Christian kingdom was founded in Sobrarve, and increased by portions of Navarre on one hand and Aragon on the other, but though it, along with the French Gascons, aided the Moors at Roncesvalles (q. v.), it was, in 801, again swallowed up by the califate of Cordova. However, 36 years afterwards a Navarrese count, casting off his allegiance to France, founded the third Christian kingdom, that of Navarre (q. v.), which from this time easily maintained itself, owing to its situation, in independence of the Moors.

The kingdom of Asturias, now (900) Leon, was for a long time distracted by bitter and bloody strife among the members of the royal line, and with its neighbor Navarre would have fallen an easy prey to the powerful Ommiades, had not the latter directed their chief attention to the subjugation of Morocco; and under

cover of this relaxation of the constant warfare between Moors and Christians, another independent monarchy, an offshoot from Leon, was founded in Castile (933, kingdom in 1035), which from its central position, and consequent greater facilities for expansion, soon became the most powerful of the Spanish states, especially after its union (temporary, 1072—1157), in 1230, with Leon. A considerable part of Aragon had been wrested from the Moors by Sancho III. (1000—1035) of Navarre, and at his death this part of his dominions passed by inheritance to his son Ramiro, who added to it the districts of Sobrarve and Ribagorza, and a considerable extent of country which he conquered from the common enemy, the Moors. This kingdom of Aragon was the last Christian kingdom formed in S.; and though it increased by acquisitions from the Moors, yet being limited by Leon, Castile, and Navarre on one side, and the Spanish March (now only the county of Catalonia or Barcelona) on the other, its princes aimed at maritime power; and by the union, through the marriage of the Count of Barcelona with Queen Petronilla, of the Spanish March with Aragon, means were obtained of carrying out this policy, and the spread of the Aragonese dominion to Sicily (q. v.), Naples (q. v.), and other regions bordering on the Mediterranean, was the consequence.

These three kingdoms—Castile and Leon, Navarre, and Aragon—continued, sometimes in combination and sometimes separately, to war against their common enemy, the Moors—Castile being, from its greater power and proximity, the most persistent assailant, and Navarre, for the opposite reason, the least so; but whenever the arrival of fresh levies from Africa, or the accession of an energetic calif threatened serious danger to any one of the three, the others generally came to its aid.

The extinction of the Ommiades in Spain in 1031, and the disruption of the califate into the minor kingdoms of Cordova, Seville, Toledo, Lisbon, Zaragoza, Tortosa, Valencia, Murcia, Badajos, and seven others of less note, was an occurrence by which the kings of Castile and Aragon did not fail to benefit, for by well-directed and unremitting attacks they subdued some, rendered others tributary, the kings of Portugal also on their side gallantly and successfully pursuing the same policy; and a few years more would have certainly annihilated Moorish domination in S., had not Mohammed of Cordova and Seville, hard pressed by Alfonso VI. of Leon and Castile about the close of the 11th c., applied for aid to an Arab tribe, whose military career in North Africa had been of the most brilliant character. This tribe, the Almoravides—i. e., men devoted to the service of God—had made themselves masters of the provinces of Africa and Almagreb, and founded the empire of Morocco.

Responding to the request of Mohammed, the Almoravides crossed over to S., defeated the king of Aragon and Castile, and recovered much of New Castile. Then, turning upon their ally Mohammed, they compelled him to yield up the provinces of Cordova and Seville, and all the minor Moorish princes to follow his example; so that, in 1094, the Almoravide sovereign was acknowledged sole monarch of Mohammedan Spain. The power of this tribe, however, began to decline about 1130, and was extinguished by the Almohades (q. v.), a fanatical sect of Mohammedans, who landed in S. in the middle of the 12th c., and conquered the territories of the Mohammedans in Spain. During the reign of the third monarch of this dynasty took place the battle between the combined forces of Castile, Leon, Navarre, Aragon, and Portugal, with the Moors, in which the former gained the most celebrated victory ever obtained by the Christians over their Moslem foes, the latter losing, according to the account transmitted to the pope, 100,000 killed and 50,000 prisoners. This sanguinary conflict, fought on the plains of Tolosa (*las navas de Tolosa*), 16th July 1212, broke the Almohade power in Spain, as that of Salamanca (22d July 1812), almost exactly six centuries afterwards, did the more formidable strength of Napoleon.

On the fall of the Almohades, Mohammed-ben-Alhamar, the king of Jaen, rose to the first place among the Mohammedan princes, and founded (1238) the *kingdom of Granada*. The king of Granada was speedily forced to become a vassal of Castile, and from this period all danger from Moslem power was over. The rest of the history of the Spanish kingdoms before their union is undeserving of a detailed account. The Castilian court was the scene of almost constant domestic strifes and rebellions, varied with a campaign against Granada or in favor of the monarch of that kingdom against his rebellious vassals; the only prominent monarchs of this kingdom being Ferdinand III., who confined the Moorish dominion to the south of Andalucia, Alfonso X. (q. v.), Alfonso XI., Pedro the Cruel (q. v.), and Queen Isabella, the last sovereign of Castile, who succeeded her brother Henry IV., owing to a wide-spread belief in the illegitimacy of the latter's daughter. Aragon, on the other hand, was almost wholly free from intestine dissensions, doubtless owing to the interest taken by the Aragonese monarchs in Italian politics; of these sovereigns Jayme I. (1213—1248) conquered Valencia and Majorca, and, first of all the Aragonese kings, received a voluntary oath of allegiance from his subjects; Pedro III. (1248—1285), who obtained Sicily (1282), Minorca, and Iviza; Jayme II., who conquered Sardinia and Corsica; Alfonso V. (1416—1468), who conquered Naples; and Ferdinand II. (q. v.), the Catholic, the last sovereign of Aragon, who, by marriage with Isabella, Queen of Castile, in 1469, the conquest of Granada in 1492, and that of Navarre in 1512, united the whole of Spain (and French Navarre) under one rule.

The year 1492, in the reign of Ferdinand and Isabella, witnessed also the discovery of America, as well as the capture of Granada. S. had now become consolidated into one empire, from the Pyrenees to the Strait of Gibraltar, civil wars were at an end; and a splendid continent, teeming with riches, had been opened up for Spanish adventure and enterprise. But as the most active spirits among the Spaniards now crowded to the New World, the soil of S., and its mineral treasures, both inexhaustible sources of wealth, were neglected for the riches of the fancied El Dorado, where, as was everywhere believed, gold was more plentiful than iron was in the old country. Besides the drain upon the country from emigration, the expulsion of the Jews and Moors was productive of the direst results; and the decline of the splendid Spanish Empire, upon which the sun even then never set, may be said to have had its origin in the event which raised the country to the height of its magnificence. Charles I. (Charles V. of Germany, q. v.) succeeded Ferdinand, and in his reign Mexico (q. v.) and Peru (q. v.) were added to the possessions of Spain. Philip II. (q. v.), by his enormous war expenditure and mal-administration, laid a sure foundation for the decline of the country. Industry, commerce, and agriculture may be said to have been extinguished at the expulsion of the Moriscoes (see MOORS); and the reigns of Philip III. and Philip IV. witnessed a fearful acceleration in the decline of S. by the contests with the Dutch, and with the German Protestants in the Thirty Years' War, the intermeddling of Olivarez (q. v.) in the affairs of Northern Italy, the rebellion of the Catalans, whom the minister wished to deprive of their liberties, the wars with France, and the rebellion of Portugal (1640), which had been united to S. by Philip II. That of Charles II. was still more unfortunate, and the death of the latter was the occasion of the War of the Spanish Succession (see SUCCESSION, WAR OF).

Philip V. (q. v.) was the first of the Bourbon dynasty who occupied the throne of Spain. Under Charles III. (1759—1788), a wise and enlightened prince, the second great revival of the country commenced; and trade and commerce began to show signs of returning activity. During the inglorious reign of Charles IV. (1788—1808), who left the management of affairs in the hands of the incapable Godoy (see ALCUDIA), a war (1796—1802) broke out with Britain, which was productive of nothing but disaster to the Spaniards, and by the pressure of the French another arose in 1804, and was attended with similar ill success. Charles abdicated in favor of his eldest son, the Prince of Asturias, who ascended the throne as Ferdinand VII. Forced by Napoleon to resign all claims to the Spanish crown, Ferdinand became a prisoner of the French in the year of his accession, and in the same year Joseph, the brother of the French emperor, was declared king of S. and the Indies, and set out for Madrid, to assume the kingdom thus assigned to him. But before this time, an armed resistance had been organized throughout the whole country. The various provinces elected juntas or councils, consisting of the most influential inhabitants of the respective neighborhoods, and it was the business of these juntas to administer the government, raise troops, appoint officers, &c. The supreme junta, that of Seville, declared war against Napoleon and France on the 6th of June 1808.

In July, England, on solicitation, made peace with S., recognized Ferdinand VII. as king, and sent an army to aid the Spanish insurrection. Joseph, on July 9, entered S., defeated (through his lieutenant Bessières) the Spaniards at Rio Seco, and entered Madrid on the 20th; but the defeat of Dupont at Baylen by the veteran Spanish general Castaños, somewhat altered the position of affairs, and Joseph, after a residence of ten days in his capital, was compelled to evacuate it, and retire north to Vitoria. The noble defence by Palafox of the city of Zaragoza against Lefebvre, and the return of the Marquis de la Romana with 7000 regular troops who had been wiled from the country by Napoleon, did much to inspirit the patriots. On the 12th July 1808, Sir Arthur Wellesley, afterwards Duke of Wellington (q. v.), at the head of the British auxiliary force, landed (5th August) at Mondego Bay, and began the Peninsular War by defeating the French at Roliza and Vimiero (q. v.); but in spite of his opposition, the Convention of Cintra was signed, and the French transported to their own country. In November 1808, Napoleon, who had been preceded by Ney (q. v.) with 100,000 men entered S., and at once assumed the command. For a time his armies were completely successful; Soult utterly routed the Spanish general Belvedere, 10th November, and annihilated Blake at Reynosa on the 13th. Castaños and Palafox were routed at Tudela by Lannes, and in the beginning of December, Napoleon entered Madrid.

At this time, the British forces were under the command of Sir John Moore (q. v.), who, aware of his great inferiority in numbers and resources, retreated west from Salamanca, whither he had come to assume the command of the allied forces, and reached Coruña (q. v.) on the 11th January 1809. On the 22d April General Wellesley arrived in Portugal, and, at once commencing operations, drove Soult from Oporto, and took possession of Portugal; then, favored by the disunity of action which subsisted between the three or four French armies who held S., he directed his attacks upon the army of the center, retreating when any of the others came to its aid, and by dint of masterly generalship and bold enterprise, succeeded, after four campaigns, in driving the French from the country. To this result, the co-operation of the Portuguese and of the Spanish *guerrillas*, the revengeful hatred of the peasantry towards their tyrannical oppressors, and the drafts from the Spanish armies so frequently made by Napoleon for his wars in Central Europe, largely contributed. See WELLINGTON, SOULT, VICTOR, &c. Napoleon, loath to lose his hold of the Peninsula, sent Soult, his most trusted general, to stop the ingress of the British into France; but the battles of the Pyrenees (24th July—1st August 1813), and of the Nivelle, Orthez, and Toulouse, in the beginning of 1814, brought to a victorious conclusion this long and obstinate contest.

In 1812, a constitution, on the whole liberal, had been devised for the country by the Cortes of Cadiz. It was, abrogated, however, by Ferdinand VII. (q. v.), who treated the subjects who had shown such devoted loyalty to him with infamous ingratitude, and obtained the aid of France to establish despotism. The reign of his daughter, Isabella II. was disturbed by the Carlist rebellion in 1834—1839, in which the British aided the queen with an army under Sir De Lacy Evans. See CARLOS. The next event of importance was the contest between Espartero (q. v.), the regent, and the Queen-dowager Christina, for the supreme power during the minority of the queen. Espartero was successful from 1840 to 1843, but was compelled to flee before O'Donnell and Narvaez, and was not restored till 1847. The constituent Cortes of 1837 drew up a new constitution, based on that of Cadiz. In 1845, another constitution was promulgated by Narvaez (q. v.), Duke of Valencia. Frequent changes of ministry, occasional revolts, the banishment of Queen Christiana (1854), the formation of the O'Donnell ministry (1858), the war with the Moors (see MOROCCO), the annexation of St. Domingo in 1861, and the quarrels between S. and her former colonies, Peru (1864—1865) and Chili (1865), were the most marked events in the more recent history of Spain prior to 1868. In 1868, Isabella was driven from the throne by a general revolt, and the Cortes, in Nov. 1870, elected Prince Amadeo of Italy to be king. Finding the task of ruling constitutionally hopeless, Amadeo abdicated early in 1873, upon which the form of government was changed into a republic. During the remainder of 1873, and the whole of 1874, S. was the scene of general anarchy and much bloodshed, resulting from the mutual opposition of the Carlists and Republicans. On Dec. 31, 1874, Alphonso, son of the ex-Queen Isabella, was declared king of S. at Santander.

SPA'LATO (often erroneously called SPALATRO; in Illyric, SPLIT), an important seaport of Dalmatia, empire of Austria, is finely situated on a promontory on the eastern coast of the Adriatic. It originated in the famous palace of Diocletian, built in the 3d century. As this immense structure (which occupied twelve years in building) stood not far from the city of Salonæ, the great bulwark of Roman power in Dalmatia, it was called *Salonæ Palatium*, briefly written *S. Palatium*. When Salonæ was conquered by the Avars in the 7th c., the inhabitants fled for refuge to the fortress-palace of the emperor, where they laid the foundations of a new town, corruptly named *Aspalathum* whence the modern *Spalato*. Even yet, more than one-half of the town is compressed within the limits of the ancient palace, a considerable portion of whose walls still remain. The best-preserved parts of the palace are the temple of Jupiter, transformed in the 7th c. into a Christian cathedral, and the temple of Æsculapius, which is now a Baptistery dedicated to St. John. Modern S. is divided into an old and new town; the former consisting mainly of narrow, crooked, and dirty lanes; the latter more agreeable and open. It is the seat of a bishop, has a chamber of commerce and manufactures, and is the principal emporium for goods passing from Italy overland into Turkey. Pop. (1869) 12,000.

SPA'LAX. See MOLE-RAT.

SPA'LDING, an important market-town and river-port in Lincolnshire, on the Welland, 8 miles from its mouth in the Wash. Considerable trade is carried on by the Welland, and vessels of 100 tons are able to reach the town. An important stock and corn market is held every Tuesday. A newspaper is published weekly. S. was a place of consequence as early as the Saxon times, and contained a Benedictine monastery. Pop. (1881) 9260.

SPALLANZANI, LAZARO, a celebrated anatomist and naturalist, was born at Scandiano, in Modena, Italy, 12th January 1729. After a careful education he took clerical orders; and in 1754, he was appointed to the chair of Logic, Metaphysics, and Greek at Reggio; but soon after this he obtained a chair at Modena, and refusing the tempting offers made him by the universities of Parma and Coimbra, and the Academy of St. Petersburg, gave himself up to the study of natural history. His attention was directed to the doctrine of generation propounded by Needham and Buffon, which, after careful study and experiment, he overturned. He then turned his attention to the circulation of the blood, and was the first to follow its course through the intestinal tube, the liver, spleen, ventricles, pulmonary organs, &c.; 'established,' according to Senebier, 'the propulsive power of the heart over the blood in the various vessels, demonstrated that the heart never wholly empties itself, explained the various causes which retard the circulation, and the obstacles produced by the weight of the blood.'

On the re-establishment of the university of Pavia, S. was appointed (1768) Professor of Natural History, and keeper of the museum, which he greatly enriched with fishes, crustacea, and testacea, the fruits of his numerous excursions. In 1785, refusing the chair of Natural History at Padua, which had been so admirably filled by Vallisnieri, he accepted the proposal of the Archduke Ferdinand to accompany, with doubled salary, the Austrian ambassador to Constantinople (22d August 1785); and during a residence of 11 months in Turkey, found ample materials for study and observation. In 1788, he visited Naples whilst Vesuvius was in eruption, the Lipari Isles, and Sicily, in restless prosecution of his scientific labors, and then retired to Pavia, where, refusing the tempting offers of the French Directory, he spent the remainder of his life, prosecuting his scientific researches amid bodily sufferings, and died of apoplexy, 12th February 1799. His works, many of the more valuable of which have been translated into English, are too numerous to mention; but a complete catalogue of them, along with a biography, will be found in the *Biographie Médicale*, vol. vii. See also, for the result of his labors, the *Eloge*, by M. Alibert, in the *Mémoires de la Société Médicale d'Emulation*.

SPAN, a natural measure of length, being the distance between the tips of the thumb and middle finger, the hand being stretched as much as posible. This space averages about 9 inches, and the term came to denote a measure of 9 inches.

SPA'NCELLED, in Heraldry, a term applied to a horse two of whose legs are fettered by a log of wood.

SPA'NDAU, a town of Prussia, in the province of Bradenburg, is situated at the confluence of the Havel and Spree, 9 miles west-north-west of Berlin. S. is an important fortress; has a citadel (besides other fortifications) surrounded by water, with a garrison of upwards of 3000 men, and is a military dépôt. S. carries on manufactures of arms, gunpowder, woollens, &c., and has an active transit-trade as a station on the Berlin and Hamburg Railway. Pop. (1880) 29,311. It is one of the oldest towns in the Middle Mark of Bradenburg, and was long the residence of the Kurfürists of the Hohenzollern House.

SPA'NDREL, the triangular space between the outside of an arch and a square head including it. This space is often filled with sculptured foliage, figures, &c.

SPA'NGLES, small circular pieces of very thin metal, usually silvered or gilded tin, pierced with a needle-hole, so that they can be sewed on to cloth. They are chiefly used for decorating theatrical dresses.

SPA'NIEL, a kind of Dog, of which there are many breeds, differing considerably in size and other characters. None of the spaniels are large; some are amongst the smallest of dogs. Some are used for sporting purposes, others are merely kept as pets and companions. All of them are lively, playful, docile, and affectionate in a high degree. The S. is ever petitioning for regard, and shows boundless joy on receiving marks of kind attention. The ENGLISH or SUSSEX S. is of elegant but moderately stout form; with very large pendant ears, of which the hair is very long; the muzzle rather broad; the tail bushy; the body covered with long silky hair; the colors various, very often liver-colored and white, or red and white. The name S. is said to indicate the introduction of this kind of dog into England from Spain. In the days of falconry, spaniels were much used for starting the game. The Cocker (q. v.), the Springer (q. v.), and the Blenheim Dog (q. v.) are different kinds of Spaniels. The KING CHARLES'S S. is a beautiful black and tan breed, almost as small as the Blenheim dog, and derives its name from Charles II., who took great delight in dogs of this kind. The WATER S. is one of the larger breeds. It has comparatively hard hair, and is distinguished by its readiness te pursue game by swimming. It is much used in decoy-ponds to drive ducks into the net.

SPANISH GRASS. See PAPER.

SPANISH LANGUAGE AND LITERATURE. The Spanish language is one of the Romanic tongues, and, like the others, originated in the *lingua Romana rustica*. See ROMANIC LANGUAGES. The earliest of the different Spanish dialects that assumed a literary form was the Castilian, which gradually became, and has continued to be, the classic dialect of the nation. It finely blends a certain soft, lingering richness of cadence with an occasional sonorous majesty of expression, and on the whole may be considered one of the most beautiful of the European tongues. The course of Spanish conquest has also led to its establishment in Mexico, Central America, Cuba, Porto Rico, the greater part of South America, the Canary Isles, and the Philippines. See the *Grammar and Dictionary* published by the Spanish Academy (1771), the grammars of Keil (Leip. 1837), Fuchs (Berl. 1837), Wiggers, and Schele de Vere (New York, 1854). The best material for a historical grammar is furnished by Diez in his *Grammatik der Romanischen Sprachen*. The best Spanish dictionaries, besides that of the Academy, are Cabrera's (Mad. 1837), the Spanish-German by Seckendorff (3 vols., Hamb. 1823), and the Spanish-English of Neumann and Baretti (re-edited by Velazquez, New York, 1852).

Literature.—The literature of Spain may, in a superficial sense, be regarded as commencing under the auspices of the Romans, for Lucan, Seneca, and other eminent Latin authors were at least Spanish by birth; and, if we please, we may further look upon the Christian ecclesiastical writers of the Gothic period as the second link in the historical chain. But in the proper sense of the term, the literature of these two periods is no more *Spanish*—i. e., national—than an English book by an Anglo-Indian is to be held as a portion of Hindu literature, or the sermons preached by a missionary to South Sea Islanders are to be quoted as specimens of the literature of the Pacific. Passing over, then, the various developments of non-national literature in Spain—pagan Latin, ecclesiastical Latin, Arabic and Jewish—we come down to the 12th c., and then, for the first time after the gradual formation of a Spanish language, begin to notice the growth of something like a Spanish literature Epic and didactic poems appear, written in Castilian verse, and full of strong national sentiment. The oldest of these is the *Poema del Cid* (see CID CAMPEADOR), of which only a single MS. exists. This MS. contains three other poems: *The Book of Appollonius, Prince of Tyre; The Life of Our Lady, St. Mary of Egypt;* and *The Adoration of the Three Holy Kings*, the authorship of which (as of the *Poema del Cid*) is unknown. Other productions of this *first* period are the rhymed *Lives of the Saints*, by Gonzalo of Berceo (died about 1260); and the anonymous poem, *Count Fernan Gonzalez*, which, like the *Poema del Cid*, paints the earnest and picturesque struggle between the Moors and Spaniards. In all of these, we trace the influence either of the church or of the chivalric poetry of France; but they maintain, nevertheless, a distinctively national and independent character.

A great impulse was given to the artistic development of Spanish literature by Alfonso the Wise of Castile (q. v.), who substituted Spanish for Latin in the courts of law, and fostered in many ways the growth of the national language. He is regarded as the founder of Spanish prose, his chief work in this department being the compilation of a series of codes, of which the most memorable is *Las Siete Partidas*, and a translation of the Bible into Spanish. Subsequent princes walked in his steps, and achieved an honorable reputation both as authors and patrons of literature, conspicuous among whom was the Infante Don Juan Manuel (died 1347), whose *El Conde Lucanor* (Count Lucanor) is a collection of 49 tales, apologues, &c., from oriental sources, and wearing an oriental aspect. The most remarkable Spanish poet of the 14th c. is Juan Ruiz, arch-priest of Hita (died 1351). His pieces, composed in a great variety of measures, number some 7000 verses, and include religious and love songs, fables, pastorals, &c. The didactic tendency is particularly visible in the *Danza general de la Muerte* (Dance of Death).

The *second* period of Spanish literature embraces the later portion of the middle ages, and is marked by the presence of lyric poetry in considerable quantity, alongside of the didactic. It seems to have been inspired by the strains of the Provençal poets settled at the court of the Counts of Barcelona, and always continued to be more courtly than national. The most complete collection of this lyric poetry is the *Concionero general* of Fernando del Castillo (Valencia, 1511; 10th edit., 1573), which contains the names of 136 authors, among which may be mentioned those of the Marquis of Villena, and the Marquis of Santillana, the three Manriques, Macias, Sanchez de Badajoz, Alonso de Cartagena, Diego de San Pedro, and Fernan Perez de Guzman. Against this court-poetry, however, a strong reaction took place, the national spirit reasserting itself vigorously in ballads, chronicles, romances of chivalry, and the drama. The best collection of the ballads (about 1000 in all) is to be found in the *Romancero general* (13 vols., 1605—1614); of the Chronicles (half-genuine, half-fabulous narratives of ancient Spanish heroes), the best are those of Ayala, of Juan Nuñez de Villaizan, the *Chronicle of the Cid*, and the *Chronicle of the Travels of Ruy Gonzalez de Clavijo;* of the romances of chivalry, the most celebrated is the *Amadis de Gaul*, parent of innumerable others (see AMADIS); and of the drama, among the first specimens are the pastoral plays of Juan de la Enzina, and the *Celestina* of Fernando de Rojas.

The *third* period, extending from the 16th to the 18th c., is the most splendid and productive in the annals of Spanish literature. Under Charles V., Spain became the foremost state in Europe, and the conquest of Naples brought it into close relation with the literature of Italy. The great Italian masters, such as Dante and Petrarch began to be studied, and Italian measures and poetic forms to be imitated, although the rich, strong Spanish spirit is never lost. The first of this new school was Juan Boscan Almogaver (died 1543), a brilliant sonneteer; other members of the same school are Garcilaso (q. v.) de la Vega, Diego Hurtado de Mendoza (q. v.), Francisco de Saa de Miranda, and Jorge de Montemayor (author of the once famous pastoral novel of *Diana*, see NOVELS), Fernando de Herrera (q. v.), and Luiz de Leon (died 1591), the last two of whom rank as the two greatest lyric poets that Spain ever produced. Gradually, a national drama established itself too. Conspicuous names in this department are Villalobos, Perez de Oliva and Naharro (about 1517), sometimes regarded as the father of the Spanish drama. The last-mentioned wrote his comedies in the favorite national measure, the *redondillas*, and divided them into three acts. Besides these, we must mention Lope de Rueda, Juan de la Cueva, and Geronimo Bermudez, who cultivated tragedy with success. Among the most eminent prose writers of the first section of this third period was Geronimo Zurita, author of *Annales de la Corona de Aragon* (Annals of the Crown of Aragon, 6 vols.)—a somewhat critical work, showing a decided advance on the credulous chronicles of the monks; Oliva, whose *Dialogo de la Dignidad del Hombre* (Dialogue on the Dignity of Man) is a fine specimen of elegant literature; and Morales, author of *Discursos* (Essays), relating to practical philosophy; &c.—Cervantes (q. v.) marks, if not exactly a new era, at least a splendid outburst of Spanish genius.

It is unnecessary here to criticise the productions of his genius; we may only note, as it were, historically the fact, that his immortal *Don Quixote* put an end to the romances of chivalry—or rather to the extravagant imitations of these that sprung up after the age of chivalry had passed away. Lope de Vega (q. v.), a contemporary of Cervantes, and Calderon (q. v.), gave the national drama a European renown, and had, especially the latter, a host of followers more or less celebrated, among whom are Francisco de Rojas, Agustin Moreto, Fragoso, Diamante, Antonio Hurtado de Mendoza, Juan de la Hoz, Antonio de Solis, and Agustin de Salazar y Torres. The lyric and 'epic' poets of this period, which embraces the second half of the 16th, and the whole of the 17th c., are innumerable, but not great. The most notable names are those of the brothers Argensola, and Alonso de Ercilla y Zuñiga (author of *Araucana*, a fine poem on the conquest of Araucania in Chili by the Spaniards). A peculiar form of the novel also appeared, called the 'rogues' novel,' of which the only memorable specimen is the *Guzman de Alfarache* of Mateo Aleman; and even it derives not a little of its importance from the fact that it suggested Le Sage's *Gil Blas*. In history, the most distinguished names are those of Mariana (q. v.) and Solis.

The *fourth* period of Spanish literature extends from the accession of the Bourbons (1701) to the present time, and was long marked (like the contemporary literature of Germany) by a servile imitation of French models, and these by no means the best of their kind. This literary ascendency of France in the first half of the 18th c. over all civilized Europe is a very curious phenomenon, worthy of closer study than it has yet received. The most notable of the Frenchified Spaniards was Ignacio de Luzan, whose *Poetica* (1737) is a thoroughly Gallican performance. His efforts to denationalize the literature of Spain were combated by Garcia de la Huerto and others, and at length a sort of compromise was effected, and the 'Salamanca School' emerged into notice. Its founder, Melendez Valdez (born 1754), was a man of high genius, who subordinated his liberal culture to the sovereign control of a patriotic inspiration, and the same qualities are visible in its other members—Iglesias, Noroña, Quintana (q. v.), Cienfuegos, Arriaza, and Gallego. The great Peninsular War, and the subsequent political movements in Spain, had a powerful effect in stirring up anew the elements of nationality, and the present century can show a lengthened list of names both in prose and poetry. We can only afford space for a few: Tapia, Maury, Juan Bautista Alonso, Jacinto de Salas y Quiroga, Espronceda, Serafin Calderon, Zorrilla, Hartzenbusch, R. de Campoamer, Santos Lopez Pelegrin, Villergos, and G. Gomez de Avellaneda, in poetry; Saavedra, Mora, Zorrilla Gregorio Romero y Larrañaga, Manuel de Santa Ana, in romantic fiction; Leandro, Fernandez Moratin, in the drama; Ulloa, Muñoz, Capmany, Ferreras, Quintana, Navarrete, Clemencin, Torreno, and Maldonado, in history; Jovellanos, Arguelles, Miñano, Marina, Donoso Cortes, Martinez de la Rossa, &c., in political oratory.

Spain has not as yet achieved great results in any departments of science, either physical, mental, or moral; but of late years she has turned her attention seriously to scientific studies, and several admirable treatises in jurisprudence, political economy, medicine, philosophy, philology, and geography have been produced.—See Bouterwek's and Sismondi's *Histories of Spanish Literature;* and above all, Ticknor's work on the same subject (3 vols., New York, 1849—1854), which has been translated into Spanish.

SPANISH MAIN (i. e., *main-land*), a name generally given during the 16th c. and the earlier part of the 18th to the north-east coast of South America, from the Orinoco to the Isthmus of Darien; as also to the contiguous southern portion of the Caribbean Sea, traversed by the Spanish treasure-ships. The name occurs very frequently in connection with the history and exploits of Buccaneers (q. v.).

SPA'NISH TOWN, the seat of government of the British possession of Jamaica (q. v.), on the right bank of the Cobre, and 10 miles west of Kingston. It contains several important public institutions, is ill-built and unhealthy, and contains about 6000 inhabitants.

SPA'NKER, a large quadrilateral sail, with parallel sides, set between the gaff and boom of a ship. Its foreleech is attached by rings to the mast. The spanker is a fore-and-aft sail of great importance in bringing the vessel to the wind.

SPAR (Ger. *Spath*), a term used by miners to denote any bright crystalline mineral, and which has been adopted by mineralogists in the names of a number of minerals, as calcareous spar, fluor spar, &c., in which, however, it has no proper generic significance.

SPA'RIDÆ, a family of acanthopterous fishes, having a general resemblance to the perch family—a single dorsal fin, which is not protected by any scales, and of which the anterior rays are spinous, the pectoral and ventral fins sharp-pointed, the tail-fin notched; the gill-cover shining, without proper spines or denticulations; the palate destitute of teeth; the scales large, broader than long, and generally thin. There are several sections of the family, distinguished by the teeth, which in some are all small and card-like, whilst others have trenchant, conical, and round molar teeth, variously arranged. The greater number inhabit the seas of the warm parts of the world; many species are found in the Mediterranean; a few on the coasts of Britain. Among the British species are the Gilthead (q. v.), and several species of different genera, known by the common name of Sea Bream (q. v.). The S. are generally good for food, and some are highly esteemed. Among them are the *Sargus* of the Mediterranean (*Sargus Rondeletii*, much valued by the ancient Romans, and the Sheep's Head (*Sargus ovis*) of the North American seas, which commands a very high price in the New York market.

SPARKS, JARED, American historian, was born at Willington, Connecticut, May 10, 1789; graduated at Harvard University in 1815; became tutor in mathematics and natural philosophy, and one of the conductors of the *North American Review*. In 1819, he was settled as a Unitarian minister at Baltimore, when he wrote, *Letters on the Ministry, Ritual, and Doctrines of the Protestant Episcopal Church*. In 1821, he established a periodical called the *Unitarian Miscellany and Church Monitor*, in which he first published his *Letters on the Comparative Moral Tendencies of the Trinitarian and Unitarian Doctrines*. In 1823, he edited six volumes of essays and tracts on theological subjects, and, abandoning the pulpit, became for seven years sole editor of the *North American Review*. In 1828, he published a *Life of John Ledyard, the American Traveler;* and from 1834 to 1837, edited at Boston, 12 octavo volumes of the *Writings of George Washington*. This important national work was followed by the *Diplomatic Correspondence of the American Revolution* (12 vols. 8vo, Bost. 1829—1830), and the *Life of Gouverneur Morris* (3 vols. 8vo. Bost. 1832). At this period, he commenced the *American Almanac of Useful Knowledge*, and began also his *Library of American Biography*, first issued in two series of 10 and 18 vols. 18mo. In 1840 was published his collection of the *Works of Benjamin Franklin* (10 vols. 8vo), after which he visited Europe to collect materials for his *Correspondence of the American Revolution* (4 vols. 8vo, 1854). He also wrote, in 1852, two pamphlets in answer to Lord Mahon, on the *Life of Washington*. Besides these multifarious literary labors, combining laborious research with clear arrangement, a simple style and accurate statement, he filled, from 1839 to 1849, the M'Lean chair of history, and from 1849 to his departure for Europe in 1852, that of President of Harvard University. S. died March 15, 1866.

SPA'RROW (*Passer* or *Pyrgita*), a genus of birds of the family *Fringillidæ*, having a strong conical bill, the upper mandible slightly curved, the lower mandible compressed and shorter than the upper, the nostrils partly concealed by the short feathers at the base of the bill, the legs moderately long and stout, the claws sharp and curved, the tail moderately long, and nearly even at the tip. The species are not very numerous, and are exclusively found in the Old World. The COMMON S., or HOUSE S. (*P. domesticus*), plentiful everywhere in the British Islands, and too well known to require description, is found also throughout Europe, abounding particularly in the northern countries, from which its range extends eastwards into Siberia, and southwards to the north of Africa and of India. Of all British birds, the S. is the boldest in its approaches to man. Town sparrows are not mere visitors from the neighboring country, but constant inhabitants of the town itself, with the smoke of which their plumage is begrimed. The S. in its best plumage is not a very beautiful bird, nor has it such elegance of form as many others of the finch tribe; it has no melodious song, but its habits are interesting, and its frequent lively chirp pleasing. Sparrows often congregate in great flocks, particularly in autumn, when they find rich supplies of food in the ripened grain.

The S. is one of the most omnivorous of birds. Animal and vegetable food seem equally acceptable to it. During summer, vast numbers of insects and their larvæ are devoured by sparrows, and in this way they make amends for their plunder of the grain in autumn, which they begin as soon as it is sufficiently ripened, and continue as long as there are sheaves in the field. Their depredations have induced many farmers to use means for their destruction. They are good to eat, though little used for this purpose in Britain. It is otherwise in France, where all the small birds are sought after as articles of food. But the destruction of sparrows may be carried too far; and in France it has been followed by an increase of caterpillars, vastly more injurious to crops than the sparrows themselves. The S. makes a very inartificial nest, collecting a quantity of hay, or some similar material, in a hole of a wall, and lining it with feathers; sometimes, but more rarely, building a rude dome-shaped nest in the higher branches of a tree. Apart from the habitations of man, which it so much frequents, it often builds in crevices of rocks, or in cliffs on the sea-coast, or under the shelter of the nests of rooks, one rook's nest sometimes covering several nests of sparrows. Several broods are produced in succession, and the breeding season is prolonged over the whole summer, one brood succeeding another.

The summer plumage of the S. is more brilliant than that of winter, and the female is of more sober plumage than the male, exhibiting indeed almost no variety of color.—The TREE S. (*P. montanus*), the only other British species, is very similar to the Common S., but of rather smaller size. It is also a widely distributed bird, frequent over great part of the old World. It is rarely seen in towns.—In Italy, the Common S. is rare to the south of Piedmont; and another closely allied species (*P. cisalpina*), takes its place, very similar in its habits as well as in its characters.—In America, there are numerous species of *Fringillidæ*, popularly known as sparrows, of which the WHITE-THROATED S. (*Zonotrichia albicollis*) is most nearly allied to the true sparrows. The nostrils are in a small groove, and the tail is slightly forked.—The HEDGE S. (q. v.) is a bird very different from the true sparrows.—The name S. is popularly given in different parts of the world to many different birds, chiefly *Fringillidæ*.—The bird called S. in the English translation of the Bible is a species of thrush.

SPARROW-HAWK (*Accipiter* or *Nisus*), a genus of *Falconidæ*, ranked among the *ignoble* birds of prey (see FALCONIDÆ and FALCONRY). The bill is curved from the base, short, and compressed; its upper ridge rounded and narrow; the cutting margin of the upper mandible with a distinct festoon. The wings are short; the legs long, slender, and smooth. Only one species is British—the COMMON S. (*A. nisus*, *A.* or *N. fringillarius*), a small hawk, only about twelve inches in length, a considerable portion of the length belonging to the tail. It is found in almost all parts

Sparrow-hawk (*Accipiter nisus*).

of Britain, and in Asia as far south as Bengal, and as far east as Japan. It is not found in America. It very often makes its nest in the deserted nest of a crow. It is a bold, active bird, very destructive to poultry and pigeons. The S. has often been trained for the purposes of falconry, to take land-rails, patridges, and similar game. The S. of Australia (*A. torquatus*) is marked by a collar of numerous bars of white. Its habits are very similar to those of the European sparrow-hawk.—The American S. (*Falco sparverius*), common in most parts of the United States, is similar in size to the European S., but is rather allied to the kestrel.

SPA'RTA, anciently LACEDÆMON, the capital of Laconia, and the most famous city of Peloponnesus, occupied partly a range of low hills on the right bank of the Eurotas, and partly the intervening plain. Its appearance, even in its palmiest days, was by no means equal to its renown, for, though not destitute of handsome public buildings, the severe law ascribed to Lycurgus, that 'the doors of every (private) house should be fashioned only with the saw, and the ceiling with the axe,' exercised a cramping influence on the development of architecture and of the fine arts generally. The natural defences of the place, or, at least, of the long valley of Lacedæmon, in which S. stood, were so great, that it continued unfortified down to the Macedonian period—nearly a century after its mighty struggle with Athens for the hegemony of Greece; and, indeed, it was not regularly fortified till the time of the tyrant Nabis (195 B.C.). Previous to the Dorian conquest, the primitive Achæans of S. seem to have dwelt in four or five scattered hamlets.—These hamlets were welded into one city, so to speak, by the conquerors, and became known as town-districts. The Acropolis of S. occupied a hill in the northern part of the city, and was adorned with a temple to Athena (the tutelary goddess of S.), plated with bronze, whence it was called the Brazen House, and the goddess herself *Chalcioecus* (the Dweller in the Brazen House). On the bronze plates were beautifully sculptured various Greek myths.

At the eastern base of the Acropolis stood the Agora or Marketplace, whence streets proceeded to the different quarters of the city. Here stood the public buildings of the magistrates. The Agora contained many statues. The principal street in S., called the Aphetais, ran south from the Agora to the southern wall, through the most level part of the city, and was lined with a long succession of monumental edifices, chiefly *heroa* and sanctuaries. Along the banks of the Eurotas stretched the *Dromos* (Racecourse), in which were several *gymnasia*, with temples of the Dioscuri, of the Graces, &c., and numerous statues; and still further south lay a broader level, Platanistas, so called from the plane trees that grew there. This was the scene of those mock-contests in which the Spartan youth learned to face without fear the realities of war.

The history of S. is really the history of Laconia. *When* the four hamlets, the *Pre-Dorian* S., originated, we have no knowledge; but it cannot be doubted that their inhabitants were Achæans. It is during the rule of the Achæan princes that the events of the famous, but unhistorical, expedition against Troy, forming the subject of Homer's *Iliad*, are described as taking place. Menelaus, husband of Helen, whose flight with Paris, occasioned the Trojan war, was king at S., and it was during the reign of his grandson, Tisamenus (according to the legend), that the Dorians (q. v.) invaded Peloponnesus.

The *fact* of a Dorian invasion is universally admitted, but of the details, scanty even as they are, we may safely be sceptical. We cannot even be certain of the date of the event, or even of the century in which it occurred. All that is clear is, that the native Achæan population were deprived of political privileges, and appear henceforth as *Perioeci* (q. v.) and Helots (q. v.)—the Dorian conquerors alone forming the historical Spartans. Towards the middle of the 8th c. B.C., the Dorians of S. had not only thoroughly established themselves in their new settlement, but had subjugated the whole of the fertile and beautiful vale of Lacedæmon, commonly known as Laconia, and had begun to cherish ambitious views of extending their supremacy over the other Dorian settlements in Peloponnesus—viz., those of Messenia and Argos. Hence originated the Messenian wars (see MESSENIA), which terminated (668 B.C.) in the complete overthrow of the Dorians of Messenia, who were reduced by the victorious Spartans to the condition of Perioeci. Similar struggles occurred both with the older Archæan inhabitants in the center of Peloponnesus and with the Dorians of Argos, &c., in which the Spartans were generally successful. The development of their warlike and ambitious character is usually ascribed to the institutions of Lycurgus (q. v.); and whatever we may think of that more than semi-mythical personage, the institutions that go under his name were well fitted to make the Spartans exactly what they figure in history—a race of stern, cruel, resolute, rude, and narrow-minded warriors, capable of a momentary self-sacrificing patriotism (as in the story of the 300 heroes who fell at Thermopylæ), but utterly destitute of the capacity for adopting or appreciating a permanently noble and wise policy.

The outbreak of the Peloponnesian war (431 B.C.) brought the rivalry between S. and Athens to a head, and in the mighty struggle that ensued, victory declared on the side of the combatant least capable of maintaining the greatness of Greece. S. now attained the hegemony of Greece; but her insolent tyranny in the hour of her triumph excited the indignation of those whom she held in virtual subjugation, and the glorious retaliations of the Thebans under Epaminondas (q. v.) stripped her of all her splendid acquisitions, and reduced the Laconian state to its primitive boundaries. Later, the rise of the Macedonian power limited still more the Spartan territory, nor did it ever after attain its earlier dimensions. Finally, after a series of vicissitudes, S. passed into the hands of the Romans, became a portion of the Roman province of Achaia, and shared the fortunes of the great republic.

SPA'RTACUS, the leader in the great insurrection of Roman slaves in Southern Italy which took place 73 B.C., and in all probability the first servile captain in point of genius of whom history preserves a record, was a native of Thrace, and originally followed the occupation of a shepherd, but afterwards became a robber-chief. Having the misfortune to be taken prisoner, he was placed in a training-school for gladiators kept by one Lentulus Batiatus, at Capua. A conspiracy to escape was formed among the gladiators (200 in all, and mostly Gauls and Thracians), the heads of which were S., and two Gauls, Crixus and Œnomaus. The conspiracy was discovered; but 70, among whom were the leaders, forced their way through the streets of Capua with cleavers and other such rude weapons as they could seize, defeated a detachment of Roman soldiers sent to bring them back, and established themselves on Mount Vesuvius, where they received considerable accessions to their number—chiefly runaway slaves. Three thousand Roman troops under C. Claudius Pulcher sought to blockade them here and starve them into surrender. S. was now chosen as their leader, with Crixus and Œnomaus for his lieutenants. Descending the hill at a place and in a way totally unexpected, he took his assailants in the rear, and inflicted on them a disgraceful defeat. His original design had been limited to securing his freedom, and making his way back to his own country, nor during the two years that the insurrection lasted did he ever forget this ultimate aim; but in order effectually to carry it out he recognized the necessity of a far more serious and extensive warfare than had yet been waged, and proclaiming freedoom to all slaves, he contrived to raise his trivial mutiny to the dignity of a servile war. Circumstances were favorable.

A great portion of Italy, especially of Central and Southern Italy, had been turned into pasture-land (see ROME), and instead of villages of sturdy and independent farmers, who owned the land they tilled, gangs of discontented slaves watched the flocks and herds of great nobles, demoralized by a plethora of ill-gotten riches. It was to these slaves that S. appealed, and his summons was not in vain. Thousands upon thousands rushed to his standard, and victory followed him wherever he went. The story of his triumphs reads like a romance. No knight of chivalry was ever more uniformly successful, for a time. After defeating Claudius Pulcher, he routed and slew Cossinius, legate of Publius Varinus; then he worsted Varinus himself in several engagements, capturing his lictors and the very horse on which he rode. All the southern part of the peninsula now fell into his hands: the country was devastated, the cities either pillaged or garrisoned. But S. knew too well the enormous resources of Rome, and the extraordinary energy which she was capable of exhibiting in the hour of peril, to hope for final success, and he consequently sought to induce his victorious bands to march northwards to the Alps, and disperse to their own homes, the Gauls to the west, and the Thracians to the east. But the slaves were too deeply intoxicated with their success to see the wisdom of his proposal, and S. had to continue his career of mere fighting against his better judgment, and embarrassed by the jealousies that are so apt to spring up among undisciplined and servile hordes. What brilliant gallantry and skill he showed, is known to all readers of Roman history. After the defeat and death of his lieutenants, who had separated from him (72 B.C), he marched north through Picenum towards the Po, overthrew first one consular army under Cn. Cornelius Lentulus and then another under Gellius Poplicola, and at the head of 100,000 men, meditated a march on Rome.

Since the days of Hannibal, there had never been such danger! Fortunately, servile indecision and unwisdom saved the city. S. was forced by his followers to retreat south, and took up his winter-quarters at Thurii, where he held a great fair for the sale of the spoils of Roman cities. In 71 B.C. Crassus (q. v.) took the field against the terrible slave-leader, but for a while even he could do nothing. Near Mutina, the proconsul C. Cassius Longinus, and the proprætor, Cn. Manlius, were defeated; in Picenum Mummius, a legate of Crassus's was utterly routed; at last, however, Crassus succeeded in forcing S. into the narrow peninsula of Rhegium, whence he tried to get into Sicily, with a view of rekindling the servile war that had recently raged in that island, but failed in his attempt, through the treachery of those with

whom he had opened negotiations. Crassus now built lines of circumvallation to hem him in, and force him to surrender; but one stormy winter-night, S. broke out of the toils prepared for him, and resumed the offensive, although he had suffered heavily by loss and desertion, and his forces were still further diminished by the formation of an independent army of Gallic slaves, which had no sooner got a leader of its own, than it was annihilated. Near Petelia, he once more defeated his adversaries; but seeing clearly that with such wretched materials as he had he could not hold out much longer, he made a dash at Brundusium, hoping to seize the shipping in the harbors, and get safely across the Adriatic to his native shore, but was baffled by the presence of Lucullus (q. v.). Pompey, too, had returned from Spain. There was nothing left for S. but to die as gallantly as he had lived. Drawing up his army in battle-array, and solemnly slaying his war-horse, he began his last fight in a spirit of heroic desperation and after performing prodigies of valor, fell unrecognized among the heaps of his slain foes. After his death, the slave insurrection was at an end.

SPASM (Gr. *spasma*) consists in an irregular and violent contraction of muscular parts—involuntary even when the voluntary muscles are concerned. There are two sorts of spasms. In one, there is an unusually prolonged and strong muscular contraction, not rapidly alternating as usual with relaxation, the relaxation only taking place slowly, and after some time. This is known as *tonic spasm* (Gr. *tonos*, a bracing up) or *Cramp* (q. v.). 'When in a more moderate degree affecting the voluntary muscles generally, it constitutes Catalepsy (q. v.), in which, from the muscles remaining contracted, the limbs will retain whatsoever attitude they are placed in, until the spasm is over. But the extreme example is Tetanus (q. v.), in which the spasms are so violent and so enduring, that they may be said to squeeze the patient to death.'—Williams's *Principles of Medicine*, 2d ed. p. 72. In the other form of spasm, the contractions of the affected muscles take place repeatedly, forcibly, and in quick succession; the relaxations being, of course, equally sudden and frequent. This is named *clonic spasm* (Gr. *klonos*, an agitation), and is popularly known as *convulsions*. Chorea (or *St. Vitus's dance*), epilepsy, and convulsive hysteria, afford examples of this kind of spasm.

The treatment varies according to the cause of the excessive muscular irritability. Firm pressure on muscles affected with spasm will promote their relaxation, and by strong steady pressure on the masseter muscles, the lower jaw has been depressed, so as to open the mouth, in cases of lock-jaw. The medicines which are employed to counteract irregular or inordinate muscular action are termed *antispasmodics;* but spasm may depend upon so many different causes that the remedies which are found most successful in combating it must vary extremely in their nature. There are, however, a few medicines which appear to exercise a control over spasmodic action generally. These may be termed *pure* or *true* antispasmodics. They are Asafœtida, Cotyledon umbilicus (or Common Navel-wort), Wood-soot, Galbanum, Musk, Rue, Sagapenum, Sumbul (Jatamansi or Musk Root), and Valerian. Amongst the narcotics often useful in these affections, we may especially mention Belladonna, Cannabis Indica (or Indian hemp), Opium, and Stramonium, Sulphuric ether in draught or inhaled, and inhaled chloroform, are often of service. In some cases, remedies which directly depress the vital powers, such as the prolonged use of the warm bath, or even, in rare cases, the abstraction of blood, are the most effectual means of subduing spasm.

SPATHE (*Spatha*), in Botany, a sheathing bract which encloses one or more flowers, as in the *Narcissus*. Very frequently the flowers within a spathe are arranged upon a *spadix*, which is a succulent spike, with numerous flowers, and of which a familiar example may be seen in *Arum maculatum*. The spadix is a characteristic feature of the Palms, and in them is compound or branching, and in general is not only provided with a common spathe, but with secondary spathes at its divisions.

SPA'VIN, a disease of horses, occurs under two different forms, both interfering with soundness. In young, weakly, overworked subjects, the hock-joint is sometimes distended with dark-colored thickened synovia or joint-oil. This is bog or blood spavin. Wet bandages, occasional friction, a laxative diet, and rest, should for several weeks be diligently tried; and if such remedies prove unsuccessful, the swelling must be dressed with strong blistering ointment, or fired. The second variety of spavin is more common and serious. Towards the inside of the hock, at the head of the shank-bone, or between some of the small bones of the hock, a bony enlargement may be seen and felt. This is bone spavin. At first, there is tenderness, heat, swelling, and considerable lameness; but as the inflammation in the bone and its investing membrane abates, the lameness is less perceptible, although the animal continues to drag his leg and go stiffly. In recent and slight cases, cold water should be applied continuously; but in serious cases, when the limb is swollen and tender, hot fomentations are best. For several days, they must be perseveringly employed. When the limb is again cool and free from pain, an iodide of mercury or fly-blister should be applied, and the animal treated to three months' rest in a small paddock, the end of a barn, or a roomy loose box. In persistent cases, firing or setoning usually gives much relief.

SPEAKER, the name given to the presiding officer in either House of Parliament. In the House of Lords, the Lord Chancellor, or Lord Keeper of the Great Seal, is *ex officio* Speaker and one or more deputy-speakers are appointed by commission to take his place in his absence. Since 1851, it has been the practice to appoint but one deputy-speaker, who is the chairman of the Lords' committee, and should he also be absent, the House can choose a Speaker *pro tempore*. The Speaker of the Lords may speak or vote on any question, and has no more authority than any other member of the House.

In the House of Commons, the Speaker is a member elected to that office at the desire of the crown, and confirmed by the royal approbation given in the House of Lords. A similar office seems to have existed as early as the reign of Henry III., when Peter de Montfort signed and sealed an answer of the parliament to Pope Alexander, *vice totius communitatis;* but the title Speaker was first given to Sir T. Hungerford in the reign of Edward III. The Speaker of the House of Commons presides over the deliberations of the House, and enforces the rules for preserving order: he puts the question, and declares the determination of the House. As the representative of the House, he communicates its resolutions to others, and conveys its thanks or its censures. He is thus the mouthpiece of the House, whence his title seems to be derived. He issues warrants in execution of the orders of the House for the commitment of offenders, for the issue of writs, the attendance of witnesses, the bringing up prisoners in custody, &c. The mace is borne before him by the serjeant-at-arms when he enters or leaves the House; when he is in the chair, it is left on the table, and it accompanies him on all state occasions. He cannot speak or vote on any question, but on an equality of voices he has a casting vote. Both by ancient custom and legislative declaration, he is entitled to take precedence of all commoners.

Down to the year 1853, no provision existed for supplying the place of the Speaker of the House of Commons when he was unavoidably absent, but in that year the House, with consent of the crown, resolved that in his absence the Chairman of the Committee of Ways and Means should take the chair, and as deputy-speaker he was in 1855 invested, both by resolution of the House and by act of parliament, with the same authority *pro tempore* as the Speaker.

SPEAKING. See READING.

SPEAKING-TRUMPET, an instrument for giving concentration rather than dispersion to the waves of sound originated by the articulation of the human voice, and thereby enabling the sound to be conveyed to a greater distance. It is of the utmost use on shipboard in enabling the officers to convey orders during windy weather from one part of the deck to another, or to the rigging. The invention is ascribed to Sir Samuel Moreland, in 1670, though Athanasius Kircher laid claim to it. Moreland's trumpet was of the same form as that now in use—viz., a truncated cone, with an outward curve or lip at the opening.

The theory of the action of this instrument has never been thoroughly explained; but it is supposed that the sides of the tube throw the sound back and back in various reflections, until ultimately the waves quit the instrument in parallel lines. It does not seem to depend on vibration of the instrument.

SPEAR, a pointed weapon with a shaft of greater or less length for thrusting, throwing, or receiving an assault. See JAVELIN, LANCE, PIKE.

The *spear foot* of a horse is his far foot behind.

SPEA'RMINT. See MINT.

SPE'CIAL CASE is the name given in the law of England to a statement of facts submitted to a court for its opinion as to the proper application of the law, or proper legal inference to be drawn from such facts. It is drawn up by mutual agreement of the parties, and may be agreed upon at any stage of the suit, or even before any step has been taken in it.

SPECIAL JURY is a jury consisting of a superior class of men, such as esquires or persons of higher degree, bankers, or merchants selected by the sheriff, and formed into a separate list. Either party to an action may demand a special jury, but he must pay the extra expense, provided the judge do not certify at the conclusion of the trial that it was a proper case to be tried by a special jury, in which case the costs are part of the costs in the cause. Each special juryman gets a guinea for his attendance on the case. The advantage of a special jury is, that the jurors are less likely to be carried away with vulgar prejudices, and more intelligent, and able to understand difficult cases.

SPECIAL LICENCE, in the marriage law of England, means a licence obtained from the archbishop, which enables the priest

to marry the parties without the publication of bans, and also at any time or place other than those necessary in ordinary cases. The statute of 25 Henry VIII. c. 21, entitled an Act concerning Peter Pence and Dispensations, continued to the archbishop of Canterbury the same right as the Pope previously had to grant special licences to marry at any convenient time and place. By a regulation of Archbishop Secker in 1759, the privilege is restricted to children of peers, and privy councillors, judges, baronets, and knights. The same conditions apply to applicants as in other cases, except that the special licence merely authorizes a different time and place for the marriage than in other cases. The stamp-duty is £5.

SPE'CIALTY DEBT, in English Law, was a debt constituted by deed under seal, as a bond, which in the event of the debtor's death had a right of prior payment over Simple Contract (q. v.) debts. Such preference is, since 1870, abolished, except where a lien or other security is held for the debt.

SPE'CIES, in Natural History, a term employed to designate groups inferior to genera (see GENUS), but superior to varieties (see VARIETY). In Mineralogy, the term is of very arbitrary application, serving only, like class, order, genus, &c., the purpose of classification, although it thus indicates common characters or points of real agreement among minerals. In organic nature, it has usually been regarded as possessing a higher and more definite signification. But no term is more difficult to define. Many definitions have been proposed, but none wholly satisfactory; every attempt at definition involving more or less the adoption of some disputed theory. If, for example, a species is regarded as including all the beings which have descended from parents created with the essential characters now belonging to the species, not only is the original creation in that particular form taken for granted, but likewise the impossibility of changes in nature, which some of the most eminent naturalists regard as actually taking place, and the belief of which implies no doubt of the act of creation itself, but only a certain opinion as to some of the laws by which organic nature is governed. To regard species as mere indeterminate and fluctuating groups, capable of indefinite modification in the lapse of ages, is equally to adopt a theory. If a species is defined as containing all the individuals which are capable of intermingling without consequent sterility of progeny, other difficult questions must be decided before the definition can be adopted as to any classes of creatures, whilst to many kinds it seems incapable of application, and much that is merely theoretical is involved in it.

Naturalists have very generally regarded species as unchanging throughout the longest succession of generations, except within narrow and marked limits, and have substantially adopted the definition of Buffon: 'A *species* is a constant succession of individuals similar to and capable of reproducing each other.' Thus De Candolle, the eminent botanist, says: 'We unite under the designation of a *species* all those individuals that mutually bear to each other so close a resemblance as to allow of our supposing that they may have proceeded originally from a single being or a single pair.' And Cuvier, the great zoologist, describes a species as 'a succession of individuals which reproduces and perpetuates itself.' Here it may be remarked, that even if the permanence of species implied in these definitions were fully ascertained, and their original creation in their present form admitted as unquestionable, it would by no means follow that we must suppose every species to have proceeded from a single individual or a single pair. Nor, accepting the biblical statement concerning the human race, that all mankind are the offspring of a single pair, are we entitled to infer that such has been the case also as to all animals and plants capable of freely intermingling, and which, therefore, are commonly regarded as forming one species.

But the separate creation and immutability of species are disputed, some naturalists maintaining that species undergo modification, and that existing forms of life have descended by true generation from pre-existing forms. Lamarck was the first to proclaim this doctrine, at least so as to attract much attention, about the beginning of the 19th century. He held that all species, even including man, are descended from species of inferior organization; whilst to account for the existence of very simple forms at the present day, he had recourse to the supposition of their spontaneous generation. He was followed, with greater caution, by Geoffroy Saint-Hilaire, who regarded what we call species as various degenerations of the same type, but did not believe that the existing species are now undergoing modification. Similar views have since been stated by many authors. But the works which have most strongly directed attention to them, and in which they have been most fully advocated, are the *Vestiges of the Natural History of Creation*, by an anonymous author, originally published in 1844, and which has since passed through many editions; and Darwin's work *On the Origin of Species by means of Natural Selection*, originally published in 1859. Of the other supporters of these views, the most eminent is Professor Huxley, who, without fully adopting the views either of the author of the *Vestiges* or of Darwin, advocates 'the hypothesis which supposes the species living at any time to be the result of the gradual modification of pre-existing species,' and maintains that to suppose each species of plant and animal to have been formed and placed on the surface of the globe at long intervals by a distinct act of creative power, is an assumption 'as unsupported by tradition or revelation as it is opposed to the general analogy of nature.'

It is impossible for us to do more than very briefly exhibit the principal arguments which have been urged on this question. Lamarck rested much on the well-known effect of use or exercise in strengthening and enlarging an organ, and of disuse in atrophying it. 'He conceived that, an animal being brought into new circumstances, and called upon to accommodate itself to these, the exertions which it consequently made to that effect caused the rise of new parts; on the contrary, when new circumstances left certain existing parts unused, these parts gradually ceased to exist. Something analogous was, he thought, produced in vegetables, by changes in their nutrition, in their absorption and transpiration, and in the quantity of caloric, light, air, and moisture which they received. This principle, with time, he deemed sufficient for the advance from the monad to the mammal.' The author of the *Vestiges*, from whom this account of Lamarck's views is taken, regards him as in error 'in giving this adaptive principle too much to do;' and says: 'In the present day, we have superior light from geology and physiology, and hence comes the suggestion of a process analogous to ordinary gestation for advancing organic life through its grades, in the course of a long but definite space of time, with only a recourse to external conditions as a means of producing exterior characters.' The author of the *Vestiges* designates the principle for which he contends that of *Progressive Development*, and states it as follows: 'The proposition determined on, after much consideration, is that the several series of animated beings, from the simplest and oldest up to the highest and most recent, are, under the providence of God, the results, *first*, of an impulse which has been imparted to the forms of life, advancing them in definite times, by generation, through grades of organization terminating in the highest dicotyledons and vertebrata, these grades being few in number, and generally marked by intervals of organic character which we find to be a practical difficulty in ascertaining affinities; *second*, of another impulse connected with the vital forces, tending, in the course of generations, to modify organic structures in accordance with external circumstances, as food, the nature of the habitat, and the meteoric agencies, these being the "adaptations" of the natural theologian.'

He further regards the *nucleated vesicle* as 'the fundamental form of all organization, the meeting-point between the inorganic and the organic,' and as the starting-point of the fœtal progress of every higher individual in creation, both animal and vegetable.' Founding on instances of the production of the *proximate principles* of which organic substances are composed in the laboratory of the chemist, he goes on to say that 'an operation which would produce in these the nucleated vesicle is all that is wanting effectually to bridge over the space between the inorganic and the organic;' and that 'it does not seem, after all, a very immoderate hypothesis, that a *chemico-electric operation, by which germinal vesicles were produced*, was the first phenomenon in organic creation, and that the second was *an advance of these through a succession of higher grades, and a variety of modifications*, in accordance with laws of the same absolute nature as those by which the Almighty rules the physical department of nature.' He regards the idea of species or specific distinction, therefore, 'as *merely applicable to certain appearances presented, perhaps transiently, to our notice*.' He adduces instances of great changes of form and character known to take place in the lower departments of nature, both animal and vegetable, as giving probability to the supposition, that in a long succession of generations, great changes may take place also in the higher.

The whole theory of the author of the *Vestiges* as to organic nature has been exposed to objection in consequence of its connection with views of the general system of the universe altogether foreign to the present subject; and because of an evident inclination to the belief in a transition from inorganic to organic existence by chemico-electric operation. The argument is also weakened by the too ready acceptance of unsubstantiated facts, as of the transmutation of one kind of grain into another; and by resting too much on what may be reckoned the mere mistakes of naturalists, as to the forms of the lower kinds of plants and animals, of which genera and even tribes have been constituted, that have afterwards been found to be mere modifications or larval stages of creatures very different in their most apparent characters. Much hostility has been also excited by the extension of the theory of development to the human species, connecting man with pre-existing and inferior forms of animal existence. All this has been avoided by Darwin, by whom, however, the chief arguments of the *Vestiges* are used with great scientific caution.

Darwin's views are distinguished by the introduction of what he designates the principle of *Natural Selection*. He maintains the variability of species, and adduces much evidence to show that variation is continually taking place, in consequence of the external conditions to which plants and animals are subjected. He rests much on the difficulty of distinguishing between varieties and species, and on the changes which are known to result from cultivation and domestication. He dwells on the *selection* which man makes, in order to produce new breeds or varieties, and supposes a similar 'selection' to take place in nature, in the *struggle for life*, which all plants and animals must undergo. This *struggle for life* is, in fact, the foundation of his theory. He shows that every kind of plant or animal must maintain it, and in order to its continued existence, must be successful in maintaining it, not only against those other creatures which seem to make it their food, but still more in a competition with those which seek the same nutriment with itself. In this struggle, the stronger, or those which possess anything peculiarly favorable in their organization, must overcome the weaker, and these must therefore cease to exist. Thus a slight variation, such as often takes place, may be perpetuated; and the possessors of any advantage in the means of procuring food, or in the powers of offence or defence, may entirely displace their less favored congeners. The modifications thus taking place, Darwin regards as accounting for the changes in organized beings from one geologic period to another, and for the great differences in the plants and animals of different parts of the world.

In support of his views, he argues from the tendency to variation seen in cultivated plants and domestic animals, and the perpetuation of the forms so produced in breeds and races; and from the fact, that the variations in cultivated and domestic species are in some cases greater than those which are regarded as affording grounds of specific, and sometimes even of generic or greater distinctions in a state of nature. 'Can it be thought improbable,' he says, 'seeing that variations useful to man have undoubtedly occurred, that other variations useful in some way to each being in the great and complex battle of life, should sometimes occur in the course of thousands of generations? If such do occur, can we doubt—remembering that many more individuals are born than can possibly survive—that individuals having any advantage, however slight, over others, would have the best chance of surviving and of procreating their kind? On the other hand, we may feel sure that any variation in the least degree injurious would be rigidly destroyed. This preservation of favorable variations and the rejection of unfavorable variations, I call *Natural Selection*. Variations neither useful nor injurious would not be affected by natural selection, and would be left a fluctuating element, as perhaps we see in the species called polymorphic.' He further supports these views by pointing out the favorable opportunity for the operation of natural selection afforded in a country undergoing great physical changes, as of climate; and particularly in an island, or a country surrounded by barriers sufficient to prevent the ready immigration of species. 'In such cases,' he says, 'every slight modification, which in the course of ages chanced to arise, and which in any way favored the individuals of any of the species, by better adapting them to their altered conditions, would tend to be preserved; and natural selection would thus have free scope for the work of improvement.'

Mr. Darwin supposes new variations to be continually taking place, but the greater number of these speedily to become extinct; whilst others, becoming perpetuated, and perhaps causing the extinction of the original forms, again give rise to other forms, until some of them have so widely diverged, that all traces of their common origin are lost. He does not, however, commit himself to the opinion, that all forms of organic life, or even all plants or all animals, have a common origin. He completely rejects Lamarck's notion, that new and simple forms are continually being produced by spontaneous generation. 'I need hardly say,' he remarks, 'that science in her present state does not countenance the belief that living creatures are now ever produced from inorganic matter,' and he accounts for the existence of low forms of life by saying that 'natural selection includes no necessary and universal law of advancement or development; it only takes advantage of such variations as arise and are beneficial to each creature under its complex relations of life.' So that even the lowest forms might 'be left by natural selection unimproved, or but little improved,' as geology tells us of infusoria and rhizopods, which have remained for an enormous period in nearly their present state.

That species differ not only in single characters, but in many, Mr. Darwin accounts for by reference to unknown laws of the correlation of organs—laws, however, which, although unknown, we know to exist, so that a modification of one organ is attended with modification of other organs, as is exemplified in our domestic breeds.

In further support of the theory of natural selection, the fact is insisted upon, 'that it is the common, the widely diffused, and widely ranging species, belonging to the larger genera within each class, which vary most.' That the several subordinate groups in any class of creatures 'cannot be ranked in a single file, but seem rather to be clustered round points, and these round other points, and so on in almost endless cycles,' Mr. Darwin thinks incapable of explanation, except on the supposition of community of origin and natural selection. He points also to the analogous manner in which species of the same genus vary, as corroborative of his views. He accounts for the absence or rarity of transitional varieties by supposing the predominant forms to have taken possession of their districts, whilst these were in process of being stocked; and that these districts, differing much in their natural characters, the forms originating in the comparatively unextensive intermediate tracts, have not been able to contend against them, and have become extinct. He points out the possibility that areas now continuous may not have been so during a long period, and that species may have been formed whilst they were broken up into islands. But this remains a chief difficulty of his theory.

He ascribes to natural selection the results which Lamarck ascribed to use and disuse in the development and atrophy of organs; and thinks it not impossible that the flying squirrels may thus have had a common origin with the true squirrels, and the *Galeopithecus* with the lemurs, although he admits that we have no graduated links of structure connecting them together. 'Nor can I see any insuperable difficulty,' he says, 'in further believing that the membrane-connected fingers and forearm of the *Galeopithecus* might be greatly lengthened by natural selection; and this, as far as the organs of flight are concerned, would convert it into a bat.' Like Lamarck and the author of the *Vestiges*, Mr. Darwin rests not a little on the unity of type throughout whole classes of creatures, and the homologies of parts very different from each other, as in the four-limbed structure of the vertebrata generally, and even the articulations of the limbs. He endeavors to trace the eye from its simplest to its most perfect form, and shows how gradual are the transitions found on comparison of existing creatures, from the one to the other. He goes even further, and says: 'Several facts make me suspect that nerves sensitive to touch may be rendered sensitive to light, and likewise to those coarser vibrations of the air which produce sound.'

He dwells at great length on the subject of hybridism, and the general sterility of hybrids, endeavoring to show that it presents no insuperable objection to the theory of a gradual modification of species, their sterility being incidental on other differences, and sterility occurring, as he labors to prove, when varieties are crossed, as well as in the hybrids of distinct species. The difficulties presented by geology he obviates very much by insisting on the imperfection of the geological record. He does not adopt the view of the author of the *Vestiges*, that the geological record exhibits to us a succession of animals corresponding in their progressive development with the fœtal development of the mammalian embryo. But he founds an argument on the many connecting links in the general system of nature which fossils supply when compared with existing species. And he endeavors to show that his theory is perfectly consistent with the known facts of the geographical distribution of species, and in particular with the remarkable facts of the peculiarity of the fauna and flora of some of the lonely oceanic islands, and of the frequent occurrence of the same species both in cold regions comparatively near the pole, and on mountains far remote from each other in lower latitudes; referring the latter class of facts to former geologic periods, when the continental areas were not the same as now, or when the prevailing climatic conditions were very different. And he finds support for his views in the correspondence, without identity, of the floras and faunas of the northern parts of America and of the Old World.

It is but a very imperfect sketch which we have thus been able to give of Darwin's theory, and of the arguments by which it is supported. Whatever may be thought of the truth of the theory, it must be admitted to be admirably framed and guarded, and to be maintained not only with great ingenuity of argument, but by the aid of a vast store of scientific information, most skilfully used. Its opponents condemn it as resting upon unwarrantable assumptions, and demand some proof, for example, of the transition of organs from a simple or rudimentary to a complex and more perfect state. They also refuse to acknowledge such imperfection of the geological record as Darwin's argument demands, and they insist much on the completeness of the changes which that record discloses, and the absence of transitional forms both among fossils and existing species. Much of what Darwin and other advocates of the same general views contend for, they admit; a certain power of development in organic nature, a 'struggle for life,' and 'natural selection;' but they regard the limits of development and variation as comparatively narrow. Nor would the state of the question, as they believe, be materially affected, if many of what have hitherto generally been regarded as species,

should be proved to be mere varieties. Any number of such errors of naturalists might be exposed and corrected, without modification of our views of the laws of nature; and errors of this kind are precisely such as might be expected, when the forms of organic life began to be discovered and described, and ere yet there was time for their mature study in all parts of the world, and under all various circumstances.

The doctrine of Darwin is usually spoken of as the *Evolution Theory*. But it must be remembered that it is not the only possible theory of evolution; Darwin's fundamental idea being that of evolution by *Natural Selection*—'survival of the fittest,' as Herbert Spencer expresses it. Darwinism has made the most remarkable progress during recent years. Scarcely a living naturalist now entirely rejects it, and the vast majority indeed are earnestly occupied in its elucidation and application. The theory too is being extensively applied in sociology and philosophy. It should here be mentioned that the theory of Natural Selection was arrived at independently by Mr. A. R. Wallace (q. v.). See articles on DARWIN, DARWINIAN THEORY, ZOOLOGY, MAMMALIA, &c.; as also Darwin's *Origin of Species*, *Descent of Man*, and other works; Lyell's *Principles of Geology;* Huxley's *American Addresses* and *Science and Culture;* Haeckel's *Natural History of Creation;* Meunier's *Le Darwinisme*, &c.

SPECI'FIC GRAVITY of any body is the proportion which the weight of a certain bulk of that body bears to the same bulk of another body, which is taken as a standard. The standard for substances solid and liquid is distilled water at the temperature of 62° Fah., barometer 30 inches; and the weight of a cubic inch of this standard is given in the Parliamentary Reports for 1825 as 252·456 troy grains, hence a cubic foot of it weighs 997·129 avoirdupois ounces, or 62·82 avoirdupois pounds. It is convenient to remember that a cubic foot of water weighs about 1000 ounces avoirdupois, as the error resulting from employing this estimate does not amount to much more than $\frac{1}{160}$th of the whole. For aëriform bodies, the standard is atmospheric air, a cubic inch of which, at a temperature of 32° Fah., weighs ·32698, and at 60° Fah., ·30935 grains troy.

The specific gravity of solid bodies is best measured by the hydrostatic balance—a figure of which is given under ARCHIMEDES, PRINCIPLE OF (q. v.)—which gives the weight of a volume of water equal in bulk to the solid, by which it is only necessary to divide the weight of the solid in air to obtain the specific gravity; that of liquids may be obtained by the Areometer (q. v.), or by comparing the weight lost by a solid body in the liquid and in water, and dividing the former by the latter—or by means of the *specific-gravity bottle*, which holds exactly 1000 grains of distilled water in its standard condition. The bottle is emptied of water, filled with the liquid, and then weighed; the result gives the weight of a volume of the fluid equal in bulk to 1000 grains of the standard, and hence this weight divided by 1000 gives the specific gravity. The specific gravity of an aëriform fluid is determined by weighing a glass globe filled first with the fluid, and then with atmospheric air. Annexed is a table of the specific gravity of a few of the more common substances.

SOLIDS (METALS).

	Sp. Gr.		Sp. Gr.
Iridium (hammered)	23·	Iron	7·78
Platinum	20·15	Tin	7·29
Gold	19·25	Zinc	7·19
Mercury	14·	Antimony	6·70
Lead	11·35	Arsenic	5·76
Silver	10·74	Aluminium	2·67
Bismuth	9·82	Calcium	1·58
Cobalt	7·81	Sodium	·97
Copper	8·78	Potassium	·86
Manganese	8·01		

OTHER SOLIDS.

	Sp. Gr.		Sp. Gr.
Loadstone	4·93	Honey	1·45
Ruby	4·28	Lignum-vitæ	1·33
Topaz	4·03	Coal	1·16
Diamond	3·52	Amber	1·08
Limestone	2·70	Spanish Mahogany	1·06
Chalk	2·45	English Oak	·97
Glass, Flint	2·90	Butter	·94
Granite	2·78	Ice	·93
Flint	2·58	Human body alive	·89
Clay	2·16	Ash	·84
Ivory	1·92	Elm	·67
Bone	1·66	Poplar	·38
Sand	1·50	Cork	·24

LIQUIDS.

	Sp. Gr.		Sp. Gr.
Sulphuric Acid	1·84	Champagne Wine	1·
Nitric Acid	1·5	Burgundy Wine	·99
Aqua Regia	1·23	Whiskey, average	·92
Blood	1·04	Oil of Turpentine	·87
Oil of Cinnamon	1·04	Brandy	·84
Oil of Cloves	1·03	Alcohol, pure	·80
Milk	1·03	Ether, Sulphuric	·72
Tar	1·01		

GASES.

	Sp. Gr.		Sp. Gr.
Hydriodic Acid	4·34	Oxygen	1·11
Chlorine	2·44	Olefiant Gas	·98
Sulphurous Acid	2·22	Nitrogen	·97
Cyanogen	1·80	Prussic Acid	·94
Carbonic Acid	1·52	Ammonia	·59
Muriatic Acid	1·28	Hydrogen	·07

SPECIFIC LEGACY. See LEGACY.

SPECIFIC PERFORMANCE, in English Law, is the compulsory execution or carrying out of a contract in its details, the Court of Chancery generally having alone jurisdiction to enforce specific performance. In Scotland, the corresponding phrase is Implement. As a general rule, the courts do not attempt to enforce specific performance, but as a substitute, give the party injured by the breach of contract satisfaction in the shape of damages.

SPE'CTACLES, for the purpose of aiding the sight when impaired by age or otherwise (see SIGHT, DEFECTS OF), were invented during the 13th century. The merit is attributed by some to Alexander di Spina, a Florentine monk, and by others to Roger Bacon. At first, they were exceedingly clumsy, both in the lenses themselves and also in their frames; and but little improvement took place in them until the beginning of this century, when light metal frames were introduced, instead of the cumbrous horn or tortoise-shell mountings, which are still occasionally seen, and have obtained the name of goggles. So skilful are the workmen of Wolverhampton, where they are chiefly made, in the manufacture of steel frames, that some of exquisite workmanship are now turned out, which, with their lenses complete, are under a quarter of an ounce in weight. They have consequently displaced gold, silver, and all other materials, when comfort and effectiveness are preferred to useless show combined with inconvenience. The lenses themselves are nearly always made of the best optical glass, and by the best makers are ground with extreme care. Many profess to be made of 'pebbles,' or rock-crystal; but lenses really made of that material are exceedingly rare, and have no real advantage over good glass.

SPECTRE BAT (*Phyllostoma*), a genus of bats having two membranous crests on the nose, the one leaf-like, the other in the form of a horseshoe. This gives to their face that peculiar appearance from which they derive their popular as well as their scientific name. The species are numerous, and all natives of the West Indies and South America.

SPECTROSCOPE, the instrument by the aid of which spectral phenomena (see SPECTRUM) may be most conveniently studied. It consists essentially of, first, an illuminated slit, from which parallel rays of light proceed; secondly, a prism or train of prisms, to separate the differently refrangible rays; and thirdly, a telescope, to view a magnified image of the specturm produced. See SUN.

SPE'CTRUM (Gr.) is a term applied in Optics to the colored image of the sun or other luminous body, produced by Refraction through a Prism (q. v.), by Diffraction (q.v.) through a fine grating, &c. In what follows we shall confine ourselves to the spectrum produced by a prism, as that which is commonly used. Besides, so far as we have at present occasion to examine it, it presents very nearly the same appearances as spectra produced by other processes.

The solar spectrum was first carefully examined by Newton, who deduced from his observations the composite nature of white light, and the different refrangibilities of its various colored constituents. A ray of sunlight enters a darkened room through a

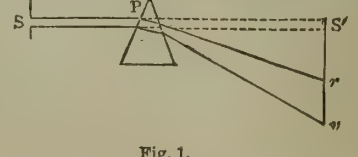


Fig. 1.

small hole, S, in a shutter. It proceeds in a straight line to the opposite wall, and forms at S′, as a circular white spot, an image

of the sun. If the edge of a glass prism, P, be interposed in the path of this ray, the white spot at S′ disappears, and the spectrum, *r*, *v*, is produced. In this form of experiment, its shape is that of a rectangle with semicircular ends, as figured below.

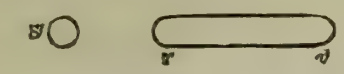


Fig. 2.

The breadth of the spectrum is equal to the diameter of the spot S′; and it is brilliantly colored, the end *r*, nearest to S′, being red, and the other end, *v*, violet. Between these we have gradations of color, and the whole appeared to Newton to be divisible into seven differently colored spaces, which he called red, orange, yellow, green, blue, indigo, violet. This was in accordance with the speculations of old days, when analogies were constantly looked for, and seems to have been suggested to Newton by the common musical scale. It is impossible, however, to settle precisely the exact boundary between any two of these fancied species of color; and, besides, such a description of the spectrum (though complete enough for mere popular language) is totally inadequate to express our present knowledge of the subject. In order to study the spectrum a little more closely, suppose we have pieces of colored glass which allow only one definite color to pass. With a red glass placed at the hole in the shutter, the prism being removed, the effect would be to render the spot S′ red, without changing its position. Introduce the prism, and the effect is to change the position of the spot to *r*, without altering its size or color.

Fig. 3.

Similarly, with a violet glass we have a violet spot at *v*, and so on; the change of position, due to refraction, being least for red and greatest for violet. It thus appears that the spectrum formed in this way, is made up of a series of circular spots, of the various colors of which white light consists, all of the same size, and having their centers ranged along a line, so that each overlaps those next it. The only parts of the spectrum which are *pure*, i. e., where no two or more colors are mixed, are the ends; so that, by this process, it is impossible to separate definitely the rays of different refrangibility, so as to see, for instance, *whether any are wanting*. How, then, are we to ascertain whether sunlight contains rays of every refrangibility from red to violet? The obvious method is to make the spot S′ not circular, but long and very narrow, a process mentioned by Newton himself. In such a case our figure would become

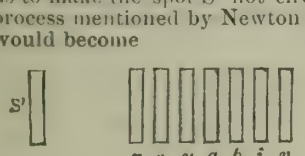


Fig. 4.

and, by making S′ narrow enough, we shall evidently be able to avoid overlapping of the various colored images, *unless there be present, in white light, rays of every refrangibility from red to violet.* To make this spot S′ thus narrow, a method commonly employed, is to set the prism about half-way between the shutter and the screen, and to place before it a lens, such that, if the prism were removed, S′ would be an image of the hole in the shutter nearly equal to it in size. The hole must, therefore, be a narrow slit, parallel to the edge of the prism. When this arrangement is adjusted we have a pure spectrum, and we find it to be (at first sight) *continuous*. Thus, it appears that sunlight contains rays of every refrangibility, from the highest to the lowest; and that Newton's sevenfold division of it, though sometimes convenient for popular reference, has no scientific basis. Besides, what we can see is not the whole spectrum but a mere fraction of it; for beyond the red end, there are invisible rays recognized at once by their heating powers; and beyond the violet there are invisible rays more powerful than the visible in producing chemical changes, as on a photographic plate, and which can be changed into visible rays by fluorescent substances. See PHOSPHORESCENCE. The breadth of the visible spectrum evidently depends on the *length* of the slit, its length on the difference of refrangibility of red and violet.

If we cut a narrow slit in the screen on which the spectrum falls, in a direction perpendicular to its length, the light which passes through has a definite refrangibility, and can no longer be drawn out by a prism into a spectrum. This experiment also is due to Newton.

If the slit in the shutter be very narrow, and the prism be adjusted to the most favorable position (so that the incident and refracted rays make equal angles with the surfaces on which they impinge, and from which they escape, respectively), we see that, after all, the solar spectrum is *not* continuous. It is found to be crossed at intervals by dark bands, (a few of which are sketched below, fig. 5), showing the absence of rays of certain definite refrangibilities. The phenomenon is found to be the same whatever be the substance of the prism; so that these rays are really wanting in sunlight.

This important discovery was made by Wollaston, but the bands were first carefully observed and measured by Fraunhofer, from whom they are commonly called *Fraunhofer's Lines*. We owe to Fraunhofer the invaluable suggestion of employing a telescope to examine the spectrum. The refracted rays are received directly on the object-glass of the telescope, which forms an image of the spectrum to be examined with the aid of the eye-piece, the screen being dispensed with. Wollaston had seen only five lines; Fraunhofer at once discovered four hundred; Brewster, with more perfect apparatus, counted two thousand; and now, with a train of prisms, and powerful telescopes, their number seems beyond computation. They show every variety of breadth and distinctness, and are grouped in the most irregular manner. For reference, Fraunhofer selected some of the more prominent, to which he attached the earlier letters of the alphabet. By their help he was enabled to measure refractive indices (see REFRACTION) with a precision completely unlooked for. If the light of a candle, a bright gas-flame, a white-hot wire, or a lime-ball in the oxhydrogen flame, be examined in the same way, *no such lines are seen.* But some of them, and others not apparently belonging to sunlight, were found by Fraunhofer in the spectra of various fixed stars—while the light of the moon and planets seemed to give spectra similar to that of sunlight.

The first to throw any light on this subject was Brewster. He showed that when light passed through nitrous acid gas its spectrum was interrupted by countless lines; and that they increased in number and breadth by the application of heat to the gas, so that at a high temperature a thin layer of this gas is *opaque to direct sunlight*. Hence it was natural to conclude that the dark bands in the solar spectrum are caused by absorption in some medium lying between us and the sun. It is to be observed, however, that this is on the supposition that light as it comes immediately from the sun would give, like that of the lime-ball, a continuous spectrum. But Brewster went farther. He showed that *some* of Fraunhofer's lines depend on the altitude of the sun, that is on the greater or less space of air, fog, and vapor through which his rays must pass before reaching the earth. *Some of them*, then, *are caused by absorption in the earth's atmosphere.*

But we must now look to another class of phenomena. A spirit-lamp flame gives a very feeble spectrum; and, if a little common salt be put on the wick, although the flame becomes instantly very much brighter, no alteration is produced on the spectrum save the appearance of a *bright* yellow line crossing it at the place where the dark line, called by Fraunhofer, D, appears in sunlight. On examining this line carefully, Fraunhofer found that it, like D, is double—and he verified that these two rays were exactly (so far as refractive index goes) two of those wanting in sunlight, and in the light of some of the stars.

About the same time Talbot and Herschel (q. v.) showed that the colors given by Lithia, Strontia, &c., in a spirit-flame were, like that produced by common salt, due to the production of light of several perfectly definite refrangibilities: so that the spectrum of the lamp-flame was crossed in each case by a series of bright lines, always the same when the same body was placed in the flame; and they suggested (in 1825) the application of this method to the qualitative analysis of minerals, &c., when the presence of extremely minute quantities of different bodies has to be ascertained. This was, in reality, the foundation of SPECTRUM-ANALYSIS; and the method was, we may say, almost complete so far as practice is concerned. The theory, however, was left incomplete so far as regards the cause of dark lines in the solar spectrum. Foucault (in 1849) seems to have been the first to approach the true explanation. An experiment of his, from which, however, he drew no inferences, contains the complete theory. When salt is placed in the voltaic arc (ELECTRIC LICHT, q. v.) the spectrum gives the double bright line (coinciding with the double dark line D) already referred to. When sunlight passes through this arc its dark line D is *strengthened*, instead of being filled up, by the yellow light from the arc as we might have expected; and when one of the white-hot carbon-points (which gives a continuous spectrum) is looked at through the yellow arc, the double dark line D appears in its spectrum.

Stokes learning, in 1850, that experiments had been made by Professor Miller of Cambridge, to test with great accuracy Fraunhofer's assertion as to the exact coincidence of the double bright line of a salted flame with the double dark line of the solar spectrum, gave for the first time the physical explanation of the phe-

nomenon. He compared the salt-flame to a space full of tuning-forks or piano-forte wires all tuned to the same note. When they are in vibration they, of course, give out this note—similarly the salt-flame the *bright* lines. When, however, sounds are produced in their neighborhood, as they naturally vibrate to one definite note, they will be set in vibration by it (i. e., will absorb it) if it be part of the sound.—Thus sound which has passed through such a space has had this note eliminated from it—similarly the salt-flame seizes these yellow rays from white light passing through it. This ingenious and satisfactory explanation shows at once that the line D proves the existence of salt (or sodium) in the atmosphere of the sun. Stokes's theory was not published, except in so far as it was annually given by Sir W. Thomson (q. v.) in his lectures in Glasgow—so that it was independently discovered, or all but discovered, by various other philosophers some 8 or 10 years later. The earliest of these was Balfour Stewart of the Kew Observatory, who proved by reasoning and experiment that a body's absorbing power for any ray of light or heat is equal to its radiating power for the same. Angström all but made the rediscovery. Finally, Kirchhoff, by reasoning similar to that of Stewart, and by actually reversing the spectra of certain substances, arrived at the same results; and, in conjunction with Bunsen, applied them to chemical analysis, with the immediate result of discovering two new metals.

One of the most valuable parts of Kirchhoff's investigation, is his map of the solar spectrum with its dark lines; side by side with which is a spectrum containing the bright lines given by various metals volatilized in an electric spark. The sunlight is admitted through the upper half of the slit, the light from the burning metal through the lower—and thus the two are subject to precisely the same deflections by the train of prisms. The following figure shows a very small portion of Kirchhoff's drawing, and exhibits the exact coincidence of the bright lines produced by highly heated vapors of iron, magnesium, nickel, and calcium, with corresponding dark lines in the solar spectrum. The particular portion exhibited (in the middle of the green), is chosen because it contains few lines

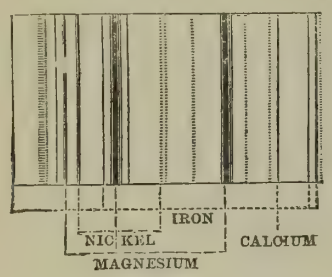


Fig. 5.

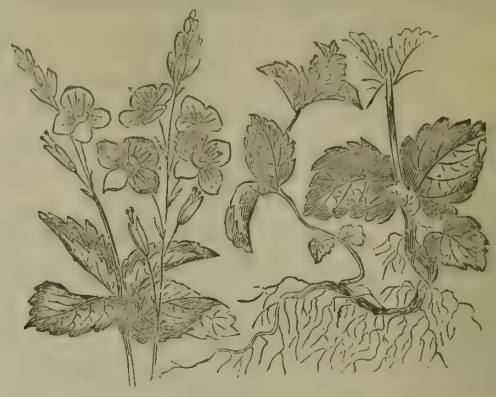
whose origin has not been ascertained. But *every* bright line in the iron spectrum has a corresponding dark line in the solar spectrum. Kirchhoff has calculated from his data the probability that the sun's atmosphere contains iron; and finds it to differ from certainty by a quantity almost inconceivably small.

The applications of the spectrum-analysis are becoming more numerous every day. We have space only for two of the most beautiful and important. Huggins has lately shown that the spectra of planetary nebulæ, and of the tails of comets, consist of a few *bright* lines only—indicating that these bodies—or, at all events, those portions of them from which their light proceeds—are masses of incandescent vapors or gases.

Again, Stokes has traced, by the alteration of the absorption bands produced by the coloring matter of blood, the oxidation and reduction which constantly take place in this substance, and its connection with the distinction between venous and arterial blood.

SPE'CULUM METAL, an alloy of copper and tin, used for making the reflecting surfaces of reflecting telescopes. The best consists of 126·4 parts copper to 58·9 tin. To obtain a perfect alloy, and to cast it successfully, is a matter of great difficulty, requiring much skill and experience. See TELESCOPE.

SPEE'DWELL (*Veronica*), a genus of plants of the natural order *Scrophulariaceæ*, distinguished by a 4-cleft wheel-shaped corolla, with the lower segment narrower, two stamens, and a two-celled capsule. The species are very numerous, annual and perennial herbaceous plants and small shrubs, natives of temperate and cold climates in all parts of the globe. Some of them grow in wet ditches and in marshes, some only on the driest soils. They have generally very beautiful blue, white, or pink flowers. The number of British species is considerable, and few wild-flowers are more beautiful than the Germander S. (*V. Chamædrys*), or the alpine species, *V. alpina* and *V. saxatilis*. A number of species are very generally cultivated in flower-gardens.—The bitter and astringent leaves of the COMMON S. (*V. officinalis*), one of the most abundant British species, found also in almost all the northern parts of the world, are in some countries used as a tonic, sudorific, diuretic, and expectorant medicine. They are also em-



Germander Speedwell (*V. Chamædrys*).

ployed, particularly in Sweden, as a substitute for tea; as are those of the Germander S.—*V. Virginica* is called *Calver's Physic* in N. America; it is said to be actively diuretic, and a decoction of the fresh root is violently cathartic and emetic.—Brooklime (q. v.) belongs to this genus.

SPEISS, a residue found in the bottoms of crucibles in which smalts or cobalt glass has been melted. It consists of nickel, arsenic, sulphur, with traces of cobalt, copper, and antimony.

SPEKE, JOHN HANNING, an African traveler, was born near Bideford, Devonshire, in May 1827, was educated at the Barnstaple grammar-school, and at the age of 17 went to India. He entered the native Bengal infantry as a cadet, and saw much service during the war in the Punjab. A keen sportsman, with a taste for natural history, he employed his rifle with success in collecting for the museums specimens of the rarer mammals and birds of India, and with this view he undertook several exploratory trips into the Himalaya. It was while so employed that he first conceived the idea of becoming an African traveler. The English government had resolved, in 1854, to despatch an expedition from Aden into the neighboring region of Africa, under the command of Captain Burton (q. v.). S., then a lieutenant in the Indian army, reached Aden at this time, on leave of absence and resolved to join Burton and his companions, Lieutenants Herne and Stroyan. Burton went to Harar; and S. was detached to visit the Dalbahantas, the most warlike of the Somauli tribes. On the return of the travelers to their starting-point on the coast, they were attacked by 150 men. Stroyan was killed, and S. made a narrow escape with 11 wounds. The attention of the Geographical Society of London had now been called to the subject of the great lakes of tropical Africa; and in June 1857, they despatched Burton and Speke. These travelers entered the country from Zanguebar, as the German missionaries Krapf and Rebmann had done in 1847, and discovered the great lake Tanganyika. In returning to the coast Speke marched alone to the northwards, and discovered the Victoria N'Yanza. In 1860 he returned to Africa, accompanied by Captain Grant, to confirm his former discovery, when he explored the western and northern shores of N'Yanza, and discovered an outlet to the northwards. See the article NILE. On their return to England in 1863, they met with an enthusiastic reception. The substantial correctness of the geographical discoveries of S. has been established by H. M. Stanley, who sailed round the Victoria N'Yanza in 1876. On the 15th September 1864, S. was killed by a gun-accident while out shooting in the neighborhood of Bath, to which he had come to be present at a meeting of the British Association.—S. is the author of a *Journal of the Discovery of the Source of the Nile*, and *What led to the Discovery of the Source of the Nile*.

SPELT. See WHEAT.

SPELTER. See ZINC.

SPENCER, HERBERT, who has attempted to work out a complete system of philosophy in harmony with the principles and results of modern science, was born at Derby in 1820. His father was a schoolmaster in that town, and, about 1814, became honorary secretary of the Derby Philosophical Association, a society which had been founded by Dr. Erasmus Darwin. From his father, S. imbibed that love of natural science and wonderful faculty of observation so conspicuous in his works. The father seems to have been chiefly interested in entomology; and S. himself used to collect, describe, and draw insects when a boy. Rejecting the Cambridge career recommended by his uncle, the Rev. Thomas Spencer—a clergyman well known for his liberal opinions on social and political questions—he became a civil engineer at Derby

at the age of 17; but about eight years afterwards, gave up this profession, having gradually entered on journalistic and literary work. He had already contributed various papers to the *Civil Engineers' and Architects' Journal;* and in the latter half of 1842, he wrote a series of letters to the *Nonconformist* newspaper on 'The Proper Sphere of Government,' which were republished in pamphlet form in 1843. These letters imply a belief in human progress based on the modifiability of human nature through adaptation to its social surroundings, and maintain the tendency of these social arrangements 'of themselves to assume a condition of *stable* equilibrium.' From 1848 to 1853, he was engaged on the *Economist* newspaper; and at this time he developed the ethical and political consequences of the ideas he had already enunciated, and sought an independent basis for them in his first important work, *Social Statics* (1850). It is thus noticeable that S.'s philosophical activity began with ethical and social questions.

The evolution of man and society as determined by circumstances, and the idea that organic and social evolutions are under the same law, *preceded* the elaboration of those scientific ideas which, in the complete *System of Philosophy*, are made to serve as their basis. The truth anticipated by Harvey and Wolff, but first put into definite shape by Von Baer—'the truth that all organic development is a change from a state of Homogeneity to a state of heterogeneity'—is regarded by S. as the organizing principle of his subsequent beliefs. It was gradually developed and applied by him in a series of articles contributed in the following years to the *Leader*, the *North British*, *Medico-Chirurgical*, *Westminster*, and other reviews.

In these essays, especially those on *Manners and Fashion* (1854), and *Progress: its Law and Cause* (1857); and in the volume of *Principles of Psychology* (1855), the doctrine of evolution began to take definite form, and to be applied to various departments of inquiry. The publication of Darwin's *Origin of Species*, in 1859, gave a wide basis of scientific proof for what had hitherto been matter of speculation, and first showed the important part played by natural selection in development.

In 1864, S. published an essay on the *Classification of the Sciences*, in which he criticised Comte's serial arrangement of the sciences according to generality, and substituted for it a classification according to abstractness: (1) *Abstract Science*, treating of the forms (space and time) in which phenomena are known to us—logic and mathematics; (2) *Abstract Concrete Science*, treating of the laws of the factors of the phenomena themselves—mechanics, physics, chemistry, &c.; (3) *Concrete Science*, treating of the phenomena in their totalities (the laws of the products)—astronomy, geology, biology, psychology, sociology, &c.

Upon this scheme of the sciences, S. had now been working for several years. As early as 1860 he had announced the issue of a *System of Synthetic Philosophy*, already in course of preparation, which, beginning with the first principles of all knowledge, proposed to trace how the law of evolution was gradually realized in life, mind, society, and morality. In pursuance of this comprehensive design, S. has published *First Principles* (1861); *Principles of Biology*, 2 vols. (1864–67); *Principles of Psychology*, 2d edition, 2 vols. (1870–72); *Principles of Sociology*, vol. i. (1876); 'Ceremonial Institutions' (1879), and 'Political Institutions' (1882), composing vol. ii.; 'Data of Ethics,' being Part 1. of *Principles of Morality* (1879).

In method, S.'s philosophy is essentially speculative or deductive. It does not begin with observation and experiment, and rise through them to scientific generalizations. Its starting-point is certain truths supposed to be ultimate, and the source from which all others are to be deduced; and its justification is sought in its ability to explain phenomena from its assumed standpoint. This is not merely due to the adoption of the synthetic form of exposition. The ultimate test is in all cases the mental inconceivability of the opposite of the proposition by the individual thinker.

Metaphysically, S.'s system is founded on the doctrine of relativity Hamilton and Mansel deduced from Kant, but carried, as he says, a step further. Along with the definite consciousness of things known in relation to one another, there is implied an indefinite consciousness of an absolute existence, in the recognition of which as inscrutable, science and religion find their reconciliation. All definite consciousness or knowledge is of the manifestations of this unknowable power; and knowledge, completely unified, is philosophy.

The data of philosophy are necessarily those organized components of our intelligence without which philosophizing could not go on. 'Our postulates are: an unknowable power; the existence of knowable likenesses and differences among the manifestations of that power; and a resulting segregation of the manifestations into those of subject and object.' Within each segregated mass there are likenesses and differences involving secondary segregations. The modes of cohesion under which manifestations are invariably presented are called, when contemplated apart, space and time; when contemplated along with their manifestations, matter and motion. All these are traceable to experiences of that mode of consciousness whose reality is shown by its persistence—to force. By the 'persistence of force' is meant the unchanging quantity both of that mode of force which is revealed to us only by opposition to our own powers, and is not a worker of change, and of that mode which is a worker of change actual or potential, and is specifically termed energy. The persistence of force—that is, the persistence of some cause which transcends our knowledge and conception—is the truth which all other truths imply, and from which they all (including the law of evolution) are derived. From the fact that force can neither arise out of nor lapse into nothing, follows the uniformity of law. Force never disappears; it is only transformed. Motion follows the line of least resistance, and is perpetually reversed within limits—is rhythmical. So far of the factors of phenomena. The phenomena themselves must be under a law of the concomitant redistribution of matter and motion, which holds of every change. The law of the entire cycle of changes passed through by every existence is loss of motion and consequent integration, i. e., evolution, eventually followed by gain of motion and consequent disintegration, i. e., dissolution. In its complete shape, the 'formula of evolution' is thus stated: 'Evolution is an integration of matter and concomitant dissipation of motion; during which the matter passes from an indefinite incoherent homogeneity to a definite coherent hetrogeneity; and during which the retained motion undergoes a parallel transformation.' This law of evolution applies equally to all orders of phenomena—whether 'astronomic, geologic, biologic, psychologic, sociologic, &c.'—since these are all component parts of one cosmos, though distinguished from one another by conventional groupings.

So long as evolution is merely established by induction, it does not belong to philosophy. It must be deduced from the persistence of force. And this can be done. For any finite aggregate being unequally exposed to surrounding forces will become more diverse in structure; every differentiated part will become the parent of further differences; at the same time, dissimilar units in the aggregate tend to separate, and those which are similar, to cluster together ('segregation'); and this subdivision and dissipation of forces, so long as there are any forces unbalanced by opposite forces, must end at last in rest; the penultimate stage of this process, 'in which the extremest multiformity and most complex moving equilibrium are established,' being the highest conceivable state.

The various derivative laws of phenomenal changes being thus deducible from the persistence of force, it remains to apply them to inorganic, organic, and superorganic existences. The detailed treatment of inorganic evolution being omitted from S.'s plan, he proceeds 'to interpret the phenomena of life, mind, and society, in terms of matter, motion, and force.'

It is impossible to give here any but the most general idea of the contents of the volumes in which the law of evolution is applied to these different departments. It is not only made to account for the phenomena within each group, but also for the connection between one science and another. The researches of Darwin had accumulated ample material for showing the continuity of development, structural and functional, in plants and animals; and S.'s view of biology, and the definition of life he proposes ('the definite combination of heterogeneous changes both simultaneous and successive in correspondence with external co-existences and sequences'), are meant to show its connection both with inorganic changes on the one hand, and with mind on the other.

Now, just as biology has to deal with the connection between phenomena in the organism, and as physical science treats of the connection between phenomena in the environment, so psychology has to do with the connection between these two connections. For this is said to be the objective aspect of what states of consciousness are subjectively. The functions dealt with by the psychologist are more special than those dealt with by the biologist; but they belong to psychology, not merely because they are more special, but also because they are the counterparts of the states of consciousness dealt with by the science of subjective psychology.

Objectively, an attempt is made to trace the evolution of mind from reflex action through instinct to reason, memory, feeling, and will, by the inter-action of the nervous system with its environment. Subjectively, mental states are analyzed, and it is contended that all of them—including those primary scientific ideas, the perceptions of matter, motion, space, and time, assumed in the *First Principles*—can be analyzed into a primitive element of consciousness, something which can only be defined as analogous to a nervous shock. These perceptions have now become innate in the individual. They may be called—as Kant called space and time—forms of intuition; but they have been acquired empirically by the race through the persistence of the corresponding phenomena in the environment, and from the accumulated experiences of each individual being transmitted in the form of modified structure to his descendants.

This principle of heredity is one of the laws by which individuals are connected with one another into an organic whole; and we thus pass quite naturally to what S. calls super-organic evolution, implying the co-ordinated actions of many individuals, and giving rise to the science of sociology. Society, like an individual man, is shown to be an organism from the fact and laws of its growth, the nature of its activities, and the inter-dependence of its parts; though it is distinguished from the individual organism in this, that it is discrete, while the latter is concrete: 'there is no social sensorium.' As societies progress in size and structure, they work on one another profound metamorphoses, now by war-struggles and now by industrial intercourse.

Assisted by a series of elaborate ethnographical charts (*Descriptive Sociology*) prepared under his direction, S. has attempted to trace the development of human ideas, customs, ceremonial usages, and political institutions. The genesis of religion is traced to ancestor-worship, or generally to worship of the dead. The notion of another life—from which those of gods and God are gradually evolved—is originated mainly by 'such phenomena as shadows, reflections, and echoes'—these being looked upon as indications of a 'double' or other self, which is not extinguished with the death of the first self. It is this fear of the dead which is the root of the religious control, just as it is the fear of the living, which is the root of the political control. Ceremonies and institutions alike have their root in this fear of the stronger and submission to the conqueror. Thus, early communities being of the predatory or militant type, tended to centralized control; while industrial communities, which are now gaining ground, tend to free institutions and to the restriction of the sphere of government to the negative duty of preventing interference (*laissez faire*). A still higher type than the industrial is possible in the future, by inverting the belief that life is for work, into the belief that work is for life; just as the industrial inverts the belief that individuals exist for the state, into the belief that the state exists for individuals.

The principles of morality are looked on by S. as the copestone of his system, all his other investigations being only preliminary to them. Ethics, he holds, has its root in physical, biological, psychological, and social phenomena, for by them the conditions of human activity are prescribed and supplied. The best conduct is that which most fully realizes evolution—which promotes the greatest totality of life in self, offspring, and fellow-men—the balance of egoism and altruism being attained by a compromise between these contending principles. The measure of life is said to be pleasure, but the Utilitarian school are at fault in assuming that the end (greatest happiness) is better known than the means to it (morality); and for ignoring the fact, that accumulated experiences of utility have become consolidated in the race into a moral sense.

In the above summary, it has been impossible to give any idea of either the strength or weakness of the proof by which this elaborate system is supported. In general, it may be said that its strength lies in the author's brilliant power of generalization, his acquaintance with various departments of science, and his unsurpassed wealth of illustration. But a clear analysis of the notions he employs is often wanting. Hence, the unsatisfactoriness of the distinction between definite consciousness or knowledge, and the indefinite consciousness implied by it, which is not knowledge; the want of any proved relation between his objective and subjective aspects of psychology; the implicit assumption at the outset of the perceptions of space, &c., when the attempt is being made to show how they have been gradually produced in the mind, by the action of the environment. Thus, too, in the *Sociology*, the ethnographical method is followed to the exclusion of the more scientific historical method; and in the *Data of Ethics*, the compromise between egoism and altruism is left wholly indeterminate. Besides the works already mentioned, S. is the author of a volume on *The Study of Sociology* (1872), and of a book on *Education* (1861). His occasional papers have been collected and published in four volumes of *Essays: Scientific, Political, and Speculative.*

The wide knowledge which all his writings display of physical science, and his constant endeavor to illustrate and support his system, by connecting its positions with scientific facts and laws, have given his philosophy great currency among men of science—more so, indeed, than among philosophical experts. At the same time, not only have the development and application he has given to the theory of evolution, profoundly influenced contemporary speculation, but he must also be regarded as one of the few in history who have carried out the attempt to give a systematic account of the universe in its totality. S. has founded a school of thought in America; and to it is due one of the best philosophical treatises adopting his principles—the *Outlines of Cosmic Philosophy*, by John Fiske.

SPENCER, JOHN CHARLES, EARL, English minister and statesman, son of the second earl, was born in 1782. The founder of the family of the Spencers was the Hon. John Spencer, youngest son of the third Earl of Sunderland by Anne, daughter and co-heiress of the great Duke of Marlborough, and who inherited much property from his grandmother, Sarah, Duchess of Marlborough. His only son was made Earl Spencer in 1765.—The second earl was First Lord of the Admiralty under Mr. Pitt's administration—1794 to 1801—the period of the great naval victories of Camperdown, Cape St. Vincent, and the Nile. He retired when Mr. Addington became premier, and became distinguished as a munificent collector of rare books. He was also first President of the Roxburghe Club for reprinting rare and curious tracts.—The third earl, the subject of this notice—better known under the courtesy title of Lord Althorp—was educated at Harrow School, and afterwards at Trinity College, Cambridge. He entered parliament in 1804 as member for Oakhampton. In 1806, his father took office as Secretary of State for the Home Department in the Grenville-Fox ministry, and S. became a junior Lord of the Treasury. He was returned for Northamptonshire, which he represented from 1806 until the period of the Reform Bill. In the Reformed parliament he sat for the southern division of the county. He went out with the Whigs in 1807, and during the long interval of their exclusion from office, steadily opposed the measures of the Tory government.

On the dissolution of the Wellington cabinet in November 1830, he was appointed Chancellor of the Exchequer and leader of the House of Commons in the celebrated Reform ministry of Earl Grey. The Reform Bill was introduced by Lord J. Russel (q. v.), but the task of carrying the bill mainly devolved upon Spencer. In 1833, he brought in and carried the ministerial Bill for reforming the Irish Church. In this memorable working session, the curious statistician discovered that S., who had, from his post of ministerial leader, naturally been the most frequent speaker, had addressed the House 1026 times, his speeches occupying 387 columns in the then *Mirror of Parliament*. In 1834, he introduced and obtained the assent of the legislature to the Poor-law Amendment Act. When the Irish Coercion Bill was under consideration in the cabinet, S. had opposed the clauses prohibiting public meetings, yet had given way rather than break up the ministry; but when the truth was elicited in debate by Mr. O'Connell, S. resigned. He was considered and described by Earl Grey as his 'right-hand man,' and without his assistance the earl felt himself unable to carry on the government. The administration of Viscount Melbourne succeeded (July 1834), in which S. consented to resume his office. In November he was called by the death of his father to the House of Peers, which had the effect of bringing the Melbourne (q. v.) administration to an end. When the attempt of Sir R. Peel to carry on the government failed, S. declined to take office again. He devoted his time to agricultural pursuits, became President of the Smithfield Cattle Club, and suggested the formation of the Royal Agricultural Society, of which he was elected President in 1838. He died at his seat, Wiseton Hall, Notts, October 1, 1845, without issue, and was succeeded by his brother. During his political career, his simplicity of character and integrity of purpose obtained for him the appellation of 'honest Lord Althorp.' He was very little of an orator, but he had a clear and practical intellect, and his influence over the Reformed House of Commons was supreme. Lord Brougham dedicated to him his work on *Natural Theology;* and his *Dialogues on Instinct* are also supposed to be carried on with S., to whose cultivation of philosophy in the midst of his political and agricultural pursuits, the author bears friendly testimony. See *Memoir* by Sir Denis Le Marchant, Bart. (London, 1876).

SPENCER GULF, a very large inlet on the coast of S. Australia (q. v.), between Eyria Peninsula on the W., and Yorke Peninsula on the E. It is about 209 m. in length, by 100 m. in greatest breadth.

SPENER, PHIL. JAK., an illustrious German reformer, and the founder of the sect known as *Pietists*, was born at Rappoltsweiler (Fr. Ribeauville) in Upper Alsace, January 25, 1635. His father was legal adviser to the Count von Rappoltsweiler. At an early age, S. showed deep religious susceptibilities. After studying the classics, at Colmar, he betook himself in 1651 to Strasburg, where the professors Dannhauer and Seb. Schmidt inspired him with a profound love of the Scriptures, not as a heap of dry theological bones, but as a fountain of life and spiritual thought. From 1659 to 1662, he attended the universities of Basel, Tübingen, Freiburg, Geneva, and Lyon. In the following year, he became a preacher at Strasburg, where the unction of his sermons exercised a powerful influence on his hearers. At the age of 31, he was transferred to Frankfürt as first pastor; and here, as elsewhere, the profound spiritualism of the man, springing out of a free simple *un*theological faith in the Bible, made itself apparent in his preaching and life. Yet S. was the very opposite of what is commonly called a *mystic*. The devotion which he sought to excite were not to show themselves in transcendental ecstacies, amid which common sense is apt to swoon away, but in acts of piety, humility,

and charity. The 'Sermon on the Mount' was the medium through which he gazed upon the 'truth as it is in Jesus.' He had a strong aversion to what goes by the name of theology, which he considered a hateful caricature of the free word of life; and he commenced in the year 1670, at his house, meetings for the cultivation of evangelical morality. These were the famous *collegia pietatis*, whose influence for good on the German character, in those days of stony and barren orthodoxy, cannot easily be overvalued. At the same time he took pains to reorganize the method of catechising, and to improve the religious instruction given to children.

His conduct in all this was marked by such prudence and discernment, that he long escaped the animadversions of the 'high and dry' Lutherans; but in 1679, a preface which he wrote for a new edition of the *Postille* of Arndt, in which he censured the morals of the upper classes, made him the target for their envenomed shafts; and after some years, he was fain to accept the invitation to become court-preacher at Dresden, and member of the Upper Consistory. In this capacity, he effected important ameliorations in the theological teaching of the university of Leipsic, and in the system of religious catechising practised throughout Saxony; but in 1689 he fell into disgrace for having addressed a temperate but energetic remonstrance to the elector Johann Georg III., on the subject of his personal vices, was attacked by Carpzow, who coveted his place at court, and by other orthodox theologians, and in 1691 went to Berlin as Provost of the Church of St. Nicholas, and consistorial inspector, offices which he retained to the end of his life. The Elector of Brandenburg encouraged his efforts after religious reform, and intrusted theological instruction in the new university of Halle to Franke, Breithaupt, and other disciples of S.—a matter that excited great irritation in the theological faculties of Wittenberg and Leipsic, which had formally censured as heretical no less than 264 propositions drawn from S.'s writings. S. died at Berlin, February 5, 1705, leaving behind him a reputation for piety, wisdom, and practical Christian energy, which all the excesses of the later pietists have not obscured. His writings are numerous; the chief are *Pia Desideria* (Frankf. 1675), *Das geistliche Priesterthum* (Frankf. 1677), *Christliche Leichenpredigten* (13 vols., Frankf. 1677), *Des thätigen Christenthums Nothwendigkeit* (Frankf. 1679), *Klagen über das verdorbene Christenthum* (Frankf. 1684), *Evangelische Glaubenslehre* (Frankf. 1688), and *Theologische Bedenken* (Halle. 5 vols., 1700—1721). See Hossbach's *Phil. Jak. S. und seiner Zeit* (2 vols., Berl. 1828); Thilo's *S. als Katechet* (Stutt. 1841); and Wildenhalm's *Phil. Jak. S.* (Leip. 1842—1847).

SPENSER, EDMUND, one of the chief literary ornaments of the great Elizabethan period, was born in London in the year 1553. There is some ground for supposing him to have been of good family connection; but inasmuch as of neither of his parents is any thing whatever known, the evidence of this is precarious. In 1569, he went to Pembroke Hall, Cambridge, in the humble capacity of sizar, in itself a sufficient proof that whatever his family, the gifts of fortune were deficient. At Cambridge, he remained several years, becoming Bachelor of Arts in 1572, and Master in 1576. After leaving college, he went to live with friends in the north of England. Of the detail of his life at this period, nothing is known further than that he busied himself with poetry, his first volume of which, *The Shephearde's Calendar*, was published in 1579. Its dedication to Sir Philip Sidney was the means of introducing him to that noble and kindly gentleman, who not only extended to him a generous patronage, but honored him with his warm friendship. He seems for some time to have been domesticated with Sir Philip at Leicester House, from which he dates his moiety of the *Foure Epistles*, exchanged between him and Gabriel Harvey, and printed in 1580. Towards the end of this year, through the influence of Sidney's uncle, the Earl of Leicester, an appointment was procured for him as secretary to Lord Grey of Wilton, the queen's deputy in Ireland, whither he at once proceeded. About this time it was that he commenced his great work, *The Faery Queen*. His official duties must have been punctually and ably performed, as in 1586 we find his services rewarded by a grant from the crown of Kilcolman in the county of Cork, an estate of upwards of 3000 acres, on which he now went to reside. Along with this piece of good fortune, came the evil news to him of the death of his friend Sidney at Zutphen, an event which he musically bewails in the elegy entitled *Astrophel*. Subsequently, the place of Sidney, as at once his patron and friend, was in a measure supplied by Sir Walter Raleigh, who visited him in Ireland in 1590, took him along with him to England, and introduced him to the notice of Queen Elizabeth.

His experiences as a suitor for court-favor seem not to have been specially of a pleasant kind, if we may judge from a passage in one of his works, in which a keen personal feeling of wrong and weary humiliation speaks out unmistakably. Documentary evidence exists, however, that a pension of £50 per annum was granted him by Queen Elizabeth; that it was ever paid, or paid with due punctuality, there seems considerable reason to doubt. That Elizabeth, along with her greater qualities, could exhibit on occasion an extreme meanness and stinginess, there is no reason to doubt whatever. What portion of S.'s after-life was passed in England, what in Ireland, we do not distinctly know. Nearly all we distinctly know of him henceforth is the date of his several publications. The first three books of *The Faery Queen*, issued on his arrival in England in 1590, were followed the year after by three more, and a collection of lesser pieces entitled *Complaints*, including *Mother Hubbard's Tale*, the *Tears of the Muses*, &c.; and in 1596, by four *Hymns*, so called, in which the Platonic doctrine of Beauty is elaborated in noble music. In 1596, he wrote his *View of Ireland*, a treatise full of sagacious observation and remark, which was only published long after in Dublin in 1633. Further than this, all record which survives to us of S. is summed in the facts, that in 1594 he was married to a woman whose very name has perished; that in 1598 he was made sheriff of Cork by the queen; and that in the course of the same year the deplorable calamity befell him, which shortly preceded, and, in part, may have caused his death. Tyrone's rebellion having broken out, his house at Kilcolman was sacked and burned by the rebels, he and his wife with difficulty escaping, whilst their youngest child perished in the flames. On January 15, 1599, his death took place in London. According to the account given by Ben Jonson to Drummond, he '*died for lake of bread.*' This is not likely to have been in the literal sense true, but it is scarce possible to evade the inference from it, as coming from one so likely to be well informed as Jonson, of a state of great wretchedness and destitution. He was buried by his own request near Chaucer in Westminster Abbey, at the expense of the Earl of Essex, who is said, in the account by Jonson, to have tendered him succor on his deathbed, though too late to be of any avail.

S. takes admitted rank as one of the very greatest of our poets; and his chief work, *The Faery Queen*, written in that stateliest of English measures, since known by the name of its inventor, tedious as it is in its allegory, and in much of its diction obsolete even when written, is a masterpiece of opulent genius. In the poetry of S., an ever-present seeking for and sense of beauty finds its fit expression and reflex in a fluent succession of sweet and various cadences; in breadth and splendor of pictorial effect, it has never, perhaps, been surpassed; such a lavish exuberance in detail as we find in it, has seldom been so combined with a total impression of chastened and majestic sobriety; and throughout it is pervaded by that atmosphere of moral wisdom and serenity which Milton reverently recognizes in 'the sage and serious Spenser.'—See *Spenser and his Poetry*, by Prof. G. L. Craik (3 vols. 1845). The most complete edition of the poet's works is that by Todd (Lond. 8 vols. 1806); but a new edition, with glossary, notes, and life, by Collier, was published in 1862. Church's short life of S. (1879) is admirable.

SPENSE'RIAN STA'NZA. See METRE.

SPERMACE'TI is a waxy matter obtained from a cavity in the head of the whale, *Physeter macrocephalus*. See CACHOLOT. It is separated from the oil, in which it is originally dissolved, by boiling water, from which the spermaceti crystallizes as it cools. It is then purified by being remelted in a weak solution of potash, and the impurities skimmed off, and it is finally melted again by the action of steam, and cooled slowly in moulds. Its specific gravity is 0·943; it is scarcely unctuous to the touch; does not melt under 100°, has little taste or odor, and occurs in pearly-white, glistening translucent crystals. It was generally regarded by chemists as a palmitate or cetylate of oxide of cetyl; but according to Heintz, who has studied the fats and their allies more, perhaps, than any other living chemist, it contains four alcohols (which act as bases), united with lauric, myristic, palmitic, and stearic acids.

Spermaceti is an emollient and demulcent, and is hence a useful ingredient in cough mixtures. It is, however, chiefly used externally as an ingredient in various ointments. The *Unguentum Cetacei*, or *Spermaceti Ointment*, of the Pharmacopœia consists of a mixture of spermaceti, white wax, and almond-oil.

SPERMATOZO'A is the term given to the true fertilizing agents occurring in the male generative organs. They appear to be formed from the epithelial lining of the tortuous seminal tubes, of which the organ known as the *testis* is essentially composed. At the period of puberty in man, and at certain periods annually in other animals, the seminal tubes are seen to be filled with cells, from which the spermatozoa are developed. Without describing the various changes that ensue, we may observe, that the spermatozoa are finally set free by the bursting of the cell-walls, and arrange themselves in parcels, symmetrically placed, with the so-called heads in one direction, and the tails in the opposite direction. In the human subject, the spermatozoa may be described as clear, hyaloid bodies, each of which consists of a dilated portion, the head or body, from which a long tail, or filament, issues. The head is flattened from side to side, and of a

conical form, the pointed extremity being anterior. The length of the spermatozoa is about $\frac{1}{800}$th of an inch. The spermatozoa of different animals vary extremely in size and form; and for a detailed account of these bodies, in different classes of animals, we must refer to the article 'Semen,' in the *Cyclopædia of Anatomy and Physiology*. It was formerly supposed that spermatozoa were independent organisms (like the infusoria, for example), but it is now known that they must be regarded as epithelial cells (or perhaps nuclei), modified in structure, and endowed with special properties. That the integrity of the spermatozoa is essential for the process of impregnation, is a fact that cannot be called in question; but of the nature of the force which they communicate to the ova, we know nothing.

SPEY, a river of Scotland, rises in the south of Inverness-shire, 6 miles north-west of Loch Laggan, and 10 miles east of Loch Lochy, follows a north-eastern direction through the counties of Inverness and Elgin, and, after a course of about 110 miles, falls into the Moray Firth, three miles west of Port-Gordon. During a portion of its lower course, it forms the boundary between the counties of Elgin and Banff. In point of length, the S. is the second river of Scotland; but except for its salmon-fisheries, it is almost without value, nor can it be called a picturesque stream. It has the swiftest current of all the large rivers in Britain, and is subject to sudden and violent freshets, resulting at times in disastrous inundations. Its salmon fisheries are very valuable.

SPEY'ER, also SPEIER (Fr. *Spires*), the capital of Rhenish Bavaria (the former Palatinate), and one of the oldest towns in Germany, stands at the influx of the Speyerbach into the Rhine, 14 miles south-west of Heidelberg, and 23 north of Carlsruhe. It is connected with Mannheim, and thence with the rest of Germany, by railway. The principal building is the cathedral (founded 1030), which contains the tombs of numerous emperors of Germany. Since 1856, it has been wholly renewed, and is the grandest specimen of Romanesque architecture in Europe. It has a hall of Roman antiquities discovered in the Palatinate, and is adorned with thirty magnificent frescoes by Schrandolph.

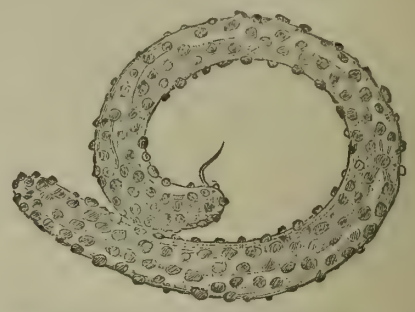
Except the cathedral and a ruined wall, the sole relic of the imperial palace in which twenty-nine diets were held—at one of which (1529) the Reformers made their famous 'protest,' and got for themselves the name of Protestants (see PROTESTANT)—S. does not contain a single ancient building. This is owing to the fact, that in the Orleans Succession War—well called by the Germans the *Mordbrenner Krieg*—during which the whole Palatinate was savagely wasted, S. was taken by the French, its inhabitants driven out, and the city blown up with gunpowder, and burned to the ground. Only the cathedral resisted the barbarous efforts to mine it. Everything else was reduced to rubbish, and for long years the noble old pile overlooked nothing but a melancholy waste of ruins. In 1794, it was wasted by the French under Custine, and has never recovered from these calamities. S. manufactures vinegar and tobacco, and has some transit-trade on the Rhine. Pop. (1880) 15,589, of whom about two-fifths are Catholics.

S. is the *Noviomagus* of the Romans, and was the capital city of the Nemetes, a German people. S. was probably the native name from the first, for in some of the later Roman notices it is called *Civitas Nemetum, id est Spira*. The name is derived from the stream, or *bach* (Speyerbach), which here flows into the Rhine. A Christian community appears to have been established here as early as 150—200 A.D., and it was certainly the seat of a bishop about 300 A.D. The German emperors had here a *pfalz* (palace, Lat. *palatium*, whence the former name of the region of which it was the capital, the Pfalz or Palatinate), in which they often resided. By them the town was made a Free City of the Empire; and having obtained the monopoly of the carrying-trade up and down the Rhine, it rapidly rose in wealth and importance. The *Reichskammergericht*, or Imperial Chamber of Justice, the highest court of the German Empire, was held here for 200 years, until removed to Wetzlar in 1689.

SPE'ZIA, a city of Northern Italy, province of Genoa, and 60 miles south-east of the city of that name. Pop. (1881) 19,864. It is situated near the inner point of the gulf of that name. The gulf is formed by the bifurcation of a spur of the Apennines, and is $3\frac{1}{2}$ miles long and 3 miles broad; its western shore is indented by many coves or creeks, five of which—Porto-Venere, La Castagna, the Varignano (the Quarantine station), Grazie, and Panigaglia—are so deep that large men-of-war may be moored in them. The Emperor Napoleon I. recognized the importance of this gulf, and at one time designed, it is said, to make it the chief naval station of his empire in the Mediterranean. The Italian government has made it the station for its ships of war, and it is now the chief arsenal of the kingdom. Its shipping and commerce is considerable. The scenery of the gulf is very beautiful, and the mildness of its climate was famous in ancient times, when it was known as the Gulf of Luna. The soil produces olives, excellent wines, fruits, &c., and the town has become within recent years a much frequented watering-place. There are numerous foreign consulates. Steamers perform the voyage from S. to Genoa in eight hours. The railway from Genoa to S. was completed in 1873.

SPE'ZZIA (the ancient *Tiparenos*), a small Greek island at the entrance to the Gulf of Nauplia. Pop. 12,000. The island is unfruitful, and its people are engaged chiefly in commercial pursuits. The town of S., on the north coast, has more than 6500 inhabitants.

SPHÆRULA'RIA, a very remarkable nematode, or round worm, which exists as a parasite in various species of bees. The female is almost an inch in length, has a nearly uniform diameter of $\frac{1}{15}$th of an inch, is of a whitish color, is bluntly pointed at each end, and is covered with numerous (about 800) small button-like projections—a peculiarity to which it owes its name. There is neither mouth, œsophagus, intestine, nor anus, and the whole animal consists of little more than an elongated mass of fatty tissue and reproductive organs, which in full-grown individuals con-



Sphærularia bombi; Male and Female:
Magnified 9 diameters. The male is seen as a thread-like appendage attached to the extremity of the female.—From Cobbold's *Entozoa*.

tain ova in various stages of development. Although the female was discovered in 1836 (by Leon Dufour), it was not until January 1861 that the discovery of the male was announced by Mr. Lubbock in his memoir on this parasite in *The Natural History Review*. The male is more than 28,000 times smaller than the female, which accounts for its having been previously overlooked. It is frequently found sexually united to the female in the same manner as occurs in *Sclerostoma syngamus* (q. v.), the parasite which gives rise to the *Gapes* in various birds.

SPHA'GNUM, a genus of Mosses, whose spore-case is an urn closed by a deciduous lid, and its brim toothless, the calyptra irregularly torn. Several species are natives of Britain, and are common in bogs, from which they derive their popular name, BOG MOSS. They are remarkable for the whitish color of their leaves. They are very elegant plants. They often grow in considerable masses, absorbing water like a sponge, but becoming friable when dry. They contribute much to the formation of peat. Gardeners employ them in preference to other mosses for covering the roots of plants and keeping them moist, as they have in a high degree the property of absorbing moisture from the atmosphere. They have been used as food in barbarous countries, but are very slightly nutritive. The cells of the leaves are remarkable for their spiral structure, and for large pores in their sides.

SPHE'GIDÆ, or SPHECIDÆ, a family of hymenopterous insects, winged in both sexes, and much resembling bees or wasps in general appearance. They are solitary in their habits. Many of them burrow in sand, and are known as *Sand wasps*. They are extremely active and restless, and may be seen running about on sandhills, with their wings in constant motion. Some of them carry spiders, and others caterpillars, into their burrows, as food for their larvæ, placing them there when the egg is laid, and stinging them so as to render them torpid, without killing them. They display wonderful energy and perseverance in dragging the spider or caterpillar to the burrow. They are mostly tropical insects, but some species are found in Britain.

SPHE'NOID BONE (Gr. *sphen*, a wedge, and *eidos*, form) is situated at the anterior part of the base of the skull, and articulated with all the other cranial bones, which it wedges firmly together. It somewhat resembles a bat with its wings extended, and hence was termed the *Os vespertilionis*. It is divisible into a body, the greater and lesser wings, and various processes. The greater wings present three surfaces: a superior or cerebral surface, forming part of the floor on which the brain rests; an anterior surface, which assists to form the outer part of the orbit of the eye; and an external surface with a rough ridge, giving attachment to the external pterygoid muscle, one of the most powerful muscles of mastication. The second, third, fourth, fifth, and

sixth cranial nerves emerge from the cranial cavity through foramina in this bone. Although considered in human anatomy as a single bone, it may be regarded as composed of several bones,

The Upper or Cerebral Surface of the Sphenoid Bone:

1, the olivary process; 2, the ethmoidal spore; 3 and 4, the lesser and greater wings on the left side; 6, the extremity of left pterygoid process; 7, the foramen for the optic nerve; 10, the sella turcica on which the petuitary gland rests; 12, the basilar portion of the bone, joining with the occipital; 13, part of the sphenoidal fissure which separates the greater from the lesser wings, and transmits the 3d, 4th, the ohpthalmic division of the 5th, and the 6th nerves, with the ophthalmic vein; 14, the foramen rotundum, transmitting the second division of the 5th nerve; 15, the foramen ovula, transmitting the third division of the 5th nerve; 16, the foramen sponosum for the passage of the middle meringeal artery.

which, after a time, unite with one another, as the basi-sphenoid, the pre-sphenoid, the ali-sphenoid, and the orbito-sphenoid bones.

SPHERE, a regular solid figure, every point of whose surface is equally distant from its center; and whose outline is traced by a circle revolving round its diameter. All sections of a sphere by a plane are necessarily circles, and all sections by planes passing through the center, or by planes cutting the sphere at equal distances from the center, are eqhal. The former sections are called *great*, and the latter *small, circles*. Small circles may vary in size between a mere point and a great circle, approaching either limit as nearly as we please. The surface of a sphere is equal to that of four of its great circles, or (taking x for the radius of the sphere) to $4\pi x^2$; and its volume to that of a cone whose altitude is twice that of the sphere, or $4x$, and whose base is a great circle of the sphere, the formula for it being $\frac{4x}{3} \times \pi x^2$, or $\frac{4}{3}\pi x^3$. The most remarkable geometrical property of the sphere is the relation which its surface and volume bear to those of the 'circumscribing' cylinder, i. e., a cylinder whose length and diameter of each end are each equal to the diameter of the sphere, and in which, therefore, the sphere will be exactly contained. The concave surface of such a cylinder is exactly equal to the surface of the sphere; and not only so, but if a section parallel to the base of the cylinder be made through both cylinder and sphere, the curved surfaces of the portions cut off are equal, whether such a portion be cut off from one end or be intercepted between two parallel sections; it follows from this that the curved surface of any section of a sphere with parallel ends is equal to the product of the circumference of a great circle of the sphere by the height or thickness of the section, and that the curved surfaces of all sections of a sphere are proportional to the thickness of such sections. The volume of the sphere, also, is equal to two-thirds of that of the circumscribing cylinder.

SPHE'ROGRAPH, a simple and exceedingly efficient instrument for the mechanical solution of such problems in spherical trigonometry as navigation, geography, &c. present, was invented in 1856 by Mr. Stephen Martin Saxby, R.N. It consists of two circular pieces of paper, the whole of the under and the rim of the upper being made of stout card-board, and the interior portion of the upper one of strong transparent tracing-paper; these two circles are attached by a pin through their common center, the pin being made to work in an ivory collar, so as to prevent any lateral motion of either circle. Round the pin as center, equal circles are drawn, one on each sheet; each circle is then filled in with lines representing meridians and parallels according to the stereographic projection, and the instrument is completed. As one of the chief uses of the spherograph is to show the course, distance, and differences of latitude and longitude in 'Great Circle Sailing' (q. v.), we shall give a problem of this sort in illustration of the working of the instrument. Fig. 1 represents the appearance presented by the spherograph when the two poles are separated from each other by an angular distance of 40°; the lines drawn on the under circle (represented by *dotted lines* in the fig.) showing through the transparent paper which forms the upper circle, on which the continuous lines are delineated.

Suppose, then, that a ship is in lat. 50° N., long. 20° W., and is bound for a point in lat. 10° N. and long. 80° W., and that its great circle track, &c., are required: let P, the pole of the under circle, represent the place of the ship (the circle ZPD always representing the meridian of the point of departure, and the upper circle, whose pole is Z, representing the earth's hemisphere), which is done by turning the upper circle till P appears at lat. 50° N.; X represents the point to be arrived at, and consequently PX, the arc of a great circle passing through P and X, is the great

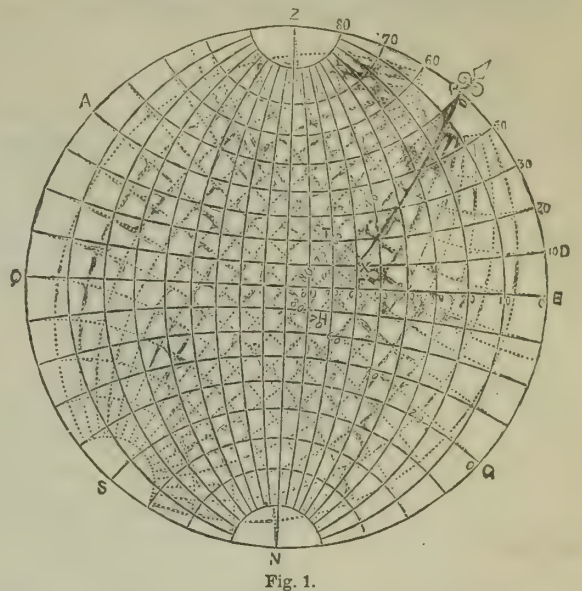


Fig. 1.

circle track, PD is the difference of latitude, EF the difference of longitude; the spherical angle XPD, measured by GH, an arc of a great circle, of which P is the pole, is the course; and the length of PX is measured by PT, the portion of PS which is cut off by a parallel of the under circle through X, in degrees. The data, then, being as above, we find by inspection of the instrument the difference of lat. = 40° S., the difference of long. = 60° W., the course = S. 72½° W., and the distance = 63½° = 3800 nautical miles. Besides the saving of time and labor by the use of this instrument—the whole work being the *setting* of the instrument, and then the reading off of the required elements—it is evident that the substitution of a mechanical solution for calculation greatly lessens the probability of error. It is found that spherographs of 5 inches radius give results of sufficient accuracy for all the purposes of the navigator.

All other spherical problems can be solved with equal facility by this instrument, but one more example will suffice. Let Z (fig. 2) now represent the zenith of a place, ZHNR its meridian,

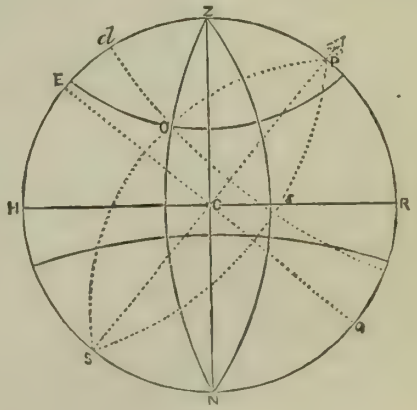


Fig. 2.

P the north pole of the heavens; the other lines are then circles of declination, altitude, azimuth, and hour circles; and let O represent the place of the sun in given declination and altitude at a certain time. The instrument is now set by turning round the upper card till the point O (determined by its circle of declination and hour circle) on the under card falls upon the circle of given altitude on the upper card; then d is the sun's place at noon, Hd being his meridian altitude, PR the latitude of the place, the angle RPS (measured in degrees along QE) the time of sunset, ds half the length of the day, sc half the length of the night, &c. The spherograph is also useful in finding latitude when the horizon is hid by fogs, right ascensions at night, and in correcting lunar observations; but for these purposes, spherographs are specially

constructed, as some slight variations in the form given above are necessary.

SPHE'ROID is a species of Ellipsoid (q. v.), and is represented by the same equation. If an ellipse be made to revolve round one of its axes, the curved outline of the ellipse describes the spheroid. Should the major or longer axis be the axis of revolution, the spheroid is said to be *prolate* (Lat. *prolatus*, lengthened), but if the minor or shorter axis, *oblate*. The earth's axis of revolution, which runs from pole to pole, being about 25 miles shorter than the longest or equatorial diameter, and these being at right angles to each other, the earth is considered as an oblate spheroid.

SPHEROI'DAL CONDITION of liquids is the name usually given to a series of very singular phenomena discovered by Leidenfrost, but first carefully investigated by Boutigny. Indeed, one at least, of these phenomena has been popularly known for a very long time, being the foundation of the rough practical method of determining whether or not a flat-iron is so hot as to be likely to singe the linen to which it is to be applied. The test consists simply in letting a drop of water fall upon the iron; if it be not too hot, the drop spreads over the surface and evaporates. If it be too hot, the drop at once glances off the iron without wetting it.

The common experimental method of exhibiting the spheroidal condition is easily performed thus: A metallic disc, slightly concave, like a watch-glass, is heated by a lamp, and water is cautiously dropped on it from a pipette. If this be done before the disc is sufficiently heated, the water boils almost explosively, and is dispersed at once in vapor. But, when the disc is hot enough, the water remains suspended, as shown in the cut, *above* the surface; and the drop, when small, takes nearly the form of an oblate spheroid. Various proofs have been given, though they are obviously unnecessary, that there is no contact in this case. Thus, if the disc be very nearly flat, light passes freely between it and the drop. Again, if one pole of a galvanic battery be connected with the disc, and the other be dipped into the drop, a galvanometer interposed in the circuit shows that no current passes. By heating the disc sufficiently, and dropping on the water very carefully, we may easily keep in the spheroidal state as much water as, if not more than, it could hold when cold. The explanation of the phenomenon is not yet quite clear; but there is no doubt that the radiant heat from the disc raises vapor so freely from the surface of the drop nearest it, as to interpose a cushion of dense and highly-heated vapor between them, on which the drop, as it were floats; the pressure of the vapor balancing its weight. This is not, however, a quite complete explanation of the experiment, and it would require too much detail to examine it more closely. But the most curious fact connected with the experiment is, that the water does *not* boil. In fact it evaporates so freely that the heat carried off from it, as latent heat, by the vapor which is constantly formed, keeps its temperature somewhere about 206° F. only. This suggests a curious experiment, which is found to succeed. *Boiling* water, dropped on a red-hot plate of metal, instantly assumes the spheroidal state, and is *cooled* six degrees below boiling.

It is not necessary that a metal plate be used—a watch-glass will suffice for the experiment; but *hot* water must be dropped on it, else the glass will crack.

Other liquids, and even some bodies which are solid at ordinary temperatures, can be easily brought into the spheroidal state—the lowest requisite temperature of the disc being dependent on the boiling point of the substance. Thus, while water has a temperature of 206° F. in the spheroidal state, the disc must have a temperature of 340° F. at least—for alcohol, these temperatures are 168° F. and 270° F.—for ether, 94° F. and 140° F. A good example of a solid entering this state is furnished by dropping crystals of iodine on a hot platinum disc.

It is not necessary that the disc should be solid; it is easy to obtain ether, and even water, in the spheroidal state over the surface of hot oil—but great care is required, as explosions are apt to occur, in which case the hot oil is freely thrown about.

Many cases of bursting of steam-boilers, otherwise apparently inexplicable, seem to be attributable to this condition of matter. Thus, if we suppose that the water-supply has run low, and the boiler has been overheated, it is conceivable that the contents may sometimes be in the spheroidal state. The addition of cold water, in such a case, would bring them suddenly *in contact with* the overheated metal, and large quantities of steam would be generated with violence.

A very singular experiment, the freezing of water on a red-hot plate is easily performed by the help of this property of matter. Liquid sulphurous acid is so volatile as to have a temperature of 13° F. only, when in the spheroidal condition. As this is 19 under the freezing-point of water, if a little water be dropped into the spheroid of acid, it is at once frozen, and the pellet of ice can be dropped on the hand from the still red-hot plate.

Even mercury can be frozen by a similar process, but as much greater cold is required, the substance in the spheroidal state is a mixture of solid carbonic acid and ether.

The hand may be dipped for a short time with impunity into melted lead, and even into melted copper. The vapor, instantly raised from the moisture of the skin, prevents, so long as that moisture lasts, more than an endurable amount of radiant heat from reaching the hand, and also prevents direct contact. It is probable that a knowledge of some forms of this phenomenon, in old days, was employed by priestcraft for the purpose of protecting, when it was desirable to do so, the victims of the Ordeal (q. v.) by fire.

The phenomenon may easily be reversed. Thus, a red-hot silver ball, dropped into a vessel of water, is seen to glow for some time, till it has so far cooled, that the water comes into contact with it, when we have, as in the other form of the experiment, an immediate and violent formation of vapor. The success of this experiment is greatly aided by the addition of some strong ammonia to the water.

SPHI'NCTER MUSCLES (Gr. *sphinkter*, that which binds tight) are circular bands of muscular fibres, whose function is to antagonize the expellent action of certain viscera, especially the bladder and the lower part of the intestinal canal. It is to the presence of these muscles that the higher animals owe the power of retaining for a considerable period the excrementitious matters collected in the bladder and rectum, and of discharging them at intervals, the sphincter muscles being like those engaged in the process of respiration, mainly, but not entirely under the control of the will. Under certain conditions, however, the necessity for expelling the contents of these viscera becomes so urgent that the sphincters lose their ordinary voluntary power.

SPHINX, a Greek word, signifying the Squeezer or Strangler, applied to certain symbolical forms of Egyptian origin, having the body of a lion, a human or an animal head, and two wings attached to the sides. Various other combinations of animal forms have been called by this name, although they are rather griffins or chimæras. Human-headed Sphinxes have been called androsphinxes; one with the head of a ram, a criosphinx; with a hawk's head, a hieracosphinx. The form, when complete, had wings added at the sides; but these are of a later period, and seem to have originated with the Babylonians or Assyrians. In the Egyptian hieroglyphs, the Sphinx bears the name of *Neb*, or Lord, and *Akar*, or Intelligence, corresponding to the account of Clemens, that these emblematic figures depicted intellect and force. The idea that they allegorized the overflow of the Nile when the sun was in the constellations Leo and Virgo, appears quite unfounded. In Egypt, the Sphinx also appears as the symbolical form of the monarch considered as a conqueror, the head of the reigning king being placed upon a lion's body, the face bearded, and the usual dress-drapery being suspended before it. Thus used, the Sphinx was generally male, but in the case of female rulers, the figure has a female head, and the body of a lioness.

The most remarkable Sphinx is the Great Sphinx at Gizeh, a colossal form, hewn out of the natural rock, and lying 300 feet

View of the Great Sphinx during the excavations of Caviglia, 1816.
From Colonel Vyse's *Pyramids of Gizeh*.

east of the second pyramid. It is sculptured out of a spur of the rock itself, to which masonry has been added in certain places, to complete the form, and measures 172 feet 6 inches long by 56 feet high.

Immediately in front of the breast, Caviglia found, in 1816, a small naos, or chapel, formed of three hieroglyphical tablets, dedicated by the monarchs Thothmes III. and Ramesses II. to the

Sphinx, whom they adore under the name of Haremakhu, or Harmachis, as the Greek inscriptions found at the same place call it —i. e., the Sun on the Horizon. These tablets formed three walls of the chapel; the fourth, in front, had a door in the center, and two couchant lions placed upon it. A small lion was found on the pavement, and an altar between its fore-paws, apparently for sacrifices offered to it in the time of the Romans. Before the altar was a paved esplanade or dromos, leading to a staircase of thirty steps placed between two walls, and repaired in the reigns of M. Aurelius and L. Verus, on the 10th May 166 A.D. In the reign of Severus and his sons, 199—200 A.D., another dromos, in the same line as the first, and a diverging staircase, were made, while some additions were found to have been made to the parts between the two staircases in the reign of Nero. Votive inscriptions of the Roman period, some as late as the 3d c., were discovered in the walls and constructions. On the second digit of the left claw of the Sphinx, an inscription, in pentameter Greek verses, by Arrian, probably of the time of Severus, was discovered. Another metrical and prosaic inscription was also found. In addition to these walls of unburnt brick, galleries and shafts were found in the rear of the Sphinx, extending northwards. The excavations, however, of M. Mariette, in 1852, have thrown further light on the Sphinx, discovering the peribolos, or outer wall that encircled it; that the head only was sculptured; and that the sand which had accumulated round it was brought by the hands of man, and not an encroachment of the desert; also that the masonry of the belly was supported by a kind of abutment. To the south of the Sphinx, Mariette found a dromos, which led to a temple built, at the time of the fourth dynasty, of huge blocks of alabaster and red granite. In the midst of the great chamber of this temple were found seven statues, five mutilated and two entire, of the monarch Shaf-ra or Cephren, made of a porphyritic granite. They are fine examples of ancient Egyptian art. While the beauty and grandeur of the Great Sphinx have often attracted the admiration of travelers, its age has always remained a subject of doubt; but these later discoveries prove it to have been a monument of the age of the 4th dynasty, or contemporary with the pyramids.

Besides the Great Sphinx, avenues of Sphinxes have been discovered at Saqqarah, forming a dromos to the Serapeium of Memphis, and another dromos of the same at the Wady Esseboua. A Sphinx of the age of the Shepherd dynasty has been found at Tanis, and another of the same age is in the Louvre; and a granite Sphinx, found behind the vocal Memnon, and inscribed with the name of Amenophis III., is at St. Petersburg. An avenue of criosphinxes has been found at Karnak. These are each about seventeen feet long, and of the age of Horus, one of the last monarchs of the 18th dynasty. Various small sphinxes are in the different collections of Europe, but none of any very great antiquity.

The Theban Sphinx, whose myth first appears in Hesiod, is described as having a lion's body, female head, bird's wings, and serpent's tail, ideas probably derived from Phœnician sources, which had adopted this symbolical form into the mythology from Egypt. She was said to be the issue of Orthos, the two-headed dog of Geryon, by Chimæra, or of Typhon and Echidna, and was sent into the vicinity of Thebes by Juno, to punish the transgression of Laius, or, according to other accounts, by Bacchus, Mars, or Pluto. See ŒDIPUS. The Sphinx was a favorite subject of ancient art, and appears in bas-reliefs, on medals of Chios and other towns, and often as the decorations of arms and furniture. In Assyria and Babylonia, representations of Sphinxes have been found, and the same are not uncommon on Phœnician works of art.

Birch, *Mus. of Classic Antiquit.* ii. p. 27; *Quart. Rev.*, xix. p. 412; Vyse, *Pyramids*, iii. p. 107; Young, *Hieroglyphicks*, Pl. 80; Letronne, *Inscr. Grecq.*, ii. p. 460; *Rev. Arch.*, 1853, p. 715; 1860, p. 20; *Schol. Euripid.*, i. 1, 1134; Hesiod, *Theog.*, 326; Creuzer, *Symbolik*, i. 495; Millin, *Gal. Myth.*, 502, 505.

SPHINX. See HAWK-MOTH.

SPHY'GMOGRAPH, an instrument by which we ascertain, and permanently record, the form, force, and frequency of the pulse-beat, and the changes which that beat undergoes in certain morbid states. This instrument consists of two essential parts: (1) Of two levers, one of which is so delicately adjusted on the vessel the pulsation of which it is desired to examine, that on each expansion of the vessel the lever undergoes a corresponding slight elevation: this lever communicates by a perpendicular arm with a second, to which it transmits the impulse received from the vessel; the extremity of this second lever is armed with a pen-point, which records the movements thus indicated on a movable plate, controlled by the second part of the instrument. (2) The second portion consists of a plate, moved by watch-work, and bearing a strip of paper on which the *sphygmographic* tracery is formed.

Mode in which the Tracery is formed.—As the pulse transmits through the levers a vertical movement to the pen-point, and the plate, on which the tracery is formed, is moved steadily across the pen-point, an undulating line (fig. 1) is the result: the *height*

Fig. 1.

of the elevations indicating the strength of the pulse; and the *number* of the elevations delineated in the time the pen takes to travel, its frequency. Figs. 1, 2, and 3 are fac-similes of sphygmographic tracings: of these, fig. 1 is the tracing presented by a natural pulse; figs. 2 and 3 are morbid. The latter are excellent examples of the tracings produced by the pulse at the wrist in two common forms of cardiac disease, and exhibit the manner in which the tracing is modified in diseased states of the circulatory system. Fig. 2 represents the pulse of a patient suffering from

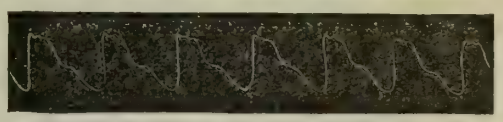


Fig. 2.

an incompetent state of the valves guarding the orifice of the aorta, the great vessel conveying blood from the heart. The blood, in such a case, when propelled into the aorta, distends it, and communicates a pulse throughout the arterial system. When the vessel again contracts, regurgitation takes place into the cavity of the heart, as the valves, which should prevent this regurgitation, and maintain the arterial tension, are unable to perform their function. The pulse-beat is accordingly abrupt, and of short duration, and the sphygmographic tracing presents a series of abrupt elevations and depressions. Fig. 3 represents the pulse met with in a differ-

Fig. 3.

ent form of cardiac disease, in which the valves are so affected as to obstruct the passage of the blood into the circulation: the effect of this on the pulse is to render its beats weakly marked and irregular; and in the sphygmographic tracing, the elevations are diminished in height and regularity. The pulse, in extreme forms of this lesion, is represented in sphygmographic tracing by a slightly waving line.

SPHYRÆ'NIDÆ, a family of fishes included by Cuvier in *Percidæ*, but having the ventral fins far behind the pectorals, and the bones of the pelvis quite detached from those of the shoulder. The form is elongated; there are two dorsal fins; the scales are small and cycloid; the mouth very large, with strong sharp teeth. The species are found in the Mediterranean and in tropical seas. Some attain a large size, as the BARRACOUDA, or Barracouda Pike (*Sphyræna barracouda*), an inhabitant of the tropical parts of the Atlantic Ocean, which is scarcely less formidable than the White Shark It is, however, held in considerable estimation as an article of food, but at some seasons of the year becomes unwholesome. It is a beautiful fish, of a rich green color above, and white beneath. The BECUNA (*S. vulgaris*) is also valued as an article of food, and its scales and air-bladder yield a substance used for making artificial pearls.

SPICCA'TO (Ital. separated), a musical term, indicative, like *Staccato* (q. v.), of a distinct and detached mode of performance. Its usual application is to music for bowed instruments, where it implies that each note is to have a bow distinct from that which precedes or follows it.

SPICE ISLANDS. See MOLUCCAS.

SPICES (Lat. *species*, kinds; in later Latin, kinds of goods, or produce in general; and then, the most highly prized kind of goods, the aromatic productions of the East), aromatic and pungent vegetable substances, used as condiments and for flavoring food. They are almost exclusively the productions of tropical countries. In ancient times, and throughout the middle ages, all the spices known in Europe were brought from the east; and Arabia was regarded as the land of spices, but rather because they came through it, or were brought by its merchants, than because they were produced in it, for they were really derived from the further east. They owe their aroma and pungency chiefly to essential oils which they contain. They are yielded by different parts of plants; some, as pepper, cayenne pepper, pimento, nut-

meg, mace, and vanilla being the fruit or particular parts of the fruit; whilst some, as ginger, are the root-stock; and others, as cinnamon and cassia, are the bark. Tropical America produces some of the spices, being the native region of cayenne pepper, pimento, and vanilla; but the greater number are from the East Indies.

SPIDER (*Aranea*), a Linnæan genus, now divided not only into many genera, but into many families, and constituting a section (*Araneida*) of the class *Arachnida*, and order *Pulmonaria*. The species are very numerous, and are found in all parts of the world, but most abundantly in tropical countries, which also produce the largest species, some of them capable of making very small birds, and not merely insects, their prey (see BIRD-CATCHING SPIDER). The *cephalothorax*, formed by the combination of the head and thorax into one piece, is covered with a kind of horny buckler, generally of an oval form; the abdomen is at-

Position of Spider when attached to a thread of web, and spinning apparatus highly magnified.

tached to it by a short stalk, and is generally soft and tumid. Each of the eight legs consists of seven joints, the last armed with two hooks, which are commonly toothed like a comb. The *frontal claws*, commonly called *mandibles*—which do not, however, correspond to the mandibles of insects, and move in an entirely different direction, up and down—are terminated by a sharp movable hook, which has near its extremity a small slit for the emission of a venomous fluid secreted in a gland of the previous joint. The *maxillæ* are two in number, and between them is an organ called the *tongue*, forming part of the external apparatus of the mouth. The maxillæ are the basil joints of the *palpi*, which resemble very small legs, and are often terminated in the females by a small hook, but in the males by complicated and curious appendages, characteristic of the different genera and species. Spiders have generally eight eyes, the relative position of which varies remarkably in the different families and genera. A few species have only six eyes, and a very small number have only two. The upper surface of the abdomen generally exhibits a number of impressed spots, most conspicuous in those kinds which have a smooth naked skin. The pulmonary orifices are either two or four in number, and are situated near the base of the abdomen. Near the anus are several *spinnerets*, small protuberances, pierced at the extremity with a multitude of minute orifices, from which threads of extreme tenuity are produced, all these threads combining to form one thread of the *web*.

The substance which exudes from the spinnerets is glutinous, and immediately dries into thread on coming in contact with the air. It is elaborated in reservoirs, which terminate in intestine-like tubes. All spiders have spinnerets, and produce threads although all do not use them for the same purposes; for they differ very much in their habits: some employ their webs in order to catch their insect prey, whilst others depend for the capture of their prey on their powers of running and leaping; and some weave for themselves habitations, in which they live, whilst others select holes and crevices as their place of abode. Almost all spiders envelop their eggs in silken cocoons, which some of them tear open when the young are hatched; they are attentive to their young, some carrying them for a time on their back, whilst some carry the cocoons or egg-cases beneath their breast, and others carry them attached to the extremity of the abdomen. Nearly 2000 eggs have been found in a single cocoon, and the young, when set free, may be seen swarming over the body of the mother, so as almost to conceal her from view. The female S. is, in many of the species, much larger than the male, and a very remarkable danger attends the amatory approaches of the latter, as, if they are not favorably received, he is not uncommonly killed and eaten on the spot. Spiders are very pugnacious, and in their combats often sustain the loss of limbs; but like crustaceans, they possess the power of repairing this loss. Like them also, they change their skin frequently during their growth; but they undergo no proper transformation. There is much similarity of form among all the multitude of kinds. Many of them exhibit very brilliant and beautiful colors, among which are some of the British species, to be found in fields and moors, although the Common House S. (*Aranea domestica*) is of very unattractive appearance.

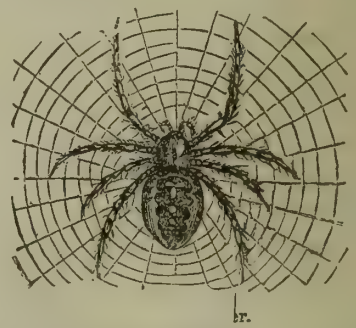
All spiders kill the insects and other small creatures on which they prey by means of their venomous mandibles, and the bite of a house S. is quickly fatal to a house-fly. The bite of the larger species is dreaded even by man, being very painful, and not only producing much inflammation and swelling, but often much fever. Death has been known to ensue.

Spider's webs have long been in high repute for stanching wounds. Threads of this material are also employed for the cross-wires of astronomical telescopes. Textile fabrics have been made of it, but only as articles of curiosity.

Spiders have been arranged by Walcknaer in five principal groups, distinguished by their habits. (1.) *Hunting Spiders*, which incessantly run about in the vicinity of their abode in quest of prey, some of them weaving silken tubes, in which they dwell, others hiding in fissures; some remarkable for the swiftness with which they run, others for their power of leaping in order to seize their prey. Some of them are of large size. Livingstone mentions a South African one which can leap a distance of one foot. A small one is common on windows in Britain in summer, and, when leaping, avoids the danger of falling from the window by suspending itself at the same moment by a thread. (2.) *Wandering Spiders*, which have no fixed residence, have the power of

Various species of Spiders.

running sideways or backwards, and throw out threads to entrap prey, but do not weave them into regular webs. Some of them live among plants, and place their egg-cases on leaves, the edges of which they bind together with their silk. (3.) *Prowling Spi-*



Geometric Spider.

ders, which have nests, but prowl about in their neighborhood, or in that of the threads which they spread to catch prey.

(4.) *Sedentary Spiders*, such as the common house S., which spin large webs, and lie in wait at the middle or at the side. These are subdivided according to the fashion and structure of their webs. (5.) *Water Spiders*, which resemble the last group in their habits, except that they live in water, generally among the stems and leaves of aquatic plants, where they construct their webs. A very interesting species, one of the most interesting possible inmates of an aquarium, is the Common Water S. (*Argyroneta aquatica*) of Britain, not unfrequently to be found in deep ditches and ponds in some parts of England. It is of a brownish color, densely covered with hairs, which are of great importance in its economy, entangling air, which the animal carries down with it into the water, to supply its pulmonary sacs; for the water spiders all breathe by the same kind of organs as their terrestial congeners. The eggs of the water S. are attached to the leaves or stems of plants under the surface of the water, and are protected by a dome-shaped web, so close in its structure as to retain the air which is brought into it, and in which the S. itself lives, bringing down air on its furred body till the dome is filled. The entrance

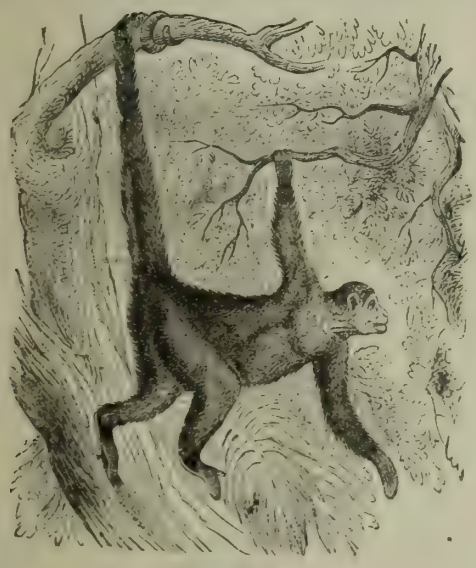
is from below.—The most curious nests are those of the Trap-door Spiders, belonging to the group *Territelariæ*, or underground weavers. The nest is a tubular burrow, lined with silk, and having the entrance covered with a circular lid of the same material attached to the edge of the lining by a kind of hinge. In the most common form of nest, the lid is made thick by having layers

Trap-door, open

of earth between the layers of silk, and fits like a cork into the mouth of the tube, which is bevelled to receive it. As mosses grow on the lid as well as on the surrounding ground, the concealment is complete. In some types of nest, there is a thin external door, and then one of a more solid kind some inches below, behind which the inmate can place itself, and resist the intrusion of an enemy. In one kind of these double-door nests, a side-gallery branches off from the main one, and the external door is so placed at the angle, that it can be made to shut either.

SPIDER FLY (*Ornithomyia*), a genus of dipterous insects, closely allied to the Forest Fly (q. v.), but the claws of the tarsi having three instead of two teeth; and the species are parasitical on birds, never on quadrupeds. *O. avicularia* frequently infests the common fowl, the blackcock, and other birds in Britain. It is greenish-yellow, with smoke-colored wings.

SPIDER MONKEY, a name often given to species of the genus *Ateles*, small American monkeys, on account of their very long, slender, inelegant limbs. The tail is very long, and not only prehensile in the highest degree, but endowed with a wondrous sensitiveness of touch. These monkeys display great intelligence. It is their common practice to break nuts by means



Spider Monkey.

of stones; and a tame one which Dr. Gardner carried with him in his travels in Brazil, used to try a larger stone, if the first did not serve its purpose, and even to take it up in both paws, and dash it upon the nut, jumping quickly out of the way to avoid injury to its own toes. This animal generally rode on the back of a large mastiff, and in descending a steep hill, would curl its tail round the root of the mastiff's tail, to make its seat secure.

SPIEGELEISEN. See BESSEMER PROCESS; also KRUPP'S STEEL.

SPIGE'LIA, a genus of plants of the natural order *Loganiaceæ*, having a calyx glandular inside, a long slender valvate corolla, long filaments, and a capsule of two *cocci*, splitting around at the base.—*S. Marilandica*, often called WORM GRASS and CAROLINA PINK, is a native of the southern United States, a perennial plant with a simple quadrangular stem. The root (PINK ROOT) is purgative, narcotic, and poisonous, but is a powerful vermifuge, and is very commonly employed in the U. S.—*S. Anthelmia*, an annual, native of tropical America, with very small purplish flowers, in spike-like racemes, possesses similar properties. The efficacy of both is, however, impaired by keeping; and they are apt to produce unpleasant symptoms when used as medicines. Other species are also known as poisons.

SPIKE, in Botany, that kind of inflorescence in which sessile flowers, or flowers having very short stalks, are arranged around an axis, as in the greater plantain, common vervain, common lavender, and some species of sedge. In rye, wheat, barley, darnel, and many other grasses, there is a sort of compound spike, that is, the flowers or fruits are arranged together in spikelets, upon short stalks, which again surround the top of the culm in the form of a spike. The catkin, the spadix, and the cone may be regarded as varieties of the spike.

SPI'KENARD, or NARD (Gr. *Nardos*), a perfume highly prized by the ancients, and used both in baths and at feasts. It was brought from India, and was very costly. The 'ointment of spikenard' (John xii. 3) was probably an oil or fat, impregnated with the perfume. The plant which produces it has been ascertained by the researches of Sir William Jones and Dr. Royle to be the *Nardostachys jatamansi*, the Jatamansi of the Hindus, a small plant of the natural order *Valerianaceæ*, a native of the mountains of the north of India, and found at least as far south as the Deccan. It grows on the Himalaya to an elevation of 18,000 feet, and its roots are a favorite perfume in Tibet and Nepaul. The ladies of Nepaul use oil in which the root has been steeped for perfuming their hair. The odor is not, however, generally agreeable to Europeans. The root, which is from three to twelve inches long, sends up many stems, with little spikes of purple flowers, which have four stamens.—The name spikenard was given by the ancients to perfumes used as substitutes for the true or Indian spikenard, some of which were derived from the roots of plants of the same natural order, the kind called Gallic or Celtic spikenard from those of *Valeriana Celtica* and *V. saliunca*, which are still used in the East for perfuming baths; and that called Cretan spikenard from those of *V. Italica*, *V. tuberosa*, and *V. phu*. All of these grow on the Alps and other mountains of the south of Europe, and the peasantry of Styria and Carinthia collect them from rocks on the borders of perpetual snow. They are tied in bundles, and sold at a very low price to merchants, who sell them at a great profit in Turkey and Egypt, from which they are partly transmitted even to India. About sixty tons are annually exported from Trieste.

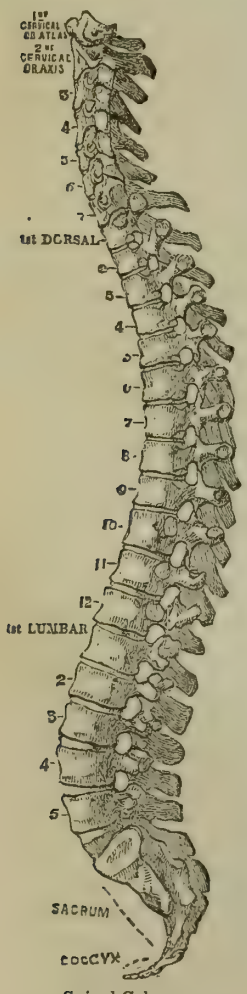
SPIKING is the operation of rendering a cannon useless without the expenditure of much time and labor. It is resorted to by troops compelled to abandon their own ordnance, or unable to remove pieces of the enemy's which they have captured. The process consists in driving a nail or spike into the vent or touchhole. To remove it, it is recommended, if an iron gun, to load with double charge and double balls, and to fire by a train laid through the muzzle. This is supposed to loosen the spike. If the gun be of brass, a few drops of sulphuric or nitric acid on the touchhole will render it practicable to extract the spike. If these methods fail, nothing remains but the tedious process of drilling out the spike or boring a new vent.

SPI'NA BI'FIDA is a congenital malformation, occurring perhaps more frequently than any other except hair-lip, and arising like it from arrest of development. It may be regarded as a congenital hernia of the membranes of the spinal cord, through a fissure in the wall of the bony canal. A tumor is thus formed, which is usually of a roundish shape, varying in size from that of an egg to that of an adult head, lying in the middle line of the back, fluctuating, and adhering to the adjacent vertebræ either directly or by a pedicle. The usual termination of the disease is death. As the size of the tumor increases, fatal convulsions ensue; or the skin investing the tumor may ulcerate, and the contents escape, in which case palsy or convulsions produce death. Occasional cases are, however, recorded in which patients with this affection have survived till middle life. Active surgical treatment usually hastens death, and should only be resorted to in the most urgent circumstances. Moderate support by means of a hallow truss, or a well-padded concave shield, may tend to keep the disease stationary; and any interference beyond this is, in the great majority of cases, unadvisable.

SPI'NACH, or SPINAGE (*Spinacia*), a genus of herbaceous plants, of the natural order *Chenopodiaceæ;* dicœcious, the male flowers consisting of a 4-parted perianth and four stamens; the female, of a 2—3-cleft perianth, and a germen with four styles; the perianth hardening around the fruit as it ripens; the fruit an achenium. COMMON S., or GARDEN S. (*S. oleracea*), is in general cultivation for the sake of its young leaves, which are a favorite and wholesome vegetable, either prepared by boiling, or by frying with a little butter. Two very distinct varieties are cultivated.—PRICKLY S., which has the leaves somewhat triangular and

arrow-headed, and the fruit rough with prickle-like projections; and SMOOTH S., or ROUND S. (*S. glabra* of some botanists), with the leaves more round and blunt, and the fruit smooth. S. is an annual. Its stem rises to the height of from two to four feet; the male flowers are in long spikes, the female in clusters close to the stem. After the stem begins to be developed, the leaves become bitter, and unfit for use. This bitterness appears also at an earlier period in dry weather, or in poor soil; and the more luxuriantly that S. grows, the better it is. It is sown in spring, and is ready for use in a very short time; or it is sown in autumn, thinned out, and used early in spring. The Smooth S. is very generally preferred for the former purpose, and the prickly kind for the latter; but a somewhat intermediate variety, called Flanders S., is now often used for both, being particularly esteemed for the large size of its leaves. The native country of S. is not well known, but it is believed to be in some part of Asia, as the plant was introduced by the Arabs into Spain, and thence diffused over Europe.—Another species (*S. tetrandra*) is cultivated, and much esteemed, in India.—The name S. is also given to a number of other plants of very different botanical characters, but which have the same bland and nutritious qualities, and are used in the same way.—NEW ZEALAND S. is *Tetragonia expansa*, a plant of the natural order *Mesembryaceæ*, sub order *Tetragonieæ* (nat. ord. *Tetragoniaceæ* of Lindley), a trailing, succulent annual, spreading widely over the surface of the ground, and producing a great abundance of stalked ovate-rhomboid leaves. The young stems and leaves of this plant are much used in New Zealand, and have now come into very general use also in other parts of the world, as a kind of spinach. It is cultivated in the middle and south of Europe and in Britain, succeeding well even in Scotland with the slightest aid of a hotbed in spring.—PATIENCE DOCK, or GARDEN PATIENCE (*Rumex Patientia;* see DOCK), is called in Germany ENGLISH S., and was formerly much cultivated in England, but is now neglected.

SPINAL COLUMN, or SPINE, THE, is the most important and characteristic part of the skeleton of the highest animal subkingdom, which includes Mammals, Birds, Reptiles, Amphibians, and Fishes. In each of these classes, it is composed of a series of bones placed one above, or in front, of another, and called Vertebræ (q. v.); and hence, these animals, having this distinguishing characteristic in common, are all included in the term *Vertebrates*. The vertebræ vary greatly in number in different animals, and even in members of the same class, and the number have no apparent relation to the other organs of the animal. Moreover, in their shape, they differ extremely even in different parts of the same spine, in accordance with their special functions. In man, the number of vertebræ which collectively form the spinal column is 7 in the neck (cervical vertebræ), 12 in the back (dorsal vertebræ), 5 in the loins (lumbar vertebræ), all of which are capable of being detached from one another, and are termed *true* vertebræ; and 5 vertebræ ossified together, and forming the sacrum, and 4 or 5 similarly united forming the termination of the column, and constituting the bone called the coccyx, which are known as *false* vertebræ. However long or short the neck may be, every mammal has 7 cervical vertebræ, excepting the three-toed sloth, which has 9, and the sea-cow, which has 6. In the other regions of the spine, no such law exists. Each vertebra is attached to the two between which it lies by numerous strong and more or less elastic ligaments, and between each pair of vertebræ there is interposed a lenticular disc of fibro-cartilage, which acts as a buffer. By these arrangements, the spinal column is rendered highly elastic, the communication of jars or shocks is prevented, and a very considerable general range of movement permitted, although the motion between any two adjacent vertebræ is slight.



Spinal Column.

The elasticity of the column is further increased by the component vertebræ being arranged in curves, instead of being placed perpendicularly. The curves should be exactly in the antero-posterior direction, any well-marked lateral deviation from the perpendicular being abnormal; but a very slight lateral curvature with the convexity to the right may often be detected in the upper and middle parts of the back, and is supposed to be dependent on the more frequent use and greater strength of the right arm as compared with the left. From their position, they are termed the cervical, dorsal, lumbar, and pelvic curves. The dorsal and pelvic curves have their concavities in front, and thus enlarge the spaces in which the thoracic and pelvic viscera are contained; the two other curves are, convex anteriorly, and thus afford support to the parts above them. The upper three curves are so arranged that their chords are in the same vertical line in the erect position of the body, and this vertical line corresponds with the line of gravity of the head. The cause of these curves is to be sought for partly in the shape of the vertebral bodies, and partly in that of the intervertebral substance. Amongst the uses of these curves it may be mentioned (1) that they enable the spine to bear a greater vertical weight than it could otherwise maintain; it is calculated that nine times as great a vertical force is required to bend it as if it had been straight; (2) that they facilitate the movements of the body, especially in the act of running; and (3) that they are so disposed as to protect the cord in movements of the spine. Similar curves are seen in the spine of other mammals, though the degree of flexure is liable to great deviations. The lumbar curve, which has especial reference to the erect position, is always much less marked than in man.

The vertebral canal formed by the apposition of the spinal foramina, or neural arches (see SKELETON), and containing and protecting the spinal cord, varies in its size at different parts of the column. It is largest in its antero-posterior diameter in the neck and loins (measuring at the last lumbar vetebra ¾ths of an inch), where the antero-posterior movements of the spine are greatest, and where the cord is least closely attached to the vertebræ; while in its lateral diameter it is greatest at the atlas, where it measures nearly an inch and a half. A transverse section of the canal is nearly circular through the greater part of the back. The intervertebral foramina through which the nerves emerge vary in shape and position in different parts, but are always of sufficient size to prevent injurious pressure on the nerves during movement of the spine; and in the dorsal region, which is the ordinary seat of angular curvature, the nerves are so protected by bony arches, that they may escape injury, even when the bodies of several dorsal vetebræ have been destroyed by ulceration.

SPINAL CORD or MARROW, THE STRUCTURE AND FUNCTIONS OF. The spinal cord is that elongated part of the cerebro-spinal axis (see NERVOUS SYSTEM) which is contained in the spinal canal from the *Foramen magnum*, at the base of the skull, superiorly, to the first or second lumbar vertebra inferiorly, where it merges into the *Filum terminale*, which extends to the lower end of the sacral canal, and in no way differs structurally from the proper spinal cord, except that no nerve-roots are connected with it. The membranes by which it is protected from danger, and kept in its proper position, are described in the article NERVOUS SYSTEM.

Its length varies from 15 to 18 inches, and it presents a difference in its diameter in different parts, there being an upper or cervical, and a lower or lumbar enlargement. In form it is a flattened cylinder. It is almost completely divided, along the median plane, by an anterior and posterior fissure, into two equal and symmetrical parts. The anterior fissure is more distinct and wider at the surface than the posterior fissure, but it only penetrates to about one-third of the thickness of the cord, while the posterior fissure extends to about half the thickness of the cord. The two halves are hence only united near the center by a commissural band, which is traversed by the 'spinal canal' (fig. 2, *f*), extending downwards from the fourth ventricle (see BRAIN), and about one-hundredth of an inch in diameter. A posterior and an anterior lateral furrow (two shallow depressions, the latter being scarcely perceptible) further divide each half of the cord into a posterior, a lateral, and an anterior column; these two furrows corresponding with the lines of attachment of the posterior and anterior nerve-roots.

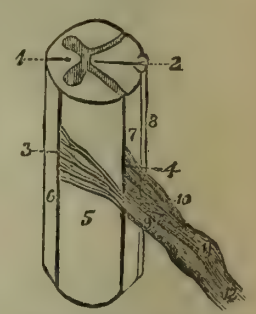


Fig. 1.—Side View of the Spinal Cord, showing the Fissures and Columns.

1, anterior median fissure; 2, posterior median fissure; 3, anterior lateral fissure; 4, posterior lateral fissure; 5, lateral column; 6, anterior column; 7, posterior column; 8, posterior median column; 9, anterior root; 10, posterior root; and 11, ganglion of (12) a spinal nerve.—From Gray's *Human Anatomy*.

The separation of the antero-lateral columns into the 'anterior' and the lateral columns (A, A, and L, L, in fig. 2), is made more

obvious internally by the mode in which the gray or vesicular nervous matter (described and figured in the article NERVOUS SYSTEM) is arranged in relation to the white or fibrous matter. Although the distribution of the gray matter differs considerably in different parts of the cord, it usually presents in a transverse section the form of two somewhat crescent-shaped masses, whose convexities are turned towards each other, and are connected by the gray commissure, while their cornua are directed towards the

Fig. 2.—Magnified View of Transverse Section of the Spinal Cord through the middle of the Lumbar Enlargement: showing, on the right side, the course of the Nerve-roots, and on the left, the position of the principal tracts of Vesicular Matter.

A, A, anterior columns; P, P, posterior columns; L, L, lateral columns; *a*, anterior median fissure; *p*, posterior median fissure; *b*, *b*, *b*, *b*, anterior roots of spinal nerves; *c*, *c*, *c*, *c*, posterior roots; *d*, *d*, tracts of vesicular matter in anterior column; *e*, tracts of vesicular matter in posterior column; *f*, spinal canal.—After J. L. Clarke.

surface of the cord; the posterior peak on each side nearly reaches the posterior lateral furrow, while the anterior, though the larger cornu, does not approach quite so near the surface at the assumed anterior furrow. The enlargement of the cord in the cervical and lumbar region, where the great nervous plexuses are given off, is chiefly due to the increase, at those points, of gray matter, which is comparatively deficient in the interval between them.

The white substance seems to increase regularly from the lower to the upper part of the cord; and this fact, as Dr. Carpenter remarks, seems to indicate the probability that the longitudinal columns serve (as formerly supposed) to establish a direct connection between the encephalic centers and the roots of the spinal nerves. Careful microscopic investigation has revealed the fact, that the root-fibres of the spinal nerves run two very distinct courses in the substance of the cord; the first *transverse*, and the second *longitudinal*. The transverse fibres traverse the cord horizontally or obliquely, and appear to pass out in the other sets of roots connected with the same segment, either on its own or on the opposite side of the median fissure; while the longitudinal fibres in part connect the posterior roots directly with the posterior column without passing into the vesicular matter, but for the most part enter the gray matter, and emerge from it into the posterior column, or into the posterior part of the lateral column of the same or the opposite side. How far these longitudinal fibres run up or down the cord, is undecided. It is probable that *some* of them are longitudinal commissures, serving to connect the nerve-roots of one segment of the cord with the vesicular matter of another above or below it, and it is possible that *all* are of this character, in which case the spinal cord will be the real center of all the nerve-fibres connected with it.

In considering the functions of the spinal cord, we have to regard it in two distinct points of view—viz., in the first place, as a *conductor* of nervous force between the nerve-trunks and the brain; and in the second place, as an *independent nervous center*. As a mere *conductor* of nervous force, its functions and behavior are the same as those of a nerve trunk; for, as Dr. Carpenter observes, 'if it be divided, all the parts of the body which are solely supplied by nerves coming off below the point of section are completely paralyzed, as far as regards sensibility and voluntary movement; no impressions made upon them having the least power to affect the consciousness, and no exertion of the will being able to determine contraction of the muscles. This state of *paraplegia*, which may be experimentally induced in animals, is frequently exhibited in man, as a result of injury or of disease that seriously implicates the spinal cord; and as it has been shown that among the lower animals complete reunion of the cord may take place after complete division, as indicated by the entire restoration of its functional powers, and the complete redintegration of its structure, so have we reason to believe that a similar regeneration may take place, to a considerable extent, in man, this being marked by a gradual return of sensibility and power of voluntary movement in the lower limbs, which had been at first completely paralyzed.'—*Human Physiology*, 6th ed., pp. 529, 530. There can be little doubt that the gray matter is essentially the conductor of *sensory* impressions, for if the anterior, posterior, and anterolateral columns are divided as completely as possible, the gray substance remaining uninjured, the sensibility of the parts below is unaffected; while, conversely, if the gray substance is divided, while the white columns remain uninjured, sensibility is almost totally extinguished.

M. Brown-Sequard, whose researches on the nervous system are of the highest importance, has shown that the central portions of the gray substance are the most effective in the transmission of sensation. He likewise brings forward strong evidence to prove that there are special conductors in the spinal cord for the sensations of touch, pain, temperature, and muscular contraction, none of which can convey other sensations than their own. Notwithstanding its singular power of conducting sensory impressions, the gray substance is itself insensible. Amongst his other remarkable discoveries in connection with this subject, Brown-Sequard has found, that on dividing one-half of the spinal cord of an animal, not only is anæsthesia (or loss of sensation) established on the opposite side of the body, but there is also produced a state of hyperæsthesia (or exalted sensibility) on the same side, which begins to appear a few hours after the operation, and continues in dogs for about 20 days, in cats about 14 days, and in guinea-pigs for many months, after which the sensibility falls below its usual standard. With regard to the conduction of *motor* impulses, there is great uncertainty. Considerable differences have been shown to exist in the position of the motor tracts in different parts of the cord, and Brown-Sequard concludes from his experiments on the effects of section, that while in the dorsal region, all parts, except the posterior columns, are employed in the conveyance of the orders of the will to the muscles, in the upper part of the cervical region, most of these conductors are in the lateral columns and in the gray substance between these and the anterior column.

We have now to consider the spinal cord as an *independent nervous center*. The simplest, and, at the same time, the most decisive evidence of the independent power of the spinal cord, is derived from the motion exhibited by the limbs of animals when irritation is applied to them after section of the cord at some point above the entrance of their nerves; the fact that these movements are reflected through the cord, and do not result from direct stimulation of the part irritated, being shown by their complete cessation when the nerve-trunks are divided. Thus, if a frog be pithed by dividing the cord between the occipital foramen and the first vertebra, an unusual convulsion takes place while the knife passes through the nervous center; but this quickly subsides, and if the animal be placed on the table, it will resume its ordinary position. It is quite unable to move by any voluntary effort; but if a toe be pinched, the limb is instantly drawn up, and seen to push away the irritating agent, and then draw up the leg again to the old position.

From these and other experiments, we may conclude (1) that the spinal cord, *in union with the brain*, is the instrument of sensation and voluntary motion to the trunk and extremities; and (2) that the spinal cord may be the medium for the excitation of movements, *independently* of volition or sensation, either by direct irritation of its substance, or by the influence of a stimulus conveyed to it from some surface of the trunk or extremities by its nerves distributed upon that surface.—For further information on this subject, the reader is referred to Todd and Bowman's *Physiological Anatomy and Physiology of Man*, 2d ed., vol. i.; Carpenter's *Human Physiology*, 8th ed. 1876; and the other standard works on Physiology.

SPINA'ZZOLA, a city of Southern Italy, in the province of Bari, 7 miles south of Minervino. Pop. 10,000. The country around is very fertile, and produces grain in abundance.

SPINDLE TREE (*Euonymus*), a genus of plants of the natural order *Celastraceæ*. This order contains about 260 known species, all small trees or shrubs.—The genus *Euonymus* has a lobed capsule, and seeds surrounded by an aril, which in some of the species is remarkable for its brilliancy of color. The Common Spindle Tree (*E. Europæus*), a native of Britain, chiefly of the southern parts, and of great part of Europe, is very ornamental when in fruit, and its aril is of a fine orange color. It is a shrub rather than a tree. The wood is hard and fine-grained. It is used for the finer articles of turnery, and for skewers. It was formerly used for making musical instruments and for spindles, whence the name of the shrub. In Germany, the shoots are bored

for tubes of tobacco-pipes. Charcoal made of it is much valued for crayons.

SPINE, or THORN, in Botany, is a sharp-pointed projection of the wood of a stem or branch, and essentially differs from a Prickle (q. v.) in being connected with the wood, and covered with bark. A spine is, in fact, a branch arrested in its growth and modified. In some trees and shrubs, as in the sloe, branches which bear leaves often terminate in the form of a spine. Cultivation, or whatever tends to increase the luxuriance of a plant, diminishes the tendency to produce spines. The name spine is also given to the sharp extremities of the midrib of leaves, and to the sharp angular projections of the margin of hard leaves, as in the holly. In some plants, the stipules are metamorphosed into spines.

SPINE, CURVATURE OF THE. There are two perfectly distinct forms of curvature, viz., LATERAL CURVATURE—arising from weakness of the bones, ligaments, and muscles, and fearfully common in girls of the middle and upper classes, between the ages of 10 and 16—and ANGULAR CURVATURE (frequently known as POTT'S CURVATURE, or the MALADY OF POTT, in consequence of that eminent surgeon having been the first to describe its true nature), which consists of caries of the bodies of the vertebræ, and is by far the more serious affection of the two. '*Lateral Curvature*, or *Distortion*, denotes deformity of the bones of the spine and chest; with corresponding change of the structures in relation to them. It is called "lateral," from the spine being curved sideways; and to distinguish it from "angular" deformity, in which the spine is directed from behind forward, owing to excavations in its forepart from caries.' The above definition is taken from Mr. Shaw's article on this affection in Holmes's *System of Surgery*, vol. iv. p. 844, an article from which we have borrowed freely in relation to the symptoms and causes of the disease. The first thing that commonly attracts attention is a projection of one scapula, or an elevation of one shoulder, generally the right; the right shoulder and right side of the chest being unnaturally high and rounded, while on the left side, the shoulder is depressed, and the side of the chest concave. On examination, the spine is found to have acquired a spiral appearance, 'not unlike what might have been produced if it had been taken, when soft, at both ends by the two hands, and twisted as a a washerwoman wrings a wet cloth.'—Shaw *op. cit.* In advanced stages of the distortion, the dorsal curve increases abruptly to such an extent as to render it angular, the attending contortion being similarly abrupt, This condition gives rise to various changes, including a *humped* appearance, a great displacement of the ribs, a diminution of the cavity of the chest, and a proportionate wasting of the lung. In consequence of these physical changes, the patient can no longer walk in a simple and natural manner, but exhibits a halting, jerking awkward gait.

The following may be noticed amongst the principal causes of lateral curvature: 1. The suppleness of the spine in the young, its structures being then more gristle than bone, and the column virtually immature. 2. Weakness of the muscles, which are seldom properly exercised in girls of the age and class in which this disorder occurs. This muscular debility is usually followed by deterioration of the bones and their ligaments, and this, apart from other obvious and direct bad effects, tends to make all the component parts of the spine—vertebræ and articulations—more prone to yield to the superincumbent weight, and to become distorted. These evil results are increased by prolonged stooping. When we enter a school, shortly before the breaking up of the class, we usually find most of the pupils standing or sitting in a tired lounging position. They are instinctively relieving the pain of over-fatigue by throwing the weight on the insensible fibrous structures, and thus relieving the aching muscles. When such attitudes are long indulged in, the ligaments undergo a process of over-stretching, and a general looseness of the vertebral joints is the result. By standing on one leg, or, more correctly speaking, by throwing all the weight of the body on one foot, the body is kept upright with the least possible expenditure of muscular power. Hence, a weak and fragile girl is induced to adopt this position. Too long indulgence in this habit will, to a certainty (for anatomical reasons, into which we have not space to enter), aggravate existing curvature, and induce it, if it did not pre-exist.

However slight a curve in the spine of a young girl may be, it ought to be deemed of importance; for when the column inclines laterally even to a slight degree, the superincumbent weight ceases to be supported on the line of the vertical axis, and falls on the oblique processes of the side to which she leans; and these processes becoming rapidly diminished in length by absorption, induced by this abnormal pressure, general distortion rapidly commences. With regard to the final issue of a case, distortion beginning at the age of ten is more dangerous than at fourteen, because the disease runs a more rapid course in the younger cases. A cure is, for the same reason, more easily effected in the younger patient. If the patient's age be beyond sixteen, little can be done beyond checking the further progress of the deformity.

Before discussing the treatment of these cases, it is necessary to say a word regarding an important preventive measure. When a girl is defective in muscular power, disinclined to take exercise, and prone to distortion of the spine, the sitting position does not afford her rest, in consequence of the great efforts she has to make in order to keep the body erect. A patient in that condition will derive benefit from being obliged to lie for two or three hours daily, at divided intervals, on a sofa or board. When the deformity has actually occurred, gymnastic exercises suggested by the medical attendant will not unfrequently, when continued for some time, have the effect of loosening the connection of the bones, of facilitating their falling into their proper places, when extension is employed, and of restoring to the spine a portion of its lost suppleness. Mr. Shaw suggests the following simple plan for attaining the same end. 'Let the patient lie on one side, with a firm cylindrical pillow, six inches in diameter, placed under the gibbosity of that side, and let her rest her weight on the pillow: the effect will be to counteract and reverse the curve. The same may be done alternately on the two sides. The posture may be continued each way for a quarter of an hour at a time, and be repeated twice or thrice daily.'—*Op. cit.*, p. 858. There are two methods of extending the curved spine—viz. (1), by stretching the body while the patient is recumbent; and (2) by letting the patient remain upright, and using spinal supports. As each method has its own advantages, a combination of them will often afford the best results. The chief objections to the former are the necessary confinement, comparative seclusion, and interference with the routine of study. Any mode of treatment with the view of producing extension of the spine must be continued for months in order to be of any avail. It would be altogether out of place to notice in this article the various extending beds, apparatuses for exercise, and different kinds of spinal supports that have been devised by surgeons and anatomical mechanicians, and we will merely observe that mechanical supports must be tried with great caution. They are always more or less irksome to bear, and if they are not doing good, are almost sure to be doing harm. On this subject, the reader may consult Heather Bigg's work entitled *The Spine and Upper Extremities.*

Angular Curvature consists, as already mentioned, of caries of certain vertebra, which first consumes the bones and fibro-cartilages, and subsequently excites a discharge of pus. The first symptom of this affection is the appearance, at the seat of the caries, of a prominence of one or more of the spinous processes. This 'growing out' of the back, as patients frequently term it, is due to the destruction of a portion of the column. In an advanced stage, the spinal ridge will stand out prominently, the knob of each process being distinctly visible; and finally, a distinct angular projection is developed. The *consequences* of this disease are thus summed up by Druitt. '1. In favorable cases, the diseased bones collapse, and are anchylosed; abscesses, if they form, are healed, or their matter is absorbed, and the patient recovers in two or three years, with more or less deformity, which is, of course, incurable. 2. In some fatal cases, the patient dies suddenly from two or three of the diseased vertebræ giving way, and crushing the spinal cord; or from dislocation of the odontoid process; owing to ulceration of its ligament; or from the bursting of abscesses into the spinal cord; or from their bursting into the pleura or peritoneum; but more frequently death is caused by slow irritation and exhaustion, consequent on the formation of psoas or lumbar abscesses.'—*The Surgeon's Vade-mecum*, 8th ed., p. 348. The most essential point in relation to *treatment* is *rest*, and the most effectual method of arresting motion between the diseased vertebræ, and of keeping them at rest, is by placing the patient in a recumbent position on his back. If possible, an invalid bed should be procured, provided with contrivances for enabling him to lie upon it, day and night, without rising. Local counter-irritants, such as compound tincture of iodine, are often useful; and good diet, backed, if necessary, by cod-liver oil and tonics, must be prescribed. In conclusion, sufferers from any form of real or suspected spinal disease are earnestly warned to avoid the numerous quacks, whether in or out of the medical profession, who have taken up the spine as a specialty.

SPI'NEL, a mineral allied to corundum, consisting chiefly of alumina, with smaller proportions of magnesia, silica, and protoxide of iron. It occurs in crystals, which are often octahedral, and is chiefly found in Ceylon and Siam. Its colors are various; red, blue, green, and black. It is much prized as a gem; red spinels are commonly called rubies; the *Balas Ruby* is a rose-red S., and a violet colored S. is known as *Alamandine Ruby*.

SPI'NET (Ital. *spinetta*), an old-fashioned stringed musical instrument with a keyboard, smaller and weaker than the harpsichord, and like it, one of the precursors of the pianoforte. Each note had but one string, which was struck by a quilled jack acted on by one of the finger-keys. The strings were placed horizontally

and nearly at right angles to the keys, as in the square piano-forte; and the general outline of the instrument nearly resembled that of a harp laid in a horizontal position, with the keys occupying the position of the sounding-board; on which account the spinet, when first introduced, was called the couched harp.

SPINNING is the art of combining animal and vegetable fibres into continuous threads fit for the processes of weaving, sewing, or rope-making. The most primitive spinning apparatus is the spindle and distaff, representations of which are to be seen on the earliest Egyptian monuments. The distaff was a stick or staff upon which a bundle of the prepared material was loosely bound, and which was held in the left hand or stuck in the belt; the spindle was a smaller tapering piece to which the thread was at-

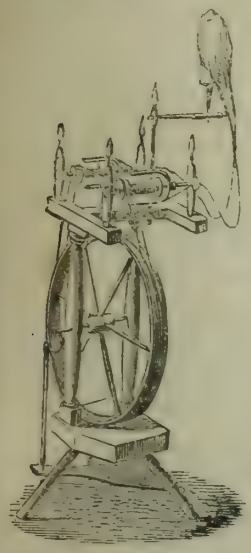


Fig. 1.—Two-handed Spinning-wheel.

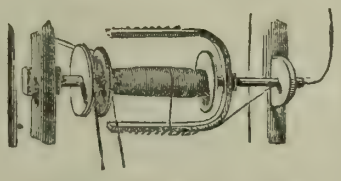


Fig. 2 —Spindle, Bobbin, and Winding-arm on a larger scale.

tached. By a dexterous twirl of the hand the spindle was made to spin round and at the same time recede from the spinster, who drew out between the forefinger and thumb of the right hand a regular stream of fibres so long as the twisting of the spindle lasted. It was then drawn in, the new length of the thread wound upon it, and the operation was renewed. An obvious improvement on this was to set the spindle in a frame and make it revolve by a band passing over a wheel driven either by occasional impetus from the hand or by a treadle; this constituted the *spinning-wheel*, which is said to have been invented in Nuremberg as recently as 1530. In the spinning wheel in its most improved form, and as used for flax, a bobbin or 'pirn,' with a separate motion, was placed on the spindle, which had a bent arm—a flyer or flight—for winding the yarn on the bobbin. The spindle and bobbin revolved at different rates, the revolutions of the spindle giving the twist, and the difference of the rate causing the winding on. The two-handed wheel had two spindles and pirns a little apart, with the distaff or 'rock' stuck into the frame between them, and the spinster produced a thread with each hand. The spinning of flax on such wheels for the manufacturer was an important branch of domestic industry in the northern counties of Scotland as late as 1830, if not later.

Neither the spinning-wheel nor the hand could spin more than one, or at most two threads at a time, and therefore, with the rapid increase of population, and the improvements made in the process of Weaving (q. v.), they became quite inadequate to supply the demand for yarn: but an accident, it is said, about the year 1764, led to an invention by which eight threads could be spun at once; and this was soon improved upon until eighty could be produced as easily. This was the invention of the *spinning jenny* for cotton spinning, by James Hargreaves, at Standhill, near Blackburn in Lancashire. In this machine, a number of large reels of cotton formed into a thickish coil, called a *roving*, were set on upright fixed spindles, and the ends of the rovings were passed between two small movable bars of wood placed horizontally and under the control of the spinner, who could thus make them press more or less on the roving, and consequently increase or decrease the draw upon it from the spinning spindles, which were set in a row at the other end of the frame, and all capable of being set in motion simultaneously by the wheel. The success of the spinning-jenny (fig. 3) was considerable, but its history has been too often told to be required here; and even previous to its invention, a better idea had been started and acted upon by others, and was afterwards brought to such perfection, that the invention of Hargreaves soon passed into obscurity.

In order to understand the operations of spinning as now practised, and as improved by the invention alluded to, it is desirable, in this place, to say a few words upon the preparation of the fibres for the process of spinning. In the first place, if wool or cotton, it has to be 'opened;' that is, it must be relieved from its original knotted and lumpy condition; this was formerly done by hand, but is now easily managed by machines called 'willows or willeys,' 'blowers' and 'openers.' By the first of these, which consists of a drum covered with small spikes moving in a hollow cylinder, also lined with spikes, but so arranged that those on the drum pass close to, but do not come into collision with them as it revolves, the cotton or wool is fed in on one side, is dragged forward by catching on the spikes, and is delivered at an opposite opening to that by which it entered, in a loose state and free from knots. It is not, however, quite loose enough for the subsequent operations, and it is more or less mingled with impurities. It is therefore taken to the 'blower' or 'opener,' and being put into a shaft, is there

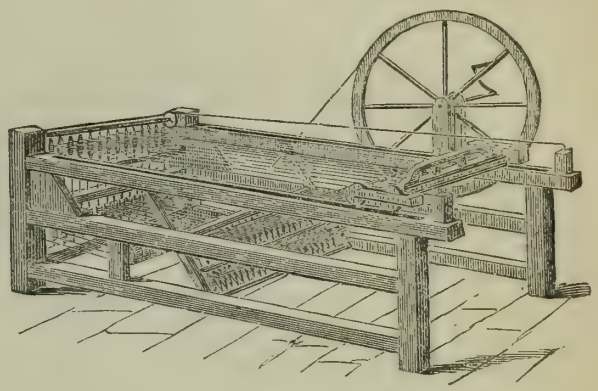


Fig. 3.

acted upon by a stream of air violently driven in by machinery, which blows it forward, removes extraneous matters, and so separates the fibres that they pass out at the other end in an exceedingly light flocculent state and ready for being formed into *laps*. This operation consists in laying the material very equally on an endless apron made of small bars of wood, and of the width of the frame of the machine in which they are placed. This apron (*a*, fig. 4) passes round two rollers, placed at a little distance apart,

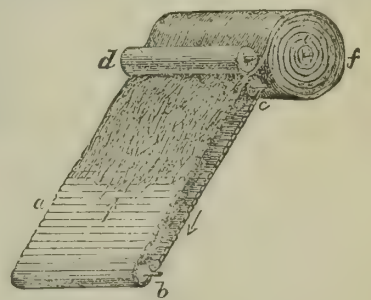


Fig. 4.

as in fig. 4, *b*, *c*, the rollers being moved by machinery. The arrows indicate the direction in which the apron moves; and as the operator covers its entire surface with a thin layer of the fibre, it passes under the roller *d*, and is taken on to the roller *e*, in the form of a compressed layer of cotton or wool, called a *lap*. When the roller *e* is full, it is removed, with its lap *f*, to make way for another. Much care is taken in weighing out and distributing the material of these laps, because upon this first operation the ultimate size of the yarn depends.

The laps are taken to the *carding-machine*, consisting of a series of cylinders revolving in a frame, and placed so close together that they almost touch each other. Each cylinder is covered with a coating of fine steel wire points, which are stuck in leather, or some other flexible material, and are technically called *cards*. The production of these cards by machinery is in itself a marvel, and the automatic machines for making them are wonderfully effective. Each piece of wire is bent as in fig. 5, and is put through two holes in the leather, as in fig. 6; *a* shows a bent wire going in, and *b*, *b*, wires completely in the holes in leather, *c*, *c*, *c*, so as to form two points on the other side, and these are slightly bent all in one direction, as in fig. 7, where the piece of card *a* is seen cut through at *b*, to show the direction given to the wires *c*. There are many variations upon this arrangement of the wires, but the general principle is the same in all. The machine

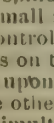


Fig. 5.

for making the cards cuts the wire to the right lengths, bends them, pierces the holes in the leather, inserts the wires, and finishes by giving them the slight sloping direction which is essential.

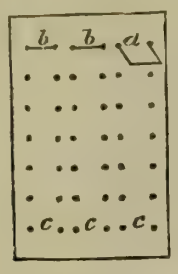


Fig. 6.

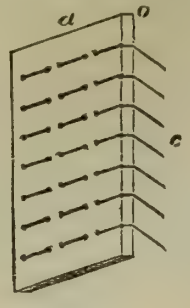


Fig. 7.

The lap is made of the same width as the cylinders of the carding-machine, and is so adjusted that, as it unwinds from its roller, it passes in between a pair of the carding cylinders, the steel wire teeth of which seize hold of the individual fibres, and drag them in one direction until they are caught by other cylinders, and so carried from one to another, always being pulled in a straight direction until they are laid as nearly as possible side by side, and are given off in a thin cobweb-like film at the last cylinder, where it is prevented from continuing its journey round the cylinders by a small bar of metal called the *doffer*, which, with a gentle and peculiar motion, removes it from the cylinder.

The film of fibre is of the same width as the cylinder of the carding-machine, but it is gathered together by the operator, who passes it through a smooth metal ring, and between two small polished rollers, the revolutions of which carry it forward, and deposit it in a deep tin can in the form of a loose untwisted column of cotton or wool, about an inch in thickness which is called a *sliver*. A small portion of this arrangement is shown in fig. 8, which represents a carding-machine with only two carded

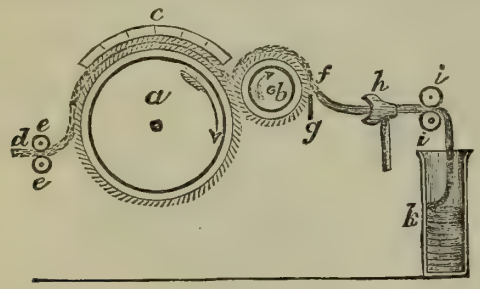


Fig. 8.

cylinders, *a* and *b*; they are, however, much more numerous. There is also a concave piece of carding, *c*, which was formerly much used, but has lately given way to additional cylinders, but it makes the action more apparent in a drawing; *d* is the lap drawn on by the action of the two small rollers *e, e*, which slightly press it as they revolve. It is quickly distributed allover the surface of the large cylinder *a* by means of its numerous wire-teeth; and as it passes the roller *b*, the teeth of which move in an opposite direction, as indicated by the arrows, the fibres are caught off the large, and are carried round the small cylinder until they reach *f*, where they are stripped off by the doffer *g*, and are passed through the ring *h*, and the rollers *i*, *i*, into the tin receiver *k*. The sliver is now in the first stage of spinning; it has next to be drawn out very gradually until it is not thicker than a quill; and in drawing it out, the operator gives it a very slight twist, still leaving it so loose in structure that it will break with a slight touch; in this state it is called a *roving;* and it was at this stage that the spinning-jenny began to operate upon it. The rovings, which were wound as they were drawn upon large reels, were unwound by the machine, and were still further drawn out and firmly twisted and wound on to spindles or cops, the drawing being regulated by the pressure of the wooden bars of the jenny, which was within reach of the operator's hand.

The *throstle-machine*, patented by Arkwright in 1769, had for its object the drawing of the rovings through a succession of pairs of rollers, each pair in advance of the others, and moving at different rates of speed. The first pair receive the sliver, compress it, and pass it on to the second pair, which revolve at a greater speed, and thus pull it out to exactly the number of times greater length that their revolutions exceed those of the other pair—in number it is usually eight times—and as the first roving is passed through a second, third, and sometimes fourth machine, the finished roving is 32 times longer than the sliver. As the roving issues through the last rollers of each machine, it is received on *spools* or *reels*, calculated to hold a given quantity; and these are transferred to the *spinning-frames*, which resemble the *roving-frames*. Here the roving takes the place of the sliver; and as it unwinds from the spool, is drawn through successive pairs of rollers, moving as before at different rates, each succeeding pair faster than the backward ones, so that the roving gets thinner and thinner, until the tenuity is carried as far as desirable. It is then carried on to a spindle which revolves with great rapidity; and by means of a simple arrangement, is made both to twist the thread and wind it on the spindle ready for the weaver.

This system produces too great a strain upon the thread in its progress to admit of its being drawn so fine as is wanted for many purposes, and this led to the invention of the *mule-jenny* by Crompton (q. v.) in 1779, which has a travelling frame upon which the spindles are set. This frame is now made long enough to carry hundreds of spindles, and it gently draws out and twists the thread after it leaves the last pair of rollers; and when it has reached its limits—now several yards, but in Crompton's time only five feet—it rapidly returns, winding up the spun thread on the spindles as it goes back. These machines are now applied, with various necessary modifications, to cotton, wool, flax, silk, and other textile materials, and the effect they have exerted upon our manufactures is more wonderful than anything in the whole history of commerce. Previous to the invention of the mule, few spinners could make yarn of 200 hanks to the pound (the hank being always 840 yards). At the same time, the natives of India were weaving yarn of numbers ranging between 300 and 400. Now, however, our manufacturers have reached such extraordinary perfection, that Manchester spinners have made No. 700, which was woven by a French firm. No. 10,000, a pound of which would reach 4770 miles, has been made to test machinery. The most modern machines combine in one the operations of carding, roving, and spinning.

SPINOLA, Ambrosio de, Marquis, a famous soldier, was born at Genoa in 1569, his father being a noble. He took service with Spain, and in 1603 became chief commander of the Spanish army in the Netherlands. He took Ostend in 1604, Julich in 1622, and Breda in 1625. He afterwards commanded Spanish troops in Italy, and died at the siege of Casale in Piedmont, 25th September 1530.

SPINOZA, Baruch (= *Benedict*), one of the greatest philosophers of modern times, was born at Amsterdam on the 24th of November 1632. His parents, rich Portuguese Jews, had their son diligently instructed in the Bible and its commentaries, and the Talmud. But after having mastered both, and imbibed the philosophical spirit of such commentators as Aben Ezra, he was allowed—the more readily that his sickly constitution unfitted him for a commercial career—to devote himself entirely to a life of study. Physical sciences and the writings of Descartes, to which he turned first of all, very soon drew him away from the rigid belief and practices of the synagogue; and Saul Levi Morteira, his talmudical teacher, who had built the fondest hopes upon the genius of his pupil, was the first to threaten him with the direst punishment if he did not retract the rank heresies that he began openly to utter. S., after a time, entirely withdrew from the the community of his brethren, who formally excommunicated him. A fanatic even attempted to frighten him by an either real or feigned attack upon him as he left the theater one night. At that period the young truth-seeker made the acquaintance of the young and beautiful daughter of Van den Ende, his master in Greek and Latin, and fell passionately in love with her, but was rejected. From that time forth, Philosophy became the sole aim and object of his life. In accordance with the teachings of the sages of the Mishna, S. had, apart from his studies, made himself master of a mechanical craft. He had learned the art of polishing lenses. This now became the means of his subsistence. Besides, he was also an expert in the art of design, and among a number of other portraits, he drew one of himself in the dress of Masaniello.

When 28 years old, he left Amsterdam, and went to Rhynsburg, near Leyden, where he wrote the *Abridgment of the Meditations of Descartes*, with an Appendix—the latter being the first cast, so to say, of his *Ethics*. The year following, he removed to Woorburg, near the Hague, and shortly afterwards, yielding to the solicitations of his, by this time, numerous friends, he removed to the Hague itself. The Elector of the Palatinate, Charles Lewis, next offered him a vacant chair at the university of Heidelberg, with 'full liberty of teaching,' provided he would not say aught to prejudice the established religion, i. e., Christianity; whereupon S. declined the both lucrative and honorable professorship. His small pittance was enough to satisfy his wants. In a similar way, he refused generous offers made to him by wealthy friends, like Simon de Vries, who intended to bestow a large sum of money upon him. All he could be prevailed upon to accept was a small annuity of a few hundred florins; the rest he persuaded his gen-

erous friend to bestow upon his (De Vries') own brother. An offer of a pension, on the condition of his dedicating a work to Louis XIV., he rejected with scorn. His domestic accounts, found after his death, show that he preferred to live on a few pence a day, to being indebted to another's bounty. He died, 44 years old, on the 21st of February 1677. Throughout his life of study, of abstemiousness, of bodily and mental suffering—for his constitution was undermined no less by consumption and overwork, than his sensitive mind was wrought upon by the violent severance of all natural ties of affection, to say nothing of the misery of occasional want and of perpetual persecution—no complaint ever passed his lips. Simplicity and heroic forbearance, coupled with an antique stoicism and a childlike, warm, sympathizing heart, were the principal attributes of him who was nicknamed epicurean and atheist by his contemporaries. It has well been said, that no man, perhaps, was more filled with religion than S., and that to be an epicure at the rate of twopence-halfpenny a day cannot be a very serious crime.

Respecting S.'s Philosophical system, of which we can only give the very faintest of outlines here, it must be premised that it developed itself on the basis of Descartes. The latter had inaugurated a new epoch by his 'reconstruction' of knowledge. Dissatisfied both with the dogma and the scepticism around him, he cleared the ground by first doubting everything, and then laying a new foundation by *Cogito, ergo sum* (I think, I therefore am). S., however, deeply struck both with the reasonings and conclusions of Descartes, took his 'I think, therefore I am,' merely as a starting-point to prove more clearly the existence of God than Descartes did. The consciousness of man's own existence and of his imperfect state, are not, he thinks, sufficient to solve the grand problem. He therefore, assumes, first of all, three fundamental things, which he calls respectively Substance, Attributes, and Mode. By substance he understands, like Descartes, that which needs nothing else to its existence; but, unlike Descartes, he assumed only One such substance—God. Yet this term is not to be understood in the ordinary sense, for S.'s God neither thinks nor creates. There is no real difference, he holds, between mind, as represented by God, and matter, as represented by Nature. They are One, and according to the light under which they are viewed, may be called either God or Nature. The visible world is not distinct from him. It is only his visible manifestation, flowing out of him, who is the last fountain of life and essence, as a finite from the infinite, variety from unity—a unity, however, in which all varieties merge again. Extension and thought, which, with Descartes, had been two Substances, with S. becomes 'Attributes;' that which the mind *perceives* as *constituting* Substance. Extension is visible Thought; Thought is invisible Extension.

The relation between Substance and Attributes, S. illustrates by the example of an object—colorless in itself, perhaps—seen through yellow or blue spectacles. And this explains the relation between body and mind, and the complete unity between them. The mind is the idea of the body—i. e., the same thing considered under the attribute of thought. The *modus* or *accidens* is only the varying form of Substance. Like the curling waves of the ocean, they have no independent existence; nay, less than these are they things of reality; but they are simply the ever-varying shapes of the Substance. Substance, thus, is the only really existing, all-embracing essence, to which belongs every thing perceptible to our senses, and not perceptible. Thus, every thought, wish, or feeling, is a Mode of God's Attribute of thought; every thing visible is a Mode of God's Attribute of extension. God is the 'immanent idea,' the One and All. 'World' does not exist as world—i. e., as an aggregate of single things—but is one complex whole and one peculiar aspect of God's infinite Attribute of extension. The variety we behold in things is a mere product of our faulty conceptions, particularly of, as S. terms it, our 'imagination,' which perceives unity as a complex of multiplicity.

On these metaphysical speculations he founds his Ethics, which he deduces in a mathematical form, after the method of Euclid. The chief doctrines are: The absence of free-will in man—himself only a *Modus* dependent on causes without, and not within him. Will and Liberty belong only to God, who is not limited by any other Substance. Good and evil are relative notions, and sin is a mere negative; for nothing can be done against God's will, and there is no idea of Evil in Him. Utility alone, in its highest sense, must determine the good and the evil in our mind. Good, or useful, is that which leads us to greater reality, which preserves and exalts our existence. Our real existence is knowledge. Highest knowledge is the knowledge of God. From this arises the highest delight of the spirit. Happiness is not the reward of virtue, but virtue itself; and this is to be attained by a diligent following in God's ways. Sin, evil, negation, &c., are merely things that retard and obstruct this supreme happiness.

S.'s system, Pantheism or Atheism, as it has been variously called, appears to be nothing but the most rigid, most abstract Monotheism that can be conceived by man. There is only Substance, only God—nought else. It was not unnatural, however, that this system should be misunderstood either as materialism or as pantheism, seeing the word 'substance,' which, with S., means 'existence,' is, in ordinary language, associated with the idea of matter or body. Be this as it may, 'this most iniquitous and blasphemous human invention,' as it has been called for 200 years, has become the acknowledged basis of modern German philosophy; and pious theologians like Schleiermacher did not hesitate to apply the highest terms of 'pious, virtuous, God-intoxicated,' to S., who, we need not add it, never left Judaism, although he left the synagogue and its human formalities.

His principal works are—*Renati Descartes Principiorum Philosophiæ, Pars I. et II., more geometrico demonstratæ* (Amsterdam, 1663); *Tractatus Theologico-politicus* (anonymous 1670); the *Opera Posthuma*, edited in the year of S.'s death by Ludwig Meyer, contain: *Ethica Ordine Geometrico Demonstrata, Tractatus Politicus, Tractatus de Intellectus Emendatione, Epistolæ, Compendium Grammatices Linguæ Hebrææ.* Several minor treatises are lost; but the lately discovered *Tractatus de Deo et Homine*, published in 1862, is a most valuable addition to our materials for tracing the development of S.'s system. The literature on the Spinozistic philosophy is very copious, especially in Germany. S.'s life has even been made by Auerbach the subject of two romances. The best editions of S.'s works are those of Paulus (1802–3) and Bruder (1843–6). See Pollock's *Spinoza* (1880).

SPIRÆ'A, a genus of plants of the natural order *Rosaceæ*, and of the sub-order *Spirææ*, in which the fruit consists of five or fewer capsular carpels distinct from the calyx, and each containing 1—6 seeds. The genus S. has one or more follicular, many-seeded carpels. It contains a large number of species, natives of Europe, Asia, and America, herbaceous plants and low deciduous shrubs; of the herbaceous species, two are natives of Britain, DROPWORT (*S. Filipendula*), and MEADOW SWEET or QUEEN OF THE MEADOW (*S. Ulmaria*), both with interruptedly pinnate leaves and flowers in cymes. Dropwort is a native of dry upland pastures; it is tonic and fragrant; and its tubers, which are somewhat nutritious, are in Sweden ground and made into bread. Meadow Sweet is well known for the powerful fragrance of its flowers. A fragrant distilled water is prepared from them. A North American species (*S. tomentosa*), called HARDHACK in the United States, is there used as a tonic and astringent. Many of the shrubby species are frequently planted for ornament.

SPI'RAL, in Geometry, is the name given to a class of curves which, during their gradual regression from a point, wind round it repeatedly. Their equations are generally expressed in terms of polar co-ordinates, and are all necessarily of the form $r = f(\theta)$, where θ never signifies a function of the angle, but the angle itself or a multiple of it. Several such curves have received distinguishing epithets, either on account of the properties they possess, or from their inventors; the chief of them are—the *equable spiral* or the *spiral of Archimedes*, whose equation is $r = a\theta$, and which, commencing at the origin, circles round and regredes from it with unvarying uniformity; the *hyperbolic* or *reciprocal spiral* ($r = a$); the *logarithmic* or *equiangular spiral* ($r = ab^{\theta}$); which recedes from the center or origin with a velocity increasing as the distance, and always cuts the radius vector at the same angle; &c.

SPIRAL VESSELS are those very delicate air-tubes in the cellular tissue of plants which run unbranched through the different parts of the plant, and whose walls are composed of fibres spirally or circularly twined. Spiral vessels are either *free*, when their windings are unconnected with each other, or *net-like*, when the windings are involved with each other in a net-like manner. If the free spaces between the convolutions in the latter are linear they form *lined* vessels; but if they are point-like, they form *punctate* or *porose* vessels. Spiral vessels, whose walls are formed of distinct horizontal rings, placed simply one above another, are called *annular* vessels. Spiral vessels seldom occur singly, but are generally united by cells into bundles called vascular bundles. These vascular bundles are scattered in the stems of endogenous plants; but in the stems of exogenous plants they are arranged in one or more concentric circles. Amongst cryptogamous plants, the ferns alone (in the most extensive signification of the term) are provided with spiral vessels. All plants which have spiral vessels are called *Vascular Plants*, in contradistinction to *Cellular Plants*, whose substance consists of cells only.

Through the operation of what laws the spiral form is assumed by spiral vessels, is still unknown, although the question has naturally been regarded as having an intimate connection with the tendency to spiral structure manifested in plants, and even in some of those cryptogamous plants in which no true spiral vessels are found; a tendency which is observed not only in spiral stems, spiral tendrils, the spiral fibres of the elaters of *Jungermanniæ*, and the like, but throughout the vegetable kingdom generally in the spiral arrangement of leaves and of the organs which are formed by the metamorphosis of leaves. The whole subject is an

extremely difficult one; there has been much speculation about it, but as yet with no satisfactory results.

SPIRE, a very acute pyramidal roof in common use over the towers of churches. The history of spires is somewhat obscure, but there is no doubt that the earliest examples of anything of the kind are the pyramidal roofs of the turrets of Norman date. Those of St. Peter's, Oxford (fig. 1), and Rochester Cathedral (fig. 2), are good specimens of circular and octagonal spires on a small

1, Turret, St. Peters's Church, Oxford; 2, Turret, Rochester Cathedral; 3, St. Mary's Church, Cheltenham; 4, Bayeux Church, Normandy.
(From Parker's *Glossary of Architecture*.)

scale. Spires of this early period are much lower than those of later date. The early English style has spires of acute form over the larger towers. They are generally what are termed broach spires, i. e., the slopes spring from the cornice of the tower without any parapet, and at the point where the square changes to the octagon, there is a small set-off or separate roof. (Fig. 3, St. Mary's, Cheltenham, indicates this arrangement.) Sometimes the angles at top of towers were occupied with pinnacles or sloping masses of masonry, as at Bayeux Cathedral, Normandy (fig. 4).

In the decorated style, the spires were more enriched, with a parapet and pinnacles at the top of the tower, crochets on the angles, and enriched windows.

The spires of the Perpendicular and Flamboyant styles are still more enriched, with flying buttresses at the angles, &c. They are sometimes perforated, and the sides of the spire filled entirely with tracery. Such spires are common in Germany, those of Strasbourg and Freiburg on the Rhine being very fine examples. As in the later styles generally, the character and beauty of the spire give place to dexterity in masonry, and many examples exist of traceried spires more wonderful than beautiful. See GOTHIC ARCHITECTURE.

Spires are most frequently constructed of stone, but they are also occasionally made of wood, and covered with lead, copper, slates, or shingles. These are chiefly to be found in localities where stone is scarce.

SPIRIT, a name of very general application to fluids, mostly of a lighter specific character than water, and obtained by distillation. Thus, the essential oil of turpentine is called Spirit of Turpentine. But in a stricter sense, the term spirit is understood to mean Alcohol (q. v.) in its potable condition, of which there are very numerous varieties, deriving their special characters from the substances used in their production.

SPIRIT DUCK. See GARBOT.

SPI'RITO SA'NTO. See ESPIRITU SANTO.

SPI'RITUALISM. Under the head of ANIMAL MAGNETISM, an account is given, from the scientific point of view, of some of those mysterious phenomena which, under the name of modern spiritualism, have recently attracted so much public attention. It is proposed here to give a more complete account of these phenomena as they appear to those who hold that they are inexplicable by the commonly received laws of physics.

That these phenomena in their higher phases—as those of trance, healing by touch, and subjection to the thought and will of another mind—are intimately allied with those of mesmerism, is obvious to all who have given any careful attention to them. Spiritualists, indeed, affirm that they differ only in this—that in the one case the operator is a mortal, in the other a disembodied human spirit possessing a spiritual body instead of a physical one. Those persons most readily susceptible to mesmeric influence generally prove to be the best mediums for spirit manifestation. Wherever mesmerism has been extensively practised, it would seem that the ground has thereby been prepared for the operators in the unseen world; and indeed, human magnetism is not unfrequently resorted to for this express purpose.

Many of the earliest and foremost advocates of spiritualism in England have traveled to spiritualism *viâ* mesmerism. As is fully shown in the correspondence of M. Billault and M. Deleuze, published in two volumes in 1836, the magnetists of France anticipated by at least half a century the revelations of what is now known as 'modern spiritualism,' which was as humble in its origin as other great movements recorded in history which have so largely influenced mankind.

In the village of Hydesville, New York State, lived Mr. John D. Fox and family, much respected by their neighbors as honest upright people. The two youngest children, Margaret, then twelve years old, and Kate, nine, were staying with their parents. Soon after they had taken up their residence here, in December 1847, they began to hear knockings in the house, which towards the end of March increased in loudness and frequency. Mr. Fox and his wife got up night after night, lit a candle, and thoroughly searched every nook and corner of the house, but discovered nothing. When the raps came on a door, Mr. Fox would stand ready to open it, the moment they were repeated, but though he opened the door on the instant, he could detect nothing, and no one was to be seen; nor could he obtain the slightest clue to the cause of these disturbances. But through all these annoyances Mr. and Mrs. Fox clung to the belief that some natural explanation of them would be found. Nor did they abandon this hope till the last night of March 1848.

Wearied out by a succession of sleepless nights, and of fruitless attempts to penetrate the mystery, the family had retired very early to rest; but scarcely had the mother seen the children safely in bed, and was retiring to rest herself, when the children cried out: 'Here they are again!' The mother child them, and lay down. Thereupon the noises became louder and more startling. Mrs. Fox called in her husband. The night being windy, it suggested to him that it might be the rattling of the sashes. He tried several, shaking them to hear if they were loose. Kate happened to remark that as often as her father shook a window-sash, the noises seemed to reply. Turning to where the noise was, she snapped her fingers, and called out 'Here, do as I do?' The knockings instantly responded. She tried, by silently bringing together her thumb and forefinger, whether she could still obtain a response. Yes! It—the mysterious something—could see, then, as well as hear! She called her mother: 'Only look, mother,' she said, bringing her finger and thumb together as before. And as often as she repeated the noiseless motion, just so often responded the raps. This at once arrested the mother's attention. 'Count ten,' she said; ten strokes were distinctly given. 'How old is my daughter Margaret?' Twelve strokes responded. 'And Kate?' Nine! 'What can all this mean?' was Mrs. Fox's thought. Who was answering her? Was it only some mysterious echo of her own thought? The answers to the next question she put seemed to refute this idea. 'How many children have I?' she asked aloud. Seven strokes. 'Ah!' she thought, 'it can blunder sometimes.' And then, aloud, 'Try again.' Still seven strokes as before Of a sudden a thought crossed her mind: 'Are they all alive?' she asked. Silence for answer. 'How many are living?' Six strokes. 'How many dead?' A single stroke; she had lost a child. Then she asked, 'Are you a man?' No answer. 'Are you a spirit?' It rapped. 'May my neighbors hear if I call them?' It rapped again. Thereupon she asked her husband to call a neighbor, a Mrs. Redfield, who came in laughing. But her mirth was soon changed. The answers to her inquiries were as prompt and pertinent as they had been to those of Mrs. Fox. She was struck with awe; and when, in reply to a question about the number of her children, by rapping four, instead of three, as she expected, it reminded her of a little daughter, Mary, whom she had recently lost, the mother burst into tears.

Of course a knowledge of these things could not be kept secret. The news soon spread, and the utmost excitement prevailed in the little village and beyond it. Neighbors flocked in, and the house was besieged and the time of the family wholly taken up with curious and eager visitors. Formal depositions appeared in more than one publication. The earliest of these, published April 1848—a pamphlet of forty pages—contains twenty-one certificates, chiefly given by the immediate neighbors. Most of the witnesses offer to confirm their statements, if necessary, under oath, and express their conviction that the family had no agency in producing the sounds.

It was found that these were more marked in the presence of Kate Fox, and in the hope of getting rid of these annoyances, Kate was sent on a visit to Mrs. Fish, a married sister, at Rochester. The only result being that, while the rappings did not cease at Hydesville, a new and more extended scene of operations was given them at Rochester, whither they followed Kate, and were found also to accompany her sister, and a girl who resided with them.

On one occasion, a visitor suggested that the alphabet should be called over, to see if the sounds would respond to the required

letters, and so spell out a communication. A shower of raps followed, as if to say: 'Yes, that is what we want!' The first message so given, was: 'We are all your dear friends and relatives.' Then the name of 'Jacob Smith,' Mrs. Fish's grandfather, was given. Previous to the spiritual telegraphy thus commenced, the only mode of communication had been by asking questions, one rap being understood as an answer in the negative, three in the affirmative, and two, doubtful, or that the answer could not then be given. It was now asked that a signal should be given when the alphabet was required; this was responded to by five strokes, which was henceforth understood as a call for the alphabet; and so a code of signals was instituted.

Similar demonstrations occurred about this time, independently, in the homes of some of the most respectable inhabitants of Rochester. At length it was communicated by the rapping that the facts should be given to the world, with a view to open up a more extended intercourse; and instructions were given as to where, how, and by whom, this was to be done. There was much difficulty in getting the parties named to take the responsibility, and incur the discredit and ridicule of this step: but their scruples were at length overcome; and on the 14th of November 1848, a public lecture, giving a simple narrative of the facts, was delivered in the Corinthian Hall, Rochester, to an audience of about four hundred people. The rappings, as had been promised, were distinctly heard in all parts of the hall; and a committee was appointed by the audience to investigate the subject, and report at a subsequent meeting. The committee all agreed that the sounds were heard; but they entirely failed to discover any means by which they were produced.

This result was very different to what had been confidently anticipated, and the dissatisfied audience, amazed at the failure, appointed a second committee, which it was expected would make such an investigation as could not fail to find out the trick; and when this committee, after the strictest investigation, only confirmed the judgment of its predecessor, the excitement became intense; and a third committee was appointed, consisting of those who had shown the most determined hostility to the reports of the previous committees, and who had expressed the utmost confidence in their ability to detect the imposition. It certainly was no fault of theirs that they did not. They resorted to every means their ingenuity could devise; but no fraud could be detected, no explanation given. The 'mediums' were separated, and their friends were rigorously excluded from the sittings of the committee. They were unexpectedly removed, first to one house, then to another. A committee of ladies divested them of their clothing; feather pillows were placed under their feet; the stethoscope was applied to see that there was no movement of the lungs by which the sounds could be made. Under every condition imposed, the obstinate raps came—on doors, floors, walls, ceiling; the place seemed alive with them. When this final committee, baffled and mortified, made known their failure, the meeting broke up in the greatest excitement and confusion. But the object was gained: the facts were reported and commented on in all the journals throughout the country.

Circles for investigation were now everywhere formed, and not only were the rappings obtained, but new phases of these strange phenomena were constantly developed. In *Forty Years of American Life*, by Thomas Low Nichols, M.D., we read: 'Dials were made with movable hands, which pointed out letters and answered questions without apparent human aid. The hands of mediums, acting convulsively, and, as they averred, without their volition, wrote things apparently beyond their knowledge, in documents purporting to be signed by departed spirits. Their writings were sometimes made upside down, or reversed so as only to be read through the paper or in a mirror. Some mediums wrote with both hands at a time, different messages, *without*, as they said, being conscious of either. There were speaking mediums, who declared themselves to be the merely passive instruments of the spirits. Some represented, most faithfully, it was said, the actions, voices, and appearance of persons long dead; others, blindfolded, drew portraits, said to be likenesses of deceased persons they had never seen—the ordinary work of hours being done in a few minutes. Sometimes the names of deceased persons, and short messages, appeared in raised red lines upon the skin of the medium. Ponderous bodies, as heavy dining-tables and pianofortes, were raised from the floor, falling again with a crash and jar. Tables on which several persons were seated were in like manner raised into the air by some invisible force. Mediums are said to have been raised into the air, and floated about above the heads of the spectators. Writings and pictures were produced without visible hands. Persons were touched by invisible, and sometimes by visible hands. Various musical instruments were played upon without visible agency. Strange feats of legerdemain, as the untying of complicated rope knottings in an incredibly short time, astonished many. Voices were heard, which purported to be those of spirits. In a word, over a vast extent of country, from east to west, these phenomena existed, or were said to exist, in hundreds of places, and were witnessed by many thousands of people—numbers of whom were of the highest credibility, and the mass of those persons whose testimony no one would think of impeaching in a trial of life and death.'

Many theories were invented to explain these phenomena: they are now for the most part obsolete or forgotten. Each theory generally began by exploding its predecessors, and was in turn exploded by its successors. No sooner was a theory invented to explain one class of facts, than another sprang up for which it made no provision, and to which it was manifestly inadequate. Not only did the flame spread, but sometimes the extinguishers caught fire; and those who at first were its opponents, ended as its advocates. The most obdurate materialists became convinced of a future life for man by the experimental evidence spiritualism supplied. For instance, Professor Hare instituted a series of experiments intended to prove that the phenomena were wholly due to natural causes: and the public, and men of science in particular, were surprised when, in place of this explanation, there appeared a large work with his name as its author, entitled *Spiritualism Scientifically Demonstrated;* and with diagrams of ingenious apparatus invented by him to test the genuineness of the phenomena. The Hon. J. W. Edmonds, judge in the Supreme Court of Appeal for the state of New York, brought to bear upon the subject a mind trained by long judicial experience, and the careful sifting of evidence. He investigated with many different mediums, and took notes as carefully as though in court. To his great astonishment he found he was himself a medium, and under the title *Spiritualism*, he published two large volumes, narrating his investigations, visions, and spiritual communications. His daughter, Laura, also became a medium, and under some foreign influence would sometimes answer freely in languages with which in her normal state she was wholly unacquainted.

Reports of these marvels soon crossed the Atlantic; but in England, for a long time, they excited little serious attention, and were generally received, not only with incredulity, but with ridicule and contempt. The visit to London of Mrs. Haydon, an American medium, in 1854, first excited any considerable degree of public interest in spiritualism. Many visited her, most of whom were puzzled, some ridiculed, a few were convinced. Among the latter were Robert Owen, the founder of English Socialism, and Dr. Ashburner, the translator of Reichenbach, and the colleague of Dr. Elliotson in the establishment of the *Zoist* and of the Mesmeric Infirmary. In 1855, a more remarkable medium came to England, Mr. Daniel Dunglas Home. The manifestations which occurred in his presence were soon the subject of newspaper controversy. From that time to this they have been seen and tested repeatedly by scientific and other witnesses of the highest credit and social position; and they made him a frequent and welcome guest at the Tuileries and at the courts of Berlin and St. Petersburg. A full account of his strange experiences is given in his autobiography, entitled *Incidents in My Life.* They include nearly the whole range of 'manifestations' referred to in the important Report of which we are about to speak.

In January 1869, the London Dialectical Society appointed a committee 'to investigate the phenomena alleged to be spiritual manifestations, and to report thereon.' The committee invited evidence from all sides, and especially solicited the co-operation of scientific men, and resolved itself into sub-committees for experimental investigation and test. In July 1871, the committee presented its report, with minutes of evidence, reports of *séances*, and other documents, making a volume of 412 large octavo pages. The committee state that 'a large majority of the members of your committee have become actual witnesses to several phases of the phenomena, without the aid or presence of any professional medium, although the greater part of them commenced their investigations in an avowedly sceptical spirit.'

A synopsis of the evidence is also given as follows: 'Thirteen witnesses state that they have seen heavy bodies—in some instances men—rise slowly in the air, and remain there for some time without visible or tangible support. Fourteen witnesses testify to having seen hands or figures, not appertaining to any human being, but lifelike in appearance and mobility, which they have sometimes touched or even grasped, and which they are therefore convinced were not the result of imposture or illusion. Five witnesses state that they have been touched by some invisible agency on various parts of the body, and often where requested, when the hands of all present was visible. Thirteen witnesses declare that they have heard musical pieces well played upon instruments not manipulated by any ascertainable agency. Five witnesses state that they have seen red-hot coals applied to the hands or heads of several persons without producing pain or scorching; and three witnesses state that they have had the same test applied to themselves with the like immunity. Eight witnesses state that they have received detailed information through rappings, writings, or in other ways, the accuracy of which was unknown at the time to themselves or to any persons present, and which, on subsequent inquiry, was found to be correct. One witness declares

that he has received a precise and detailed statement, which, nevertheless, proved to be entirely erroneous. Three witnesses state that they have been present when drawings, both in pencil and colors, were produced in so short a time, and under such conditions, as to render human agency impossible. Six witnesses declare that they have received information of future events, and that in some cases the hour and minute have been accurately foretold days and even weeks before. In addition to the above, evidence has been given of trance-speaking, of healing, of automatic writing, of the introduction of flowers and fruits into closed rooms, of voices in the air, of visions in crystals and glasses, and of the elongation of the human body.'

One of the latest scientific investigators of spiritualism is Mr. William Crookes, F.R.S., discoverer of the metal thallium, editor of the *Chemical News* and of the *Quarterly Journal of Science*. In the latter journal for January 1874 is an article by him, entitled, 'Notes of an Inquiry into the Phenomena called Spiritual, 1870—1873.' He attests phenomena similar to those affirmed by the Dialectical Society's committee and its witnesses, which came under his notice in his own house, in the light, and with only private friends present except the medium, at times appointed by himself, and under circumstances which, he says, absolutely precluded the employment of the very simplest instrumental aids.

One of the most recent phases of spiritualism in this country is 'spirit photographs.' On clean and previously unused plates, marked by the sitter, and even when the sitter has used his own plates and camera, there has appeared with the sitter a second figure, which in many instances have been recognized as portraits of deceased relatives and friends. In the *Spiritual Magazine* for December 1872, is a list of the names and addresses of forty sitters who have so recognized these figures. They have been obtained by many photographers, both professional and amateur, in England, the United States, and on the continent of Europe.

The *Spiritual Magazine* (the oldest journal of spiritualism in England, and which contains a record of the movement from its establishment in January 1860) has the following as its motto: 'Spiritualism is based on the cardinal fact of spirit communion and influx; it is the effort to discover all truth relating to man's spiritual nature, capacities, relations, duties, welfare, and destiny; and its application to a regenerate life. It recognizes a continuous divine inspiration in man; it aims through a careful, reverent study of facts, at a knowledge of the laws and principles which govern the occult forces of the universe; of the relations of spirit to matter, and of man to God and the spiritual world. It is thus catholic and progressive, leading to true religion as at one with the highest philosophy.'

At a conference in Liverpool in November 1873, at which delegates from about forty societies attended, steps were taken which have led to the establishment of the 'British National Association of Spiritualists'—'to unite spiritualists of every variety of opinion for their mutual aid and benefit; to promote the study of pneumatology and psychology; to aid students and inquirers in their researches, by placing at their disposal the means of systematic investigation into the now recognized facts and phenomena, called spiritual or psychic; to make known the positive results arrived at by careful scientific research; and to direct attention to the beneficial influence which those results are calculated to exercise upon social relationships and individual conduct.'

In 1881 the chief English journals of spiritualism were *Light*, *Medium and Daybreak*, *Spiritualist*, and *Spiritual Notes*, weekly or monthly. In the United States the earliest was the *Banner of Light*, founded in 1857. In 1881 it was stated that there were in Germany 1 spiritualist magazine, in Austria 1, Holland 1, France 1, Belgium 4, England 7, Italy 1, Spain 5, United States 5, Argentine Republic 2, Mexico 2, Colombia 2. The literature of the movement is very voluminous. The following are important works on spiritualism: *Transcendental Physics*, translated from the German of Prof. Zöllner (1880), *Psychic Facts*, by Harrison (1880); *Researches in the Phenomena*, by Crookes (1874); *Modern American Spiritualism*, by Hardinge (1870); *From Matter to Spirit*, by Mrs. De Morgan, with preface by Professor De Morgan; *The Two Worlds*, by Thomas Brevior; *Footfalls on the Boundary of Another World*, and *The Debatable Land*, by Robert Dale Owen; *History of the Supernatural*, by William Howitt; *A Defence of Spiritualism*, by Alfred Russell Wallace; *Lights and Shadows of Spiritualism*, by D. D. Home (1877); *Mesmerism, Spiritualism, &c., Historically and Scientifically Considered*, by W. B. Carpenter, F.R.S. (1877).

SPI'TALFIELDS, a district of London, adjoining Bethnal Green, derives its name from the *hospital* of St. Mary, founded there in 1197, by Walter Brune and his wife Rosia, and is inhabited chiefly by silk-weavers and other poor people. The manufacture of silk was established in S. by emigrants from France, after the revocation of the Edict of Nantes.

SPI'THEAD, a celebrated roadstead on the south coast of England, and a favorite rendezvous of the British navy, is the eastern division—the Solent (q. v.), being the western division—of that strait which separates the Isle of Wight from the mainland. It is protected from all winds, except those from the south-east, and its noted security warranted the name, which has been applied to it by sailors, of the 'king's bedchamber.' It receives its name from the 'Spit,' a sandbank stretching S. from the English shore for 3 miles; and it is 14 miles long by about 4 miles in average breadth. Here, in 1797, the sailors of the Channel Fleet mutinied for more liberal pay and allowances, which were granted to them.

SPI'THEAD FORTS. The troubled state of European politics which gave rise in 1859 to the Volunteer movement, led also to the recommendation of an extensive plan of defence for the arsenals and coast. A Board of Commissioners drew up a scheme for these defences, to cost about £5,000,000, of which a sum of £2,000,000 was for Portsmouth, Spithead, and the neighboring coast. At present, the entrance to the important arsenal and dockyard at Portsmouth is defended by Fort Monckton on the Gosport side, Southsea Castle on the opposite side, Cumberland Fort at the entrance to Langston Harbor, Lumps and Eastney Forts between the two last named, and some defensive lines between the island of Portsea and the mainland. £580.000 was voted in 1860 as a beginning, to increase the number and strength of these forts, to build detached forts on shoals in the sea between the mainland and the Isle of Wight, and to raise fortified lines on Portsdown Hill (the principal work being Fort Southwick), wholly northward of Portsmouth Harbor. The works were commenced; but the often-conflicting lessons furnished by the American war led to much delay and endless variations of plan.

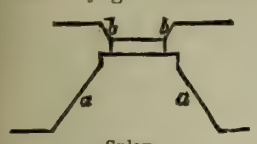
The National Defence Commissioners had proposed five advanced forts on the shoals known as Horse Sand, Noman or No Man's Land Shoal, Sturbridge Shoal, Spit Point, and a point intervening between Horse Sand and Portsea Island. But after much discussion and numerous alterations of plan, it was only in 1864 that it was determined to proceed with the foundations at least of two—the Horse and the Noman forts. The foundation of each fort consists of rings of stone-work, laid on the leveled bed of the shoal, tapering a little upwards from a width of 54 feet to one of 43 feet; the outer diameter of the ring gradually lessening from 231 to 213 feet. From 20 to 15 feet of sub-marine masonry is required. Outside the rings of stone are layers of rubble, to protect the stone-work from the action of tidal rush. Two years later, similar forts were begun on Spit Bank and St. Helens shoal. In 1865 a mortar battery had been erected at Puckpool in the Isle of Wight, commanding at long range the approach to Spithead. In 1868, after it had been found impossible to secure a foundation for a fifth fort on the Sturbridge shoal, Puckpool Battery was strengthened and armed with 30 mortars and four 25-ton guns.

All this time the government had not determined which of three modes to adopt for constructing the forts—whether to form them entirely of iron; or of granite faced with iron; or simply of granite, leaving the facing for after-consideration. The plan most in favor with the government in 1866 was to erect on each of the foundations at Spithead a *revolving* iron fort or tower of enormous magnitude.

Circumstances in 1867 induced the government again to pause. Experiments on the Rodman 15-inch and 20-inch guns led some engineers to believe that no iron casing for forts could resist shot of 500 lbs. to 1100 lbs. from such ordnance; while the rolling of an armor plate 15 inches thick (see ARMOR-PLATES) revived the hopes of those who believe that armor will eventually vanquish guns. Finally, the forts are nearly finished, of a granite core, surrounded by a great thickness of iron plates. Above each fort are revolving turrets carrying 35-ton guns, which throw shells of 700 lbs. The inner line of defence has been strengthened by new works at Gilkicker, Southsea Castle, &c., and by the increase in the size of the guns, and the additon of iron shields in the embrasures.

SPITZBE'RGEN, a group of islands in the Arctic Ocean, in lat 76° 30′—80° 40′ N., and long. 9°—22° E., lies 300 miles north of Scandinavia, and 325 east of Greenland. The group which is estimated to contain about 30,000 Eng. sq. m., is composed of three large and several small islands. The largest of the group, *Spitzbergen Proper*, consists of two oblong and parallel tracts known as West S. and East S. or New Friesland, connected by a neck of land; the whole strongly resembling a boat-hook in shape. The two next in size are *Egede* and *North-east Island*. Being far within the Arctic Circle, and surrounded by a wide expanse of sea, almost the whole of its surface is covered with perpetual snow and glaciers. The whole of the west side is mountainous, the general elevation being 3000—4500 feet above sea-level; and the same is true of the north-east coast. During ten months of the year, mercury freezes, and for the other two months, the temperature is seldom more than 5° above the freezing-point; yet, during this short summer, more than 100 species of plants, which constitute the vegetation of this inhospitable region, succeed in springing up, and producing and ripening

their seed. The whole of S. could not afford sustenance for one human being; but it is, nevertheless, a haunt of reindeer, foxes, and bears, and whales, and seals abound on the coasts. S. has from time to time been occupied by Dutch and Russian colonies, who were supplied from the mainland of Europe. It was discovered, in 1596, by William Barentz, the Dutch explorer, in his third voyage to discover the North-east Passage and has since been frequently visited by other explorers and by whalers. It is claimed as a dependency of its European territories by Russia.



Splay.

SPLAY, the sloping or bevelled opening in window recesses and such openings, as at *a*, *a*. Also the corner taken off the outer angle of such openings, as at *b*, *b*.

SPLEEN, THE, is the largest and most important of the so-called ductless glands, whose chief object is supposed to be to restore to the circulation any substances that may have been withdrawn from it. It is of an oblong flattened form, soft, of very brittle consistence, highly vascular, of a dark bluish-red color, and situated on the left hypochondriac region, with its interior slightly concave surface embracing the cardiac end of the stomach and the tail of the pancreas. (See the figure in the article PANCREAS.) It is invested by an external or serous coat, derived from the peritoneum, and an internal fibrous elastic coat. Mr. Gray, who wrote the Astley-Cooper Prize Essay, *On the Structure and Use of the Spleen*, states that the size and weight of this organ are liable to very extreme variations at different periods of life, in different individuals, and in the same individual under different conditions. In the *adult*, in whom it attains its greatest size, it is usually about five inches in length, three or four in breadth, and an inch or an inch and a half in thickness, and weighs about seven ounces. At *birth*, its weight in proportion to that of the entire body is as 1 to 350, which is nearly the same ratio as in the adult; while in *old age* the organ decreases in weight, the ratio being as 1 to 700. The size of the spleen is increased during and after digestion, and is large in highly fed, and small in starved animals. In intermittent fevers and leucocythemia, it is much enlarged, weighing occasionally from 18 to 20 lbs., and constituting what is popularly known as the *ague-cake*.

On cutting into the spleen, a section of it shows the presence of numerous small fibrous bands termed *trabeculæ*, united at numerous points with one another, and running in all directions. The parenchyma, or proper substance of the spleen, occupies the interspaces of the above described areolar framework, and is a soft pulpy mass of a dark reddish-brown color, consisting of colorless and colored elements. The *colorless elements* are described by Gray as consisting of granular matter, of nuclei about the size of the red-blood discs, and a few nucleated vesicles; and as constituting one-half or two-thirds of the whole substance of the pulp in well-nourished animals, while they diminish in number, and sometimes altogether disappear in starved animals. The *colored elements* consist of red blood-discs and of colored corpuscles either free or included in cells; sometimes enlarged blood-discs are seen included in a cell, but more frequently the enclosed discs are altered in form and color, as if undergoing retrograde metamorphoses. Besides these, numerous deep-red, or reddish-yellow, or black corpuscles and crystals, closely allied to the hæmatin of the blood, are seen diffused through the pulp-substance.

The venos blood of the spleen is carried away by the splenic vein, which contributes to form the great portal venos system, distributed through the liver; while arterial blood is supplied by the splenic artery, the largest branch of the cœliac axis. The branches of this artery subdivide and ramify like the branches of a tree, with the *Malpighian* or *splenic corpuscles* attached to them like fruit. These splenic corpuscles, originally discovered by Malpighi, are whitish spherical bodies, which are either connected with the smaller arterial branches by short pedicles, or are sessile upon their sheaths. They vary considerably in size and number, their diameter usually ranging from one-third to one-sixth of a line. Each consists of a membranous capsule, homogeneous in structure, and formed by a prolongation from the sheath of the artery.

The blood-vessels ramifying on the surface of a corpuscle consist of the larger branches of the artery with which it is connected, of venous branches, and of a delicate capillary plexus. From this arrangement of the vessels, it may be inferred that active changes are carried on in the contents of these corpuscles, which consist of a soft, white, semi-fluid substance, made up of granular matter, nuclei similar to those found in the pulp, and a few nucleated cells. These splenic corpuscles are much more distinct in early life than subsequently, and are much smaller in man than in most mammals. They, however, bear a remarkable relation to the general state of nutrition, being much the greatest in well-fed animals, especially in the early periods of the digestion of albuminous food; while they diminish extremely in ill-fed animals, and in those that have been starved, they disappear altogether.

The chemical composition of the spleen confirms the view that a retrograde change of tissue occurs very freely in it. In 1000 parts, there were found (by Oidtmann) nearly 250 of solid residue, of which more than 243 was organic, consisting of albumen, fats, inosite, uric acid, sarcine, xanthine, leucine, tyrosine, and pigment, all of which, excepting the first two, are products of the metamorphosis of tissue. This gland also contains a large quantity of oxide of iron, obtained probably from the disintegration of red blood-discs in it.

With regard to its uses, it may be regarded as a storehouse of nutritive material, which may be drawn upon according to the requirements of the system; and of the exertion of an assimilative action upon the albuminous matter, during its withdrawal from the general current of the circulation, we have direct evidence in the large increase in the proportion of fibrin contained in its venous blood—the blood of the splenic vein sometimes containing nearly six times the usual quantity of fibrin. Before the institution of the chemical inquiries which led to the above conclusion, it was held that the function of the organ was to act as a reservoir for the portal blood, with the view of preventing the portal vessels from being unduly distended during the digestive process. To what extent it is the seat of the disintegration of old blood-corpuscles, and of the formation of new ones, is still uncertain. The removal of this organ from the body has frequently been performed in animals without serious effects; but in some of these cases, small secondary spleens are developed, and in others, various sets of lymphatic glands are observed to increase rapidly, shortly after the operation, and these probably act vicariously for the spleen. Its singular and complicated microscopic structure, and its extreme vascularity, would lead to the inference that this is a highly important viscus.

It is unnecessary to enter into any detail regarding the diseases of the spleen, as most of them occur secondarily in the course of other affections, as in Intermittent Fever (Ague) and Leucocythemia (q. v.), when it is sometimes enlarged to 40 times its natural weight. It is sometimes diminished to the size of a walnut, the cause of this atrophy being unknown, but the apparent result being a loss of color, and a comparatively bloodless condition. The spleen is also liable to the singular morbid change known as *Waxy Degeneration* in which the presence of starch-like amyloid granules is observed in the tissue on submitting it to microscopico-chemical investigation. These remarkable granules dissolve when heated in water, and by the action of iodine acquire a bluish tint.

SPLEE'NWORT. See ASPLENIUM.

SPLE'NIC APOPLEXY, a disease of cattle and sheep, resembles Black Quarter (q. v.) in suddenly attacking animals in good thriving condition, and, like it, appears to depend upon the rapid manufacture of insufficiently elaborated blood, probably faulty in the healthy proportion of some of its constituents. The animal staggers, froths at mouth, throws itself about in convulsions, and sometimes dies within an hour. Few cases recover. The blood is thin, dark-colored, and indisposed to coagulate. It accumulates in the large internal organs, particularly in the liver and spleen, and is poured out on the mucous surfaces. If the animal is seen in time, and before the pulse becomes small and weak, a moderate bleeding may be tried. A full dose of physic, with a prompt stimulant, must at once be given, and cloths wrung out of hot water applied for several hours continuously, to the belly and loins. If the animal is weak, and the pulse scarcely perceptible, stimulants must be freely given from the first; and where there is stupor, cold water likewise applied to the head. To prevent the disease, attention must be paid to regular moderate feeding; abundance of wholesome water must be supplied; the grazings not allowed to become too rank, and changed occasionally; rock-salt placed within reach; and a seton inserted in the dewlap of animals pastured upon lands subject to S. A.

Pasteur's researches have shown that this fatal disease of splenic fever, also known as Anthrax or Siberian plague, is due to the presence in the blood of small organisms, specific bacteria in the blood. By artificially cultivating these bacteria, he further succeeded in developing a weaker crop of germs. By inoculating healthy animals with the viris, he produced a milder form of the disease, which protects from the more violent and dangerous malady—a process analogous to vaccination. See GERM-THEORY.

SPLINT, or SPLENT, is a bony enlargement on the horse's leg, between the knee and fetlock, usually appearing on the inside of one or both forelegs, frequently situated between the large and small canon bones, depending upon concussion, and most common in young horses that have been rattled rapidly along hard roads before their bones are consolidated. When of recent and rapid growth, the splint is hot and tender, and causes lameness, especially noticeable when the horse is trotted along a hard road. A piece of spongiopiline saturated with cold water should be ap-

plied to the splint, kept in position with a light linen bandage, and wetted with cold water or a refrigerant mixture every hour. Perfect rest must be enjoined for ten days or a fortnight. When the limb is cool, and free from tenderness, the swelling, which will still remain, may be greatly reduced by some stimulating applications, such as the ointment of the red iodide of mercury, the common fly-blister, or the firing-iron.

SPLINT-BONES. The horse and certain allied mammals have what is popularly known as an outer and an inner splint-bone in the skeleton of the leg. Beyond the bones of the carpus and tarsus, there is one very large bone (the metacarpal or metatarsal of the third toe), which supports the whole weight of the animal. On either side of this bone are the outer and inner splint-bones, which are small bones, not running more than half the length of the great central bone, into which they merge. They represent, in a rudimentary form, the metacarpal and metatarsal bones of the fourth and second toe.

SPLINTS, in Surgery, are certain mechanical contrivances for keeping a fractured limb in its proper position, and for preventing any motion of the fractured ends; they are also employed for securing perfect immobility of the parts to which they are applied in other cases, as in diseased joints, after resection of joints, &c.

Ordinary splints are composed of wood carved to the shape of the limb, and padded; the best pads being made out of old blankets, which should be cut into strips long and wide enough to line the splints, and laid in sufficient number upon one another to give the requisite softness. The splints should be firmly bound to the previously bandaged limb with pieces of bandage, or with straps and buckles; care being taken that they are put on sufficiently tight to keep the parts immovable, and to prevent muscular spasm, but not so tight as to induce discomfort. Gutta percha, sole-leather, or pasteboard, after having been softened in boiling water, may in some cases advantageously take the place of wooden splints. They must be applied when soft to the part they are intended to support, so as to take a perfect mould, and then be dried, stiffened, and, if necessary, lined. An account of the more complicated kinds of splint required in certain cases, as Macintyre's Splint, Liston's Splint, &c., may be seen in any illustrated catalogue of surgical instruments.

The ordinary splint is now to a great degree superseded by immovable bandages, which consist of the ordinary bandage saturated with a thick mucilage of starch, or with a strong solution of a mixture of powdered gum-arabic and precipitated chalk, which, when dry, form a remarkably light but firm support. As, however, these bandages require some hours to dry and become rigid, means must be used to counteract any displacement of the limb in the interval. On this account, many surgeons prefer the plaster of Paris or gypsum bandage, which is applied in the following manner: the limb being protected by a layer of cotton-wool, a bandage composed of coarse and open material, into which as much dry powdered gypsum as possible has been rubbed, must be immersed in water for about a minute, and then rolled around the limb in a spiral manner, just as an ordinary bandage; after every second or third turn of the bandage, the left hand of the surgeon should be plunged into water, and smeared over the part last applied. When the whole has been thus treated, the exterior of the bandage should be smeared over with a paste of gypsum and water until a smooth surface and complete rigidity have been attained—a process not occupying more than ten minutes or a quarter of an hour.

In a case of simple fracture, where no surgical aid is at hand, any non-professional person of ordinary intelligence might apply this bandage, extreme care being taken that the ends of the broken bones are in their proper position.

SPLÜ'GEN, a mountain of the Lepontine Alps, in the Grisons, Switzerland, whose summit, 9600 feet high, bears the name of the Tombenhorn. The pass of the Splügen, connecting the south-east of Switzerland with the region of Italy round Lake Como, is at its highest point 6940 feet above the sea, and in its present condition is the work of the Austrian government (1823.) The southern or Italian descent has three great 'galleries'—i. e., covered portions of the pass constructed of solid masonry, and intended to protect the road from avalanches. They are the longest on any Alpine high-road. When Marshal Macdonald conducted the French army of reserve across the S. by the old path, 27th November—4th December 1800, he lost severely in men and horses from the fall of avalanches

SPOHR, LUDWIG, an eminent German musical composer and violinist, son of a physician of Brunswick, and born in that town in 1784. He began his violin studies in boyhood; at the age of twelve, he played a violin concerto of his own at the court of Brunswick; and at thirteen he obtained an appointment as chamber-musician to the duke. A few years later he made a musical tour through Russia and Germany, giving concerts, and acquiring a high reputation as a performer on the violin. In 1804, he became music director at the court of Saxe-Gotha, and held afterwards for several years the office of Music Director of the Theater an der Wien at Vienna. He visited Italy in 1817, Paris in 1819, and in 1820 appeared in London, where he was received with great applause at the Philharmonic Society's concerts, and produced two symphonies and an overture. In 1823, he became Kapellmeister at the court of Hesse-Cassel, which post he continued to hold till 1857, when he retired from professional life. He died in 1859.

S.'s musical works include seven operas—*Faust*, *Jessonda*, *Zemira und Azor*, *Der Zweikampf der Geliebten*, *Der Berggeist*, *Peter von Albano*, and *Der Alchymist;* three oratorios, *Die letzten Dinge*, *Des Heiland's letzte Stunden*, and *Der Fall Babylons;* various masses, psalms, and hymns, six grand symphonies, four overtures, besides nonettes, quartetts, violin concertos, sonatas for violin and harp, fantasias, and rondos. *Die letzten Dinge*, or Last Judgment, is a very grand and very attractive work; so also is *Der Fall Babylons*, first produced at a Norwich musical festival. Of his operas, the most esteemed are *Faust* and *Jessonda*, the latter remarkable for its successful embodiment of the spirit of oriental poetry. His songs are rather deficient in broad and decided melody; but his instrumental works occupy a very high place in the estimation of musicians, more especially the C minor symphony, and the symphony known as *Die Weihe der Töne*. As a violinist, S.'s purity of tone and high finish have never been surpassed, and his *Violinschule* is the best and most complete work on violin-playing ever written.—See *The Autobiography of L. Spohr;* translated from the German (Lond. 1864).

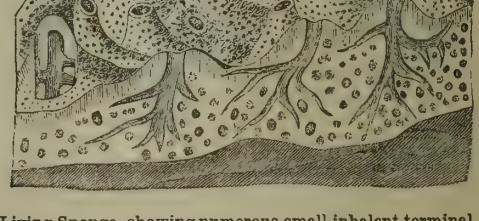
SPOLE'TO (Latin, *Spoletium*), a city of Central Italy, province of Perugia, is situated on a rocky hill, 61 miles north-north-east of Rome. Pop. (1871) 7493. It is commanded by a citadel, which is built on a separate hill, divided from that on which the town stands by a deep gorge, crossed at an immense height by a bridge and aqueduct. The streets are steep, narrow, and dirty. S. has a fine cathedral, built in the time of the Lombard dukes, and containing many interesting works of art. The churches of St. Dominico, San Giovanni, the collegiate church of San Pietro, and the palace of the ancient dukes of S., are also worthy of being mentioned.

The ancient *Spoletium* had its origin in a Roman colony which was planted here about 240 B.C.; and during the second Punic War, Hannibal is said to have been repulsed by the colonists in an assault which he made on the town (217 B.C.), after the battle of Thrasymene. Under the Lombard dukes, it became the capital of an independent duchy. In 1860, it was taken by the Italians from a body of Irish mercenaries in the service of the pope, and now forms a part of the Kingdom of Italy. S. contains many interesting Roman remains, as also a ruin which goes under the name of the Palace of Theodoric. It has manufactures of woollens and hats.

SPO'NDIAS. See HOG PLUM.

SPONGE (*Spongia*), a genus which originally included all the numerous genera and species of the family *Spongiadæ*, all of which are still commonly spoken of by naturalists as sponges, although in its more popular sense that term is limited to a few kinds, or to their fibrous framework. The sponges are creatures of very low organization, concerning which controversies long raged, first as to whether they ought to be referred to the animal or the vegetable kingdom, and more recently as to their systematic position in the former group. At first referred to the *Protozoa*, and later to the *Cœlenterata* (see ZOOLOGY), they are now considered by the greater number of naturalists as entitled to rank as a separate subkingdom, *Porifera*, characterized by the multitude of mouths or inhalent apertures which open through the body wall, the primitive mouth of the two-layered sac-like embryo being converted into the large exhalent opening.

They may be classified as follows: 1. *Myxospongiæ* destitute of



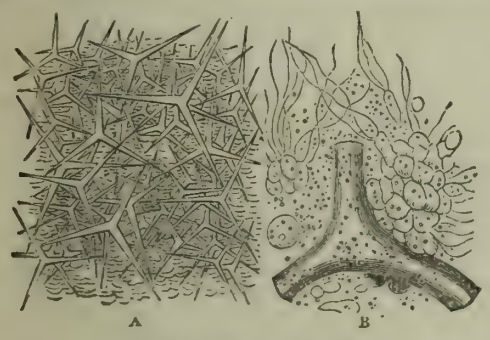
Living Sponge, showing numerous small inhalent terminal, large exhalent orifices.

skeleton; 2. *Fibro-spongiæ*, having a fibrous skeleton, with or without siliceous spicules; 3. *Calcispongiæ*, having calcareous spicules. These spicules are not purely mineral, but contain a trace of organic matter. They are most beautiful microscopic objects,

and spicules of different forms are sometimes found in the same species, sometimes lying close together in bundles, sometimes straight or slightly curved, sometimes in the shape of needles pointed at one end, or at both; sometimes of needles radiating from a center; whilst some have a head at one end, like a pin, some have grapnel-like hooks at the ends. Some of the species with horny framework have spicules imbedded in it; some have them implanted in the fibres; some are destitute of them. There is a beautiful West Indian species, *Dictyocalyx pumiceus*, in which the siliceous matter becomes itself a fibrous network, and is so fine and transparent as to resemble spun glass. In a living state, many sponges exhibit lively colors, from the presence of coloring matter.

Like any of the higher animals, the body of the sponge is composed of a distinct outer layer of cells, the ectoderm or epidermis, and a ciliated inner layer or endoderm (often restricted to definite areas, the so-called 'ciliated chambers'), between which a middle layer of cells, the mesoderm arises. This may be of very variable thickness, and gives rise to the skeleton. From the close resemblance which the cells of the ectoderm and mesoderm present to *Amœbæ*, and those of the endoderm to those Infusorians known as *Monads*, it has been argued that the sponge is a mere colony of Protozoa. The development of the sponge, however, accords too closely with that of higher animals to admit of such a view, a free-swimming ciliated larva being produced by segmentation of a fertilized ovum; but it is undeniable that in the sponge we have a degree of independence of the cell units far greater than that which exists in any other group—a divided sponge readily reunites, and adjacent masses grow together. They assume very various forms, which, as well as the peculiarities in the structure of the framework, are characteristic of the different genera and species. Some are nearly globular; some cup-shaped, top-shaped, conical, cylindrical, thread-like, &c.; some are simple, and some branched.

The surface of a living sponge is generally covered with minute pores, through which water is imbibed, carrying with it both the air and the organic particles necessary for the support of life. The pores are supposed to be permanent in many of the sponges,



Structure of *Grantia compressa*:
A, portion showing general arrangement of triradiate spicules and intervening tissue, magnified; B, small portion highly magnified, showing ciliated cells.—From Carpenter *On the Microscope*.

and the currents which enter through them to be produced by cilia, although these have as yet been detected only in a few species. But in those of the very lowest organization, the pores seem to be formed for the occasion, just as the *Amœba* opens anywhere to admit food within its substance.

In *Spongilla fluviatilis*, a small fresh-water species found in Britain, the opening and closing of each pore occupies less than a minute, and the pores do not open simultaneously, but in irregular succession, and apparently never again in precisely the same spot. No trace of the pore remains for an instant after its closing, nor is there any indication of the point where a new one is to open. The water which enters by the pores passes out of some sponges by a single orifice, which serves for the whole mass; others have numerous orifices (*oscula*) which are permanent, and are much larger than the pores by which the water is imbibed, the whole mass being pervaded by canals which lead from the pores to these orifices, from which, under the microscope, a constant discharge of water may be seen taking place, minute opaque particles being carried along with its current. These particles are not only fæcal matter, but gemmules and ova.

Reproduction takes place both by gemmation and by true ova. Many of the gemmules go to increase the sponge-mass; but the greater part finally become detached, and are carried out into the water, to settle down in a new locality. Mr. Huxley has detected true ova and sperm-cells imbedded in the substance of sponges.

The sponges employed for domestic and other purposes derive their value from the elasticity and compressibility of their fibrous framework, divested of the glairy substance, and its power of imbibing fluids. The absence of spicules is essential to a useful sponge. The kinds fit for use are found in the seas of warm climates. Some small species of sponge live at great depths. One has been brought up in the Gulf of Macri from a depth of 185 fathoms. Numerous species of sponge are very abundant on many parts of the British coasts.

Fossil remains of sponges are found in many rocks, and of horny, fibrous kinds, as well as of those with calcareous or siliceous framework.

Several species of sponge are in use for economical purposes. Two species are chiefly brought from the Levant, and a very inferior one from the West Indies and coast of Florida. The trade in sponge is very considerable; it is carried on chiefly by the Turks and the inhabitants of the Bahama Islands. The number of men employed in the Ottoman sponge-fishery is between 4000 and 5000, forming the crews of about 600 boats. These boats find their chief employment on the coasts of Candia, Barbary, and Syria. The sponge is obtained by diving, the diver taking down with him a flat piece of stone of a triangular shape, with a hole drilled through one of its corners; to this a cord from the boat is attached, and the diver makes it serve to guide him to particular spots. When he reaches the growing sponges, he tears them off the rocks, and places them under his arms; he then pulls at the rope, which gives the signal to his companions in the boat to haul him up. The value of sponges collected in Greece and Turkey is from £90,000 to £100,000 annually. The Greeks of the Morea, instead of diving, obtain sponges by a pronged instrument; but the sponges thus collected are torn, and sell at a low price. The best sponges are obtained on detached heads of rock in 8 or 10 fathoms water.

The sponges of the Bahamas and other West Indian islands are of a larger size and coarser quality; but large quantities are gathered; and about 215,000 lbs., worth £17,000, are sent annually to Great Britain. The sponges are torn from the rocks by a fork at the end of a long pole. To get rid of the animal matter, they are buried for some days in the sand, and then soaked and washed.

The domestic uses of sponge are familiar to every one. It is also of great value to the surgeon, not only for removing blood in operations, but for checking hæmorrhage. Burnt sponge was once a valued remedy was scrofulous diseases and goitre; but iodine and bromine, from which it derives all its value, are now administered in other forms.

SPO'NSOR (Lat. one who promises), the name given in theological use to a Godfather[s] or Godmother (q. v.). The name is derived from the circumstance, that in baptism or confirmation, and especially in infant baptism, the sponsor is understood to make certain promises or engagements in the name, and on the part of the person baptized or confirmed. The idea of sponsorship is entirely rejected not only by Baptists, but generally also by Presbyterians and Independents.

SPONTANE'ITY, the name for the doctrine, referring to the Human Mind, that muscular action may, and does, arise from purely internal causes, and independent of the stimulus of sensations. It had long been the tacit assumption, in Mental Philosophy, that we are never moved to action of any kind, except under the stimulation of some feeling, some pleasure or pain, or some end in view. To this is now opposed the doctrine of the Spontaneous commencement of movements under certain circumstances; which, however, does not exclude, but only supplements, the operation of the feelings in stimulating movements, as in the ordinary course of voluntary action. The doctrine supposes that the nerve-centers, after repose and nourishment, acquire a fulness of vital energy, which discharges itself in the play of movement, without any other occasion or motive; the addition of a feeling, or end, enhances and directs the activity, but does not wholly create it.

Of the various proofs and illustrations of Spontaneity, perhaps the most striking is that furnished by the movements of young animals of the active species. A young dog or kitten shows a degree of activity out of all proportion to any feeling to be gratified, or any end to be served; we can interpret it only as internal energy seeking vent, irrespective of the pursuit of pleasure or the avoidance of pain—in other words, the action of the will. When the accumulated energy is expended, the animal falls back into a state of repose, and is then roused only by the stimulus of sensation. The state called 'freshness' in a horse, for example, is a state of superabundant and irrepressible activity. Children go through the same phase: after rest or confinement, they burst forth incontinently into some form of active excitement, of which a part may be considered as pure spontaneity, while part may be owing to sensation.

The doctrine is well fitted to express the difference between the active and the sensitive temperaments; for if it were true that action is in proportion to the stimulation of the feelings, the most susceptible characters would be the most active. But, in point

of fact the active temperament is manifested by a profusion of activity for its own sake, with little circumspection or regard to consequences; and constitutes the restless, bustling, roughshod, energetic, and enterprising disposition of mind, as seen in sportsmen soldiers, travelers, &c.

The explanation of the growth of the Will (q. v.), or voluntary power, involves the spontaneous beginning of movements.—See Bain on *The Senses and the Intellect*, 2d edit., p. 76.

SPONTA'NEOUS COMBU'STION is a phenomenon that occasionally manifests itself in mineral and organic substances. The facts connected with the spontaneous ignition of *mineral* substances are well known to chemists, and some of them have been already described in the article PYROPHORUS (q. v.). Ordinary charcoal does not undergo combustion in air under a temperature of 1000°, but in some states it is liable spontaneously to acquire a temperature which may lead to unexpected combustion. Thus, lamp-black impregnated with oils, which contain a large proportion of hydrogen, gradually becomes warm, and inflames spontaneously. According to M. Aubert, Chevallier, and other French observers, recently-made charcoal, in a state of fine division, is liable to be spontaneously ignited without the agency of oil; but we are not aware that this phenomenon has been observed in this country. There have been many instances of the spontaneous ignition of coals containing iron pyrites, (q. v.) when moistened with water. The pyrites which most readily give rise to spontaneous combustion are those in which the protosulphide is associated with the bisulphide of iron; and these occur in the Yorkshire coals from Hull, and in some kinds of South Wales coal. Sulphur has no tendency to spontaneous combustion, but Dr. Taylor refers to an instance that came to his own knowledge, in which there was reason to believe that the vapor of bisulphide of carbon in an india-rubber factory was ignited by solar heat traversing glass. Phosphorus, when in a dry state, has a great tendency to ignite spontaneously, and it has been observed to melt and take fire (when touched) in a room in which the temperature was under 70°. The ordinary lucifer-match composition is luminous in the dark, in warm summer nights, which shows that oxidation, and therefore a process of heating, is going on. Hence, large quantities of these matches kept in contact may produce a heat sufficient for their ignition. 'I have seen them ignite,' says Dr. Taylor, 'as a result of exposure to the sun's rays for the purpose of drying.'—*Principles and Practice of Medical Jurisprudence*, 1865, p. 603.

From these cases occurring in the mineral kingdom, we pass to the consideration of spontaneous combustion in *organic* substances. Passing over the accidents that may result from the admixture of strong nitric or sulphuric acid with wool, straw, or certain essential oils, and which, if they occur, are immediate and obvious, we have to consider the cases in which, 'without contact with any energetical chemical compounds, certain substances—such as hay, cotton and woody fibre generally, including tow, flax, hemp, jute, rags, leaves, spent tan, cocoa-nut fibre, straw in manure-heaps, &c.—when stacked in large quantities in a damp state, undergo a process of heating from simple oxidation (eremacausis) or fermentation, and, after a time, may pass into a state of spontaneous combustion.'—Taylor, *op. cit.* p. 606. There is undoubted evidence that hay and cotton in a damp state will occasionally take fire without any external source of ignition. Cotton impregnated with oil, when collected in large quantity, is especially liable to ignite spontaneously; and the accumulation of cotton-waste, used in wiping lamps and the oiled surfaces of machinery, has more than once given rise to accidents, and led to unfounded charges of incendiarism. Dr. Taylor relates a case in which a fire took place in a shop 'by reason of a quantity of oil having been spilled on dry sawdust.' According to Chevallier, vegetables boiled in oil furnish a residue which is liable to spontaneous ignition; and the same chemist observes that all kinds of woollen articles imbued with oil, and collected in a heap, and hemp, tow, and flax, when similarly treated, may ignite spontaneously.

In the case of Hepburn *v.* Lordan, which came before Vice-chancellor Wood in January 1865, and was carried by appeal before the Lords Justices, in the following month, an attempt was made to prove that wet jute was liable to undergo spontaneous combustion; and the great fire at London Bridge in 1861 was referred to the spontaneous combustion of jute in its ordinary state. With regard to the latter hypothesis, Dr. Taylor remarks that it is wholly incredible, and from experiments which he made for the defendants in the above lawsuit, and on other grounds, he holds that there is no evidence of moist jute undergoing spontaneous combustion; but, he adds, although no cases are recorded, it is probable that jute, cocoa-nut fibre, and linen and cotton rags, imbued with oil, might undergo this change. Dry wood is supposed by Chevallier and some other chemists to have the property of igniting spontaneously. Deal which has been dried by contact or contiguity with flues or pipes conveying hot water or steam at 212°, is supposed to be in a condition for bursting into flame when air gets access to it; and the destruction of the Houses of Parliament, and many other great fires, have been ascribed to this cause; but from the experiments of Dr. Taylor (*op. cit.*, p. 615) this view must be regarded as untenable.

It is still an open question whether such organic nitrogenous matters as damp grain or seeds of any kind ever undergo spontaneous combustion. In a case recorded in the *Annales d'Hygiène* for 1841, MM. Chevallier, Ollivier, and Devergie drew the conclusion that a barn had caught fire from the spontaneous combustion of damp oats which were stored in it. No such cases are known to have occurred in this country.

The subject of the article is of extreme importance, not only because it may cause great destruction of life and property, but because it may lead to unjust charges of incendiarism.—For further details regarding it, the reader is referred to Graham's 'Report on the Cause of the Fire in the *Amazon*,' in the *Quarterly Journal of the Chemical Society*, vol. v. p. 34; to the article 'Combustion' in Watts's *Dictionary of Chemistry*, vol. i.; and to the elaborate chapter on this subject in Taylor's *Principles and Practice of Medical Jurisprudence*.

SPONTANEOUS COMBUSTION OF THE HUMAN BODY. In medico-legal works, cases are recorded, generally of a somewhat ancient date, in which it was supposed that the body was either spontaneously consumed by inward combustion, or acquired such extraordinary combustible properties as to be consumed when brought into contact with fire. The following is one of the first of the cases on record. It rests on the authority of Le Cat, a distinguished surgeon of his time, and is stated to have occurred at Rheims in 1725. The remains of a woman named Millet were found burned in her kitchen, about eighteen inches from the open fire-place. Nothing was left of the body, except some parts of the head, of the legs, and of the vertebræ. Suspicion was excited against the husband, and a criminal inquiry was instituted; but learned experts reported that the case was one of spontaneous combustion, and the prisoner was acquitted. The facts are explicable on the supposition, that the clothes of the deceased woman were accidentally ignited; and although the almost complete destruction of the body appeared to the medical men of that time to be inconsistent with the ordinary effects of fire, subsequent observations have shown that this is an error. In reference to this case, Liebig observes that it is easy to see that the idea of spontaneous combustion arose at a time when men entertained entirely false views on the subject of combustion, its essence, and its cause. What takes place in combustion generally has only been known since the time of Lavosier (about a century ago), and the conditions which must be combined in order that a body should continue to burn, have only been known since the time of Davy, or for little more than half a century. From the time when the case of Millet occurred to the present day, probably somewhat over 50 supposed cases have been recorded. (In an article published on the subject by Dr. Frank of Berlin in 1843, 45 cases are adduced.)

From an analysis of all the cases on record up to 1851, Liebig arrives at the conclusion that the great majority agree in the following points: '1. They took place in winter. 2. The victims were brandy-drinkers in a state of intoxication. 3. they happened where the rooms are heated by fires in open fireplaces and by pans of glowing charcoal, in England, France, and Italy. In Germany and Russia, where rooms are heated by means of closed stoves, cases of death ascribed to spontaneous combustion are exceedingly rare. 4. It is admitted that no one has ever been present during the combustion. 5. None of the physicians who collected the cases, or attempted to explain them, has ever observed the process, or ascertained what preceded the combustion. 6. It is also unknown how much time had elapsed from the commencement of the combustion to the moment when the consumed body was found.'—*Letters on Chemistry*, 3d ed., 1851, p. 282. Out of the 45 cases collected by Frank, there are only three in regard to which it is assumed that combustion took place when no fire was in the neighborhood; and Liebig distinctly shows that these three solitary cases are totally unworthy of belief. With regard to the other cases, the writers who record them do not deny the presence of fire, but assume that the body was ignited by the fire, and then burned on like a candle or a bundle of straw, under similar conditions, till nothing but ashes or charcoal was left. These writers maintain that excess of fat, and the presence of brandy in the body, induce an abnormal condition of easy combustibility; but Liebig shows, by numerous illustrations, the utter fallacy of this view; and adds, as further evidence, 'the fact that hundreds of fat, well-fed brandy-drinkers do not burn, when by accident or design they come too near a fire. It may with certainty be predicted, that so long as the circulation continues, their bodies would not take fire, even if they held a hand in the fire till it was charred.' Spontaneous combustion in a living body is (he adds) absolutely impossible.

Notwithstanding the wide promulgation of Liebig's views, the

belief in the possible occurrence of spontaneous combustion, seems not yet to have disappeared. In 1847, the body of a man, aged 71, and who was neither fat nor a drunkard, was found in bed in a state of combustion. Dr. Nasson, who was commissioned to investigate the case, reported that the burning must have resulted from some inherent cause in the person—probably roused into activity by a hot brick that was placed at his feet; and Orfila is reported to have coincided in this opinion.' This case is reported in the *Gazette Médicale*, September 4, 1847. On the 13th of June 1847, the Countess of Goerlitz was found dead in her bedroom, with the upper part of her body partly consumed by fire. The head was a nearly shapeless black mass, with the charred tongue protruding from it. The physician who was consulted could suggest no other explanation than that the body of the countess must have taken fire spontaneously, and not even by ignition of her dress by a candle. On this evidence, she was buried; but circumstances having led to the suspicion that she had been murdered by her valet Stauff (who had been detected in attempting to poison the count), her body was exhumed in August 1848, fourteen months after her death, and was subjected to a special examination by the Hesse Medical College, who reported that she had not died from spontaneous combustion. The case was then referred to Liebig and Bischoff, and their report was issued in March 1850, when Stauff was put upon his trial. They found no difficulty in concluding that the body was wilfully burned *after death*, for the purpose of concealing the murder (either by strangulation or a blow on the head), which had been previously perpetrated. The prisoner was convicted, and subsequently confessed that he had committed the murder by strangulation, as indeed the protruded tongue might have suggested. Since that date, there has not been any case of alleged spontaneous combustion.—On this subject, the reader is referred to the various articles on 'Spontaneous Combustion' in the Medical Dictionaries and Encyclopædias; to Dupuytren's *Leçons Orales;* to Liebig's *Letters on Chemistry;* and to Taylor's *Medical Jurisprudence.*

SPONTANEOUS GENERATION. See GENERATION SPONTANEOUS.

SPONTOO'N, a weapon bearing resemblance to a halberd, which, prior to 1787, was borne instead of a half-pike by officers of British infantry. It was a medium for signaling orders to the regiment. The spontoon planted in the ground commanded a halt; pointed backwards or forwards, advance or retreat; and so on.

SPOOL, in Spinning, a wooden reel for winding yarn upon. In sewing and lace-making machines, the spools are of metal, and their forms vary according to the requirements of the machine.

SPOO'NBILL (*Platalea*), a genus of birds of the Heron family (*Ardeidæ*), much resembling storks both in their structure and their habits, but distinguished by the remarkable form of the bill, which is long, flat, broad throughout its whole length, and much dilated in a spoon-like form at the tip. The species are not numerous, but are widely distributed. The only European species is the WHITE S. (*P. leucorodia*), rare in Britain, although in former times, before the draining of the fens in England, it was a more frequent summer visitor. It is common in Holland, in marshy districts throughout the northern parts of Europe and Asia in summer, and in the salt marshes of the coast of Italy in winter. It also inhabits Africa, and its range extends over the whole of that continent. It is gregarious, and the flocks of spoonbills generally make their nests in woods, in the tops of lofty trees. It is considerably smaller than the Common Heron. Its color is white, slightly tinged with pink; the bill and legs are black. A curious convolution of the windpipe, in the form of the figure 8, is found on dissection in the adult S., but does not exist in the young. The flesh of the S. is said to be tender and of good flavor. The S. is easily tamed, is quiet and inoffensive, and feeds readily on any offal.—The ROSEATE S. (*P. ajaja*) is an American species; very abundant within the tropics, and found in the most southern parts of the United States. It is nearly equal in size to the White S., which it resembles in its habits, It is a beautiful bird, with plumage of a fine rose-color, of which the tint is deepest on the wings; the tail-coverts crimson.

SPO'RADES. See ARCHIPELAGO.

SPORA'DIC (Gr. scattered) is a term applied to any disease that is naturally epidemic or contagious, when it attacks only a few persons in a district, and does not spread in its ordinary manner. The conditions on which the occurrence of epidemic or contagious diseases in a sporadic form depend are unknown. Amongst the diseases which occur in this form may be especially mentioned catarrh, cholera, dysentery, measles, scarlatina, and small-pox.

SPORE, in Botany, may be called the *seed* of a cryptogamous plant, as it serves the same purpose of reproduction as the seed of a phanerogamous or flowering plant, and after remaining for a time in a state of rest, is developed into a new plant on the occurrence of the necessary conditions. A spore, however, differs very much from the seed of a phanerogamous plant, as it always consists of a single cell, and therefore does not contain any *embryo* or rudiment of the future plant. In its formation, it corresponds rather with the grains of pollen in the anther of a flower. Spores are small, often so minute as to be invisible to the naked eye—many of them extremely minute, so that they may be wafted about unperceived. This, indeed, might be expected from the very small size of many of the cryptogamic plants themselves, as moulds and many other fungi. But even the spores of the largest ferns are very small. Spores often remain capable of germination for many years, and they seem to be capable of enduring much drought without destruction. They seem to germinate indifferently from any part of their surface, in which they differ essentially from the seeds of phanerogamous plants. In the parent plant, they are either scattered singly, or are united in a fruit-like envelope, which is generally known as a *Sporangium*, or *Sporecase*. In some plants, they are united in definite numbers, as of four (a *tetraspore*), surrounded by an envelope (*perispore*, or *sporidium*). The peculiar reproductive organ, which in some cryptogamous plants produces the spores, is called a *sporocarp*, or a *sporophore*. In many plants, as in mushrooms, the production of spores belongs exclusively to a part of the plant called the *hymenium*.

SPORTS, BOOK OF, the name popularly given to a Declaration issued by James I. of England in 1618, to signify his pleasure that on Sundays, after divine service, 'no lawful recreation should be barred to his good people, which should not tend to the breach of the laws of his kingdom and the canons of his church.' The sports specified were dancing, archery, leaping, vaulting, May-games, Whitsun-ales, morrice-dances, and the setting up of May-poles. The occasion of this proclamation was the conduct of some Puritan authorities in Lancashire, who, in illegally suppressing, instead of regulating, the customary recreations of the common people, had excited much discontent, and increased the influence of the Roman Catholics by giving a repulsive aspect to the Reformed religion. Although the Declaration was ordered to be read in the parish churches of the diocese of Chester, this order was not enforced, and the king's design was allowed to drop. Among the excepted unlawful sports were bear-baiting, bull-baiting, bowling, and interludes. Non-conformists and others not attending divine service at church were prohibited from joining in the sports, nor was any one allowed to go out of his own parish for that purpose, or to carry offensive weapons. By republishing this Declaration in 1633, and enforcing with great severity the reading of it by the clergy in their churches (see SABBATH), Charles I. and Laud excited among the Puritans a degree of indignation which contributed not a little to the downfall of the monarchy and the church. In 1644, the Long Parliament ordered all copies of it to be called in and publicy burned.—Heylin's *Hist. of the Sabbath and Life of Laud*, Fuller's *Church History*, D'Israeli's *Life of James I.*, Southey's *Book of the Church*, Hallam's *Constitutional History of England*, and Cox's *Literature of the Sabbath Question.*

SPOTTISWOOD, JOHN, Archbishop of St. Andrews, son of John Spottiswood, Superintendent of Lothian, was born in the year 1565. He was educated at the university of Glasgow, and on his father's death, succeeded him as Parson of Calder. In 1601, he attended the Duke of Lennox as chaplain, when that nobleman was sent as ambassador to France by King James VI. When James succeeded to the English crown, S. accompanied him on his journey to London, and, soon after that event, on the death of Archbishop James Beaton, was appointed to the see of Glasgow. He was chosen Moderator of the General Assembly of the Scottish Church, which met at Glasgow in 1610, and completed the establishment of episcopal government, which James had labored so long to accomplish. In October of that year, he was, along with the bishops of Brechin and Galloway, consecrated at London House by the Bishop of London and other English prelates. In 1615, he took a leading part in the examination of John Ogilvie, a Jesuit priest, who was apprehended at Glasgow, and hanged for refusing to disown the temporal power of the pope. The share he took in this matter was most discreditable to the archbishop. In the course of the same year, he was translated to the see of St. Andrews. As primate of the Scottish Church, S. had now the chief management of ecclesiastical affairs, and great influence also in the civil government, and his rule was marked by uniform ability, and, with rare exceptions, by prudence and moderation. He presided at the Assembly which met at Perth in 1618, and sanctioned the five points of ecclesiastical discipline known as the Perth Articles. He was as much in favor with King Charles I. as he had been with King James, and at the coronation of that sovereign at Holyrood in 1633, he placed the crown on his head and anointed him.

In 1635, S. was made Chancellor of Scotland, a dignity which no churchman had held since the Reformation; but in accepting

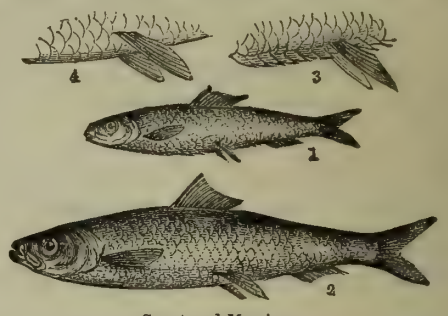
an appointment so invidious to the nobles, he did not act with his usual discretion. He reluctantly entered into the king's unwise measures for the introduction of a liturgy into Scotland, and became one of the chief objects of popular dislike when the Covenanters acquired the ascendency. He soon found it necessary for his safety to retire to England, and in the end of 1638, at the king's request he resigned the chancellorship. He protested against the lawfulness of the General Assembly which met at Glasgow in November of the same year, and was deposed and excommunicated by that body for alleged offences, which, so far as his private character was concerned, were improbable in themselves, and supported by no evidence whatever. The archbishop did not long survive the overthrow of the polity which it had been the work of his life to build up. He died at London on the 26th of November 1639, being then in the 74th year of his age. He had expressed a wish to be buried at Dairsie in Fife, where he had rebuilt the church after the English model, but this was found impracticable, and he was interred in Westminster Abbey. The writings of S. are his well-known *History of the Church of Scotland*, first published in 1655; a Sermon preached at the meeting of the Perth Assembly of 1618, which was published by Bishop Lindsay in 1621 in his account of the proceedings of that Assembly; and a Latin treatise, *Refutatio Libelli de Regimine Ecclesiæ Scoticanæ*, written in answer to a tract of Calderwood's, and published in 1620. The chief authorities for the biography of the archbishop are the Life ascribed to Bishop Duppa, prefixed to the folio editions of his *History*, and the Life by Bishop Russell, prefixed to the Spottiswood Society edition of the same work.

SPRAIN. A sprain or *strain* is a term employed in Surgery to designate a violent stretching of tendinous or ligamentous parts with or without rupture of some of their fibres. Sprains are very frequent in all the joints of the upper limbs, especially in the wrist and the articulations of the thumb. In the lower extremity the ankle is the joint by far the most frequently affected; and this is accounted for anatomically by the small size of the articular surfaces, the great weight the astragalus (the bone presenting the lower articular surface) has to support, and the unyielding nature of the lateral ligaments. In slight sprains of this joint, the ligaments are only stretched or slightly lacerated, but in more severe cases they may be completely torn through. Sprains of the ankle are sometimes mistaken for fractures and *vice versâ;* and the two injuries may co-exist. The pain and swelling sometimes make an accurate diagnosis difficult, especially if the patient is not seen for some time after the accident; and if any doubt exists, the case should be treated as for the more severe injury, since it is better that the treatment should be prolonged than that the patient should be maimed; and fortunately, that which is the proper treatment of a fracture is the best that can be employed for a sprain. Sprains of the knee are not uncommon, and are characterized by great swelling from effusion of fluid within the joint.

Sprains of the back are not unfrequent accidents, and are the most serious of any, but in most cases it may be anticipated that after confinement in bed or on a sofa for two or three weeks, and with proper treatment, the patient will be able to walk, although he may feel stiffness and pain for several weeks longer. The treatment of sprains generally must be regulated by their severity. In a severe sprain, attended with much pain and inflammation, leeches should be applied, followed by hot-water fomentations, or the application of a hot linseed-meal poultice. In slighter cases, rest and cold lotions constitute sufficient treatment. In all cases of sprain of the extremities, thin pasteboard splints placed on the outer and inner surfaces of the joint, over a wet bandage previously laid round it, afford support to the part, and comfort to the patient. In sprains of the back, more decided antiphlogistic or lowering measures are required. 'After an active mercurial purge, a dose or two of Dover's Powder may be given, with salines at intervals. The diet ought to be spare. In those of vigorous constitution, the abstraction of blood may be required. Afterwards, nothing will conduce more to the comfort of the patient than well-managed fomentation of the back. Amendment will be denoted by the patient's turning in bed more freely, and seeking to sit up. At that period, stimulating liniments, or the application of the compound tincture of iodine, will be called for. When able to walk, he will be benefited by a warm plaster to his loins.' —Shaw on 'Injuries of the Back,' in Holmes's *System of Surgery*, vol. ii. p. 202.

SPRAINS, or STRAINS, are very common amongst horses, owing to the severe exertions required of them, often whilst they are young and unprepared for such work. Various muscles, ligaments, and tendons are liable to strain, but none more frequently than the large tendons passing down the back of the fore-limbs. In slight cases, cold water continuously applied for several hours gives relief; but in all serious cases, diligent fomentation with water about the temperature of 100° is preferable; or the injured part may be swathed in a thick woollen rug, kept constantly moist and warm by frequent wetting with the hot water. Perfect rest is essential, and in order to insure the relaxation of the large tendons of the horse's limbs, he may in bad cases be kept slung for several days. Blisters, hot oils, firing, and all such irritants, are on no account to be used until the inflammation abates, and the part becomes cool, and free from tenderness. Such remedies are then useful for causing the reabsorption of swelling, and perhaps also for invigorating the weakened part.

SPRAT (*Harengula sprattus*, formerly *Clupea sprattus*), a fish of the family *Clupeidæ*, very abundant on many parts of the British coast, and elsewhere in the northern parts of the Atlantic. It is smaller than the herring, being only about six inches in length when full grown, but much resembles it. It is, however, easily distinguished by the serrated belly, and by the position of the fins, the ventral fins beginning immediately beneath the first ray of the dorsal fin, and not beneath the middle of it, as in the herring and pilchard. Another easily observed distinction is the want of axillary scales to the ventral fins, which both the herring and pilchard have. The dentition is also different, and on this account Valenciennes has constituted, for the S. and a number of other species, the new genus *Harengula*, characterized by having teeth on the jaws, tongue, palatines, and pterygoids, but no teeth on



Sprat and Herring:
1, sprat; 2, herring; 3, belly of sprat; 4, belly of herring.

the vomer. The herring has teeth on the vomer. Valenciennes states also that the S. has only 48 vertebræ, whilst the herring has 56. Notwithstanding all this, an old opinion has recently been revived, and urged with some pertinacity on public attention, that the S. is the young of the herring, which, therefore, it is injurious to a more important fishery to capture. Except that it is not common to find sprats full of roe, nothing has been stated in support of this notion more to the purpose than that the serratures of the belly may possibly be a provision for the growth of the fish; a provision to which it may be remarked that nothing analogues appears in any province of nature. Nor is it wonderful that many sprats may be examined without roe being found, as the greater part of those taken on our coasts have not attained their full size. Sprats abound especially on the coasts of Norfolk, Suffolk, Essex, and Kent in November and several following months. The net used for their capture has smaller meshes than the herring-net.

Drift-net fishing is practiced as for herring, and a method called *stow-boat* fishing, in which a large bag-net is suspended between two horizontal beams beneath the boat, and about a fathom from the bottom of the water; ropes from the ends of the upper beam enabling the fisherman in the boat to keep the mouth of the bag always open and against the tide. Vast quantities of sprats are taken in this way, so that they are used as manure by farmers, although London is also very largely supplied with them, and being sold at a very cheap rate, they are a favorite article of food of the poorer classes. The Firth of Forth also produces sprats—in Scotland, called *garvies*—so abundantly that they are sold both in Edinburgh and Glasgow by measure, and cheaper than any other kind of fish. But there are many parts of the British coast where the S. is rare, some of these being parts where the herring is plentiful. Notwithstanding its cheapness, the S. is a very fine fish, of flavor quite equal to the herring, although decidedly different. Dried sprats are a very common article of provision, and sprats are also sometimes salted. The *kilkies* brought from Riga and other ports on the Baltic, are sprats cured with spices; and many of the boxes of *Sardines* which are sent to market from the west coast of France, are really filled with sprats. The value of the S. does not seem to be as yet fully appreciated in Britain. —Very closely allied to the S. is another fish (*Harengula latulus*), the *Blanquette* of the French, which is caught in great abundance on some parts of the west coasts of France.—Other species of *Harengula* are found in other seas. One of them (*H. humeralis*), which abounds in the West Indies, and southwards as far as Rio Janeiro, is much esteemed, but becomes dangerous at certain seasons, from some unknown cause.

SPREAD EAGLE. See EAGLE.

SPREE, a river of Prussia, rises near Ebersbach in the east of Saxony, on the borders of Bohemia, and after an irregularly

winding, but generally north and north-western course of 200 miles, falls into the Havel (q. v.) at Spandau. It has all the peculiarities of a stream flowing through a low and marshy region —abounding in fish, and frequently expanding into lakes, the largest of which are the *Schwielochsee* and *Müggelssee*. Its banks are flat, sometimes sandy and wooded, and sometimes rich in meadow-pastures. It becomes navigable for small craft at Kosenblatt. The principal towns past or through which it flows are Bautzen, Spremberg, Kottbus, Lübben, Beeskow, and Berlin. Its trade is very considerable. By the Friedrich Wilhelm's or Müllrose Canal, it is connected with the Oder.

SPRING, a stream of water issuing from the earth. The source of springs is the rain and snow that falls from the clouds. Very little of the water precipitated in any district finds its way immediately by rivers to the sea; the great proportion is either evaporated from the surface of the earth, and, reabsorbed by the atmosphere, is employed by plants and animals, or sinks into the earth. All loose soils and gravels greedily absorb water, which descends until it meets with a stratum through which it cannot penetrate. A pit dug into the water-charged soil would speedily fill itself by draining the water from the soil. All rocks contain water; some retain it by capillary attraction, like a sponge, others hold it merely mechanically, and easily part with it. Chalk will absorb and retain one-third of its bulk of water; and sand, on the other hand, while it will absorb as much, will part with nearly the whole amount to a well dug in it. Argillaceous deposits and compact rocks are barriers to the passage of water, and cause the superincumbent pervious strata to become water-logged, where there is no outlet. Sometimes the edges of the strata are exposed on the sides of a valley, and permit the free escape of the contained water, which pours from them over the neighboring land. But rents and fissures, as well as inequalities on the surface of the impervious beds, give the water a circumscribed course, and cause it to issue in springs.

The water, as it percolates through the earth, always becomes more or less charged with foreign matter, owing to its solvent property. Carbonate, sulphate, and muriate of lime, muriate of soda, and iron, are the most common impurities in spring-waters; magnesia and silica also frequently occur. These substances, from the evaporation of part of the water, or the escape of the carbonic acid gas, by which so large a quantity is often held in solution, are frequently deposited on the margins of the springs, or in the courses of the streams flowing from them. Such deposits are found in all so-called petrifying springs; and the hot wells of Iceland and the Azores are surrounded with basins formed of siliceous sinter which has been derived from the water. When the foreign ingredients have medicinal qualities, the springs are known as Mineral Waters (q. v.).

Springs are either associated with the superficial strata, or rise from a considerable depth. *Surface-springs* occur where the absorbent surface-deposits rest on an impervious bed, which prevents the further downward progress of the water, or where the beds through which the water flows are near the surface, as shown in fig. 1, where C and E are impervious clay-beds, and D is a bed

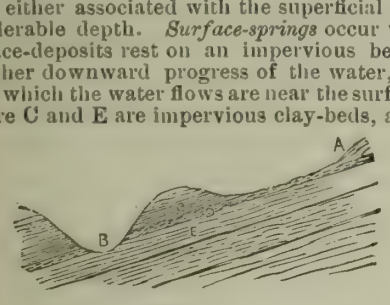


Fig. 1.

of sand or gravel, which in the upper portion is exposed on the surface, or is only overlaid by loose soil, and after being covered for some distance by the clay-bed C, makes its appearance again at B, where the valley cuts it through: here the water collected over the area, A, is discharged. Surface-springs, depending as they do so directly on the rain for supplies, are very variable in the amount of water they deliver. They frequently fail entirely in the summer, and always after great draughts. Their temperature varies with that of the district where they exist, being warm in summer, and cold in winter, as they do not penetrate below that plane in the earth's crust which is affected by the seasonal changes in temperature.

When the bed which forms the reservoir for the spring is at such a distance from the surface as to be beyond the zone of season changes, and yet within that which is influenced by the climate, the water has a temperature equal to the mean temperature of the locality where it springs. Such springs have generally a large area for the collection of the superficial water, and are consequently regular in the quantity of water they give out. They are brought to the surface by means of faults. The celebrated Well of St. Winifred, at Holywell, in Flintshire, rises through a fault in the Coal Measures. It discharges at the rate of about 4400 gallons per minute, being the most copious spring in England, and the water, in its short course of little more than a mile to the sea, is used to propel 11 mills.

Most deep wells have a lower origin than the zone of climate temperature, which in Britain is between 200 and 300 feet. It is well known that a regular increase in the temperature is observed after this zone is passed, equal to 1° of F. for every 55 feet. As wells have a temperature corresponding to that of the strata from which they spring, it follows that the deeper the spring the higher will be its temperature. Local conditions may affect the thermal state of springs, as in the case of the Geysers in the active volcanic district in Iceland, and the warm springs near Naples; but where no such local influences exist, the depth of the bed from which the water comes may be to some extent estimated by its temperature. Thermal springs occur in Britain at Matlock (66° F.) and Buxton (82°) in Derbyshire, at Bath (117°) in Somerset, and at Clifton (76°) in Gloucestershire. Artificial communications have been opened with deep-lying strata, by which the water they contain has been brought to the surface, and in these the temperature is found to increase in proportion to the depth of the bore. See ARTESIAN WELLS. The most remarkable thermal springs are the Geysers of Iceland, which are fully described under GEYSER.

Intermittent springs are sometimes produced by the ebb and flow of the tide, as at Richmond, where the rise at high water is seen in the wells which flow from the arenaceous strata on the banks of the Thames; and sometimes they depend on the supply of rain water. But there is a kind of spring the intermittences of which are believed to be owing to the structure of the internal cavities from which the supply is obtained. This will be more easily understood by a reference to the accompanying diagram (fig. 2). The large reservoir A, is fed by the rain percolating

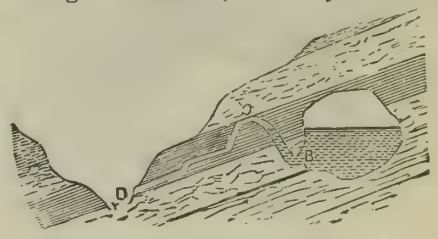
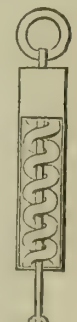


Fig. 2.

through the rock. It communicates with the surface by a siphon-shaped tube BCD. As long as the water in the reservoir is at a lower level than the arch of the siphon at C, no water can escape; but as soon as it reaches its level, the whole of the water in the cavity will be drawn off, the spring will then cease, and will only make its appearance when sufficient water has accumulated to permit the siphon again to act.

SPRING-BALANCE, THE, for determining the weight of bodies, consists of a spring in the form of a cylindrical coil, through which passes freely a graduated bar, having a hook attached to its under end, and a plate to its upper (fig.). The spring is enclosed in an oblong or cylindrical box, quite closed except at the bottom, where there is a hole just large enough to allow the free passage up and down of the graduated bar. When the instrument is to be used, it is suspended by a ring fastened to the upper part of the box; the weight to be estimated is then hung on the hook, and pulls down the rod, the button or plate at the top of which compresses the helical spring within against the bottom of the box; and the graduation corresponding to this amount of compression of the spring is read off at that part of the rod which just shows itself outside.



Spring-balance.

In another form of the spring-balance, known as Salter's Balance, a brass index-plate is attached to the side of the box, and a vertical slit through both plate and box is made from top to bottom; the weight is in this case read off on the plate by a pointer fastened to the spring, and protruding through the slit. In a third form, known as Martin's 'index weighing-machine,' the interior rod, instead of being graduated, is furnished with a rack on one side; this rack moves a toothed-wheel fastened on the side of the instrument; and this wheel, again, has at one extremity of its axis a long index, which, on the wheel being put in motion, traverses a circular dial-plate, on which the graduations of weight are marked. The advantage of this last construction consists in the arrangement of the size of the toothed-wheel to that of the dial-plate, so that, since the toothed-wheel and index make a complete revolution simultaneously, a small motion of the former may produce a large motion of the latter, and the weight of the body be much more accurately read off than can be done directly on the graduated rod. The spring-balance has one advantage

over the ordinary balance, that it does not estimate unknown weight by that which is known, and is therefore applicable to the determination of 'absolute' weight in all latitudes, at the equator as well as at the poles; but it has the great disadvantage of being considerably affected by change of temperature, the force of the spring to resist compression being diminished as the temperature increases at the rate of about $\frac{1}{5000}$th for each degree of Fahrenheit, and consequently the apparent weights of bodies must be corrected in this proportion. Various other forms of springs, semicircular, elliptical, &c., are employed instead of the helical spiral, in several French balances, but in other respects the instruments correspond. The spring-balance is also called a 'dynamometer,' from its being employed to indicate the intensity of the forces exerted by animals or machines; for this purpose, it is attached between the force and its object, the force being applied to its object solely through the medium of the dynamometer.

SPRI'NGBOK (*Antilope euchore*, or *Antidorcas euchore*), a species of antelope, nearly allied to the gazelles, very abundant in South Africa. It is an extremely beautiful creature, of graceful form, and fine colors. It is larger than the roebuck, and its neck and limbs much longer and more delicate. The general color is fulvous brown on the upper parts, pure white beneath, the colors separated on the flanks by a broad band of deep vinous red. The whole head is white, except a broad brown band on each side from the eye to the mouth, and a brown spot in the center of the face.

Springbok (*Antilope euchore*).

Two curious folds of skin ascend from the root of the tail, and terminate near the middle of the back; they are usually closed, but open out when the animal is bounding, and disclose a large triangular white space which is otherwise concealed. The S. derives its name from the prodigious leaps which it takes either when alarmed or in play, often to the height of 7 feet, and sometimes of 12 or 13 feet. Its ordinary residence is in the *karroos* or arid sandy plains; but when all pasture there is burned up, immense herds congregate together, and migrate to more fertile regions, often devastating the fields of the colonist. Mr. Pringle speaks of seeing the country near the Little Fish River specked with them as far as the eye could reach, and estimates the number in sight at once as not less than 25,000 or 30,000. Captain Cumming describes a still more extraordinary scene, a vast herd pouring through an opening among hills, in one living mass, half a mile in breadth, and so continuing for hours together. So dense are these herds sometimes in their migrations, that the lion or the leopard, which ordinarily hangs on their skirts with a view to prey, is taken prisoner, and compelled to march along in the midst. The strongest animals are generally foremost, but when satiated with food, they fall behind, and others, hungry and active, take their place. When taken young, the S. is easily tamed, and becomes very familiar, troublesome, and tricky.

SPRINGER. See ARCH.

SPRINGER, a kind of dog, regarded as a variety of the Spaniel (q. v.). It is small, elegant, usually white, with red spots, black nose and palate, long pendent ears, and small head. Its aspect is very lively, and its manners equally so. It is used by sportsmen for raising game in thick and thorny coverts. There are several breeds or sub-varieties.

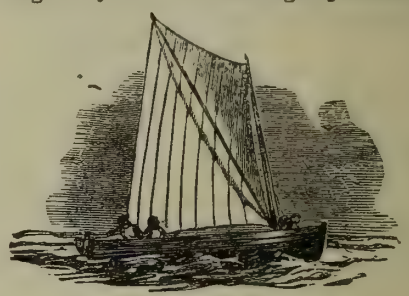
SPRI'NGFIELD, a city of Massachusetts, U. S., on the east bank of Connecticut River, 98 miles west-by-south of Boston. It is the seat of many important manufacturing establishments, which are supplied with water-power by the falls of Mill River, and among which are the United States Armory, employing about 700 men chiefly in the manufacture of rifles and carbines; foundries, manufactories of machinery, cotton-presses, steam-engines, fire-engines, locomotive-wheels, railway-carriages, india-rubber goods, &c. At the immense station-house of S. four important lines of railway meet. There is a large city hall, 26 churches, city library and museum, high school, 32 other schools, five banks, and two daily and two weekly newspapers. The town, one of the finest in New England, was settled in 1635. Pop. (1870) 26,703; (1880) 33,340.

SPRINGFIELD, the capital of Illinois, is built on a vast prairie, near the middle of the state, 178 miles south-west of Chicago, at the intersection of five railway lines. It is regularly laid out with broad streets and gardens, which have given it the name of the 'Flower City.' The State House, built in a great central square, is the principal architectural ornament. It is also the seat of the Illinois state university, and has several newspapers, foundries, machine-shops, breweries, and flouring-mills, and is the entrepôt of a rich agricultural country. Pop. (1870) 17,364; (1880) 19,746.

SPRINGFIELD, a town of Ohio, U.S., on Lagonda Creek and Mad River, 43 miles west of Columbus. It contains the Wittenberg Lutheran College, flouring-mills, iron-foundries, machine shops, woollen and paper mills, publishes several newspapers, has extensive railway connections, and a large trade in corn, cattle, and hogs. Pop. (1870) 12,652; (1880) 20,729.

SPRINGS, MECHANICAL, are very variously constructed for different purposes. The simplest form of spring is a piece of elastic metal wire, rolled on a mandrel, so as to form a continuous single cylindrical coil of any length needed. Clock and watch springs are made in flat coils, thin bands of steel being used. The *balance-spring* of watches is, however, made of fine wire often thinner than hair. Coach-springs are formed of a series of curved narrow plates of steel of different sizes, placed one over the other, the largest being at the bottom, and the others in regular succession according to size, the whole being held together with nuts and screws. These are some of the commonest forms, but very many others are in use.

SPRIT (*Spriet*, Dutch; old English verb, *sprit*, to sprout or spring out) means a pole or spar. The word occurs most frequently in the compound, bowsprit, which explains itself. When used alone, a sprit is a diagonal yard for sustaining a quadrilateral (usually



Spritsail.

square) fore-and-aft sail. The sprit's heel is held on the mast in a ring of rope, called a 'snotter,' and its head reaches to the after upper corner of the sail. The sail thus extended is a spritsail, and is frequently employed in boats.

SPRUCE. See FIR.

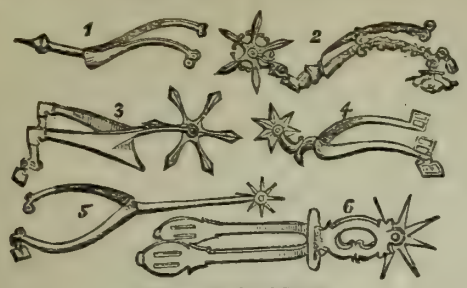
SPRUCE, ESSENCE OF, AND SPRUCE-BEER. The essence of spruce is obtained by boiling the green tops of the Black Spruce (*Abies nigra*) in water, and then concentrating the decoction by another boiling without the spruce tops. The young shoots of this fir, like most others of its family, are coated with a resinous exudation, which is dissolved in the water. The beer is made by adding the essence of spruce to water in which sugar or treacle has been dissolved, in the proportion of about four ounces of essence of spruce to ten pounds of sugar, or three quarts of treacle, and ten or eleven gallons of water, with about half a pint of yeast. Various spices are used for flavoring. A similar beverage is made largely in the north of Europe, from the buds of the Norway Spruce (*Abies excelsa*), and is known as Black Beer, that of Danzig being the most famous. The Antiscorbutic Beer of the Russian Army Pharmacopœia is made by mixing spruce tops and fresh horse-radish root with common beer, ginger and *Calamus aromaticus* being added for flavoring, and after fermentation, a little cream of tartar, tincture of mustard, and proof spirit.

SPUI'LZIE, in the Law of Scotland, is the taking away of the movable goods in the possession of another, against his will, and without any legal authority. Whenever a spuilzie has been committed, an action of damages may be brought against the wrongdoer, not only for restoration of the goods, but for all the profits which the owner might have made with the goods in the meantime. This action must be brought within three years, but the action for ordinary damages may be brought within forty years.

SPU'NGING-HOUSES are, in the Law of England, the private houses of the bailiffs, who may detain there a debtor who has been arrested for debt, for twenty-four hours, to admit of his or his friends' arranging to settle the debt; and the name is derived from the extortion often practised in this state on the debtor.

SPUR, an apparatus fastened to the heel of a horseman, for goading the horse. It is much less used than formerly. All cavalry soldiers wear spurs; but their use, except in the heat of an

actual charge, is discouraged as much as possible. In the days of chivalry, the use of the spur was limited to knights, and it was among the emblems of knighthood. To win his spurs, was for a young man to earn knighthood by gallant conduct. The degradation of a knight involved the hacking off of his spurs; and the serving before a knight of a pair of spurs on a dish, was a strong hint by his host that he had outstayed his welcome.



Various Kinds of Spurs.
(From Antiquarian Museum, Edinburgh.)
1, bronze prick spur found at Linlithgow Palace; 2, iron spur found near Bannockburn; 3, bronze spur found at Colchester; 4, brass spur found at Culloden; 5, spur found at Halidon Hill; 6, spur found in making a drain in High Street, Edinburgh.

SPURGE (*Euphorbia*), a genus of plants of the natural order *Euphorbiaceæ*, having monœcious naked flowers, the male flowers membranous, and surrounding a tricoccous stalked female flower, the whole placed within a cup-shaped involucre. The fruit has three valves and three cells, the cells one-seeded, and bursting elastically. The species are very numerous, natives of warm and temperate climates, mostly herbaceous, but some of them woody. About twelve species are natives of Britain. All contain a resinous milky juice, which in most is very acrid.

SPURGE LAUREL. See DAPHNE.

SPURGEON, CHARLES HADDON, a celebrated preacher born at Kelvedon, Essex, 19th June 1834. Intended by his family for the office of an independent minister, his own sympathies drew him towards the Baptists, whose connection he joined in 1850. He became at once an active tract-distributor and school-teacher; and, removing to Cambridge in 1851, began to deliver cottage sermons in the neighborhood. The popularity of the 'boy-preacher' was almost immediately established; and at the age of 18 he had charge of a small Baptist congregation in the village of Waterbeach. In 1854 he entered upon the pastorate of the New Park Street Chapel, London, where his preaching proved so attractive, that, in two years' time, the building had to be greatly enlarged. His hearers continuing to increase, the Surrey Music Hall was for some time engaged for his use; and finally his followers built for him his well-known 'Tabernacle,' in Newington Butts, opened in 1861. The evangelistic and philanthropic agencies in connection with this immense chapel comprise the Stockwell Orphanage, of which S. is president; a Pastor's College, where hundreds of young men are trained for the ministry under S.'s care; the Golden Lane Mission, &c. S. continues to preach in the Tabernacle to thousands of hearers, though of late repeatedly prostrated by illness. His sermons have been published weekly since 1854. They have had an enormous circulation, and many of them have been translated into various languages. He has also written *John Ploughman's Talk, Morning by Morning, Evening by Evening, The Treasury of David, Lectures to my Students, The Saint and his Saviour*, &c.; and since 1865 he has edited a monthly magazine, *The Sword and the Trowel*.

SPURN HEAD, the name given to the extreme point of a long, low, narrow, and shingly peninsula in the south-east of Yorkshire, at the mouth of the Humber, 24 miles south-east of Hull. Two light-houses have been built here, one of which is in lat. 53° 34′ 7″ N., and long. 0° 7′ 2″ E.

SPURREY (*Spergula*), a genus of plants which has been variously ranked by botanists in the natural orders *Caryophylleæ*, *Illecebraceæ*, and *Crassulaceæ*. The species are annuals, dichotomously branched, or with whorled branches; their leaves linear-filiform, in clustered whorls, with membranaceous stipules; the flowers in terminal divaricating corymbs. The flowers have a calyx of five sepals, five white petals, five or ten stamens, and five styles; the capsule is five-valved, with numerous round seeds, surrounded with a membranous border. COMMON S., or YARR (*S. arvensis*), is plentiful in corn-fields, especially on light stony or sandy soils in Britain and most parts of Europe. In some parts of Europe, a larger variety is frequently sown for fodder, and is much relished by cattle.

SPURZHEIM, JOHANN GASPAR, a German physician and phrenologist, was born near Treves, December 31, 1776. While studying medicine at Vienna, he was introduced to Dr. F. J. Gall (q. v.), whose pupil, and afterwards colleague, he became, in investigating the structure and functions of the brain (see PHRENOLOGY), in lecturing on the subject, and in writing for the press. In 1807 they settled in Paris, but parted in 1813; and next year S. came to England, where he published *The Physiognomical System of Drs. Gall and S.* (Lond. 1815), *Outlines* of the same (1815), and a treatise on *Insanity* (1817). The first of these works having been severely handled by Dr. John Gordon in No. 49 of the *Edinburgh Review*, S. proceeded to Edinburgh, and, in the lecture-room of his critic, demonstrated the reality of the anatomical discoveries which had been denied and ridiculed. To the same and other opponents, he replied in *An Examination of the Objections made in Britain against the Doctrines of Gall and S.* (Edinburgh, 1817). It was about this time, and under his tuition, that George Combe (q. v.) became a student of phrenology.

After lecturing in many British and Irish cities, S. returned, in 1817, to Paris; but from 1825 till his death, he resided much in England, teaching and defending his opinions in lectures and books. In 1832, he went to America for the same purpose, and began his labors at Boston, but was cut off by fever on 10th November in that year. Besides the English works already mentioned, he wrote: *Elementary Principles of Education* (Edinburgh, 1821; 2d ed. Lond. 1828; French translation, Paris, 1822); *Phrenology* (Lond. 1825); *Philosophical Principles of Phrenology* (1825); *Phrenology in Connection with the Study of Physiognomy* (1826); *Anatomy of the Brain* (1826), supplemented, in 1829, by an Appendix, with *Remarks on Charles Bell's Animadversions on Phrenology; Outlines of Phrenology* (1827); and *Sketch of the Natural Laws of Man* (1828). Some of these were reprinted at Boston, U. S. His French works (besides those written jointly with Gall) are: *Obs. sur la Folie* (Paris 1818); *Obs. sur la Phrénologie* (1818); *Essai Philosophique sur la Nature Morale et Intellectuelle de l'Homme* (1820); and *Manuel de Phrénologie* (1832). See *Phren. Jour.*, vol. viii. p. 126; *For. Quart. Rev.*, vol. ii. p. 15; *Memoir of S.*, by A. Carmichael (Dublin, 1833); and Combe's *System of Phrenology*.

SPY, in War, is a useful but not highly honored auxiliary, employed to ascertain the state of an enemy's affairs, and of his intended operations. Spies have been used in all wars from the time when Moses sent Joshua on such a purpose to the present time. Their employment is quite recognized by the law of nations as interpreted by Grotius, Vattel, and Martens; nor is it held to be any dishonor to a general to avail himself of their services. On the other hand, the spy himself is looked upon as an outlaw, and one devoid of honor. If taken by the enemy, he is put to death ignominiously and without mercy. As, however, the calling is so dangerous, and so little redounds to honor, it is never permissible for a general to compel by threats any person, whether of his own or the hostile party, to act as spy; but he is at liberty to accept all such services when proffered. A spy is well paid, lest he betray his employer. In the British army, spies are usually controlled by the quartermaster-general. Martial law, though distinct enough in ordering the death of a spy, is not clear in defining what constitutes a spy. A man—not of the enemy—within the enemy's lines, and in the enemy's uniform, would presumably be a spy. If in civil dress, and unable to give a good account of himself, his chance of hanging would be considerable; but if found in one camp in the uniform of the opposite side, he may not be treated otherwise than as a prisoner of war, or at least as a deserter from the enemy.

Both as regards honor and penalties, it would seem that spies ought in fairness to be divided into two classes—first, those who betray their own country to an enemy; secondly, those who, being enemies, contrive surreptitiously to obtain information by penetrating into the opposing army. The first class are traitors of a deep dye, for whom no ignominious death is too bad; but the second class are often brave men, who dare much in the service of their country. It is unfair to accord them the same treatment as the traitors.

SQUAD (diminutive of squadron) is any small number of men assembled for the purposes of drill or inspection. A troop or company of soldiers should be divided into as many squads as there are officers or sergeants at hand to drill them.—The *awkward squad* comprises recruits not yet fitted to take their places in the regimental line.

SQUADRON (Ital. *squadra*, from Lat. *quadra*, a square), in Military Language, denotes two troops of cavalry. It is the unit by which the force of cavalry with an army is always computed. Three or four squadrons constitute a regiment. The actual strength of a squadron varies of course with that of the component troops; but it ranges from 120 to 200 sabres.

In Naval Affairs, a squadron is a section of a fleet, and constitutes the command of a junior flag officer or commodore.

SQUALUS AND SQUALIDÆ. See SHARK.

SQUAMIPENNÉS. See CHÆTODONTIDÆ.

SQUARE, in Military Evolutions, is the forming of a body of men into a rectangular figure, with several ranks or rows of men facing on each side. With men of ordinary firmness, a square should resist the charges of the heaviest horse. The formation is not new, for a Grecian syntagma was a solid square of 16 men in every direction; but in modern warfare, the solid square having been found cumbrous, has been abandoned for the hollow square, with officers, horses, colors, &c. in the centre. The front rank kneels, and the two next stoop, which enables five ranks of men to maintain a rolling fire upon an advancing enemy, or to pour in a murderous volley at close quarters.

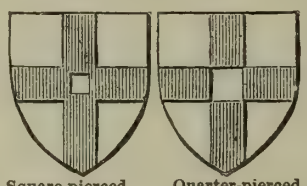
SQUARE, in Geometry. See PARALLELOGRAM.

SQUARE AND SQUARE ROOT are particular cases of *Involution and Evolution* (q. v.) in which the second power and root are alone involved. The process by which the square root of a number is obtained resembles division, differing only by the the circumstance, that the divisor is changed at each successive step. The rule adopted in arithmetic is deduced from algebra in the following manner: The square of $a + b$ is $a^2 + 2ab + b^2$, which may be written $a^2 + b\,(2a + b)$; and to find the square root of the latter, we have merely to subtract a portion (a^2), taking care that it be a square number, and forming a divisor with twice the square root of this portion ($2a$) increased by (b) the remainder of the root (which, in arithmetic, must be found by trial as in division), and putting (b) the remainder of the root now found, in the quotient, proceed as in division. This mode of obtaining a divisor from the part of the root already obtained (a), and the part next to be obtained (b), and employing it, must be repeated till the whole square root is found. In the extraction of the square root in arithmetic, it is assumed that the squares of the nine digits are known; and also that the square of a number contains either twice, or one less than twice, as many digits as the number itself contains; the former being the case when the square number has an *even* number of digits, the latter when the number of digits is *odd*. By dividing, then, a number into periods of two figures each, we can at once see how many digits its root contains. To illustrate the method of operation adopted in arithmetic and algebra, let the square root of 128,881 be required; remembering that the square of $a + b + c$ is $a^2 + 2ab + b^2 + 2\,(a + b)\,c + c^2$:

	12·88·81	(300 + 50 (or 350) + 9 = 359	a =	300	12·88·81 (300 = a
$(a^2 =)\ 300^2$ =	90000	$a + b$ (or $a + b$) + c		300	90000 50 = b
	38881		$2a + b$ =	650	)38881 9 = c
$(2ab + b^2 =)\ 2 \times 300 \times 50 + 50^2$ =	32500			50	32500 359
$(2\,(a + b)\,c + c^2)$	6381		$2\,(a + b) + c$ =	709	)6381
$2 \times 350 \times 9 + 9^2$ =	6381				6381

In the common arithmetical mode, the zeroes are omitted, and we substract from 12 the square nearest to it, not recognizing the portion of the root, 3, as more than a digit of units, till the next period, 88, has been brought down for the second step, when it is evident that the 3 is *at least* 3 tens, and consequently the 6 in the divisor represents 60; similarly, it is only at the commencement of the third step that we find the 5 to represent 50, and the 3, 300. A comparison of the above examples will show the agreement and difference between the two modes.

SQUARE-PIERCED, in Heraldry, a term used to designate a charge perforated with a square opening, so as to show the field. A cross square-pierced is often improperly confounded with a cross quarter-pierced, where the intersecting part of the cross is not merely perforated, but entirely removed.



Square-pierced. Quarter-pierced.

SQUARES, METHOD OF LEAST, in Astronomy, the best mode hitherto discovered of obtaining the most correct result from a number of observations upon any phenomenon. These observations are assumed to differ slightly from each other, and to be all of equal value, that is, taken under equally favorable conditions, and with equal instruments. The ordinary and long-established mode of approximating to the truth in such cases, is by finding the arithmetic mean, and accepting it as the correct result; but in all cases where the result required does not come directly from observation, but requires to be discovered by calculation, this simple and useful method is inapplicable, and that of 'Least Squares,' which gives more probable corrections, is adopted. The method is founded on a theorem which was first propounded by Legendre in 1806, more for the sake of insuring uniformity among calculators than from any belief in its intrinsic value; but it was afterwards thoroughly discussed and proved by Gauss and Laplace, that 'if the mean of a number of distinct observations be so taken, that the sum of the squares of its differences from the actual observations (generally designated *errors*) shall be a minimum, this mean will be, under these circumstances, the correctest obtainable value.'

The process by which the mean thus obtained is shown to be the most trustworthy approximation is too long for insertion here; but it may not be undesirable to give an example of the most common form of the method as occurring in astronomy. Let there be a series of equations—

$$\begin{aligned} X &= x + y + 2z, \\ X_1 &= 3x + 2y + 5z, \\ X_2 &= 4x + y + 4z, \\ X_3 &= -x + 3y + 3z; \end{aligned}$$

where the unknown quantities are x, y, and z, connected by various (the more the better) equations with X, X_1, &c., quantities which must be determined by actual observation. Suppose the values of the quantities thus found to be 3, 5, 21, and 14, then, since by hypothesis all these four observations are erroneous, the errors are $3 - X$, $5 - X_1$, $21 - X_2$, $14 - X_3$, or

$$\begin{aligned} 3 &- x - y - 2z, \\ 5 &- 3x - 2y - 5z, \\ 21 &- 4x - y - 4z, \\ 14 &+ x - 3y - 3z. \end{aligned}$$

The squares of these four errors are now added together; and, to find the values of x, y, and z, which will render this sum (call it S) a minimum, we must differentiate S with respect to x, y, and z in turn, and putting each of these partial differential coefficients equal to zero, we obtain the three equations, $-88 + 27x + 8y + 30z = 0$; $-76 + 8x + 15y + 25z = 0$, and $-157 + 30x + 25y + 54z = 0$; from which the most trustworthy values of x, y, and z, can be found by common algebra.—See a paper by Mr. Ellis in the *Cambridge Transactions*, vol viii.

SQUASH. See GOURD.

SQUATTERS, the name given in the Australian colonies to the sheep-farmers who occupy the unsettled lands as sheep-runs under lease from government. See NEW SOUTH WALES, VICTORIA.

SQUID. See CALAMARY.

SQUIER, EPHRAIM, GEORGE, LL.D., American author and archæologist, was born at Bethlehem, New York, June 17, 1821. In his youth, he was a school-teacher and engineer, and in 1840 was editor of *The Mechanic*, at Albany; in 1843, of the Hartford *Journal;* and in 1844, of the *Scioto Gazette*, in Ohio. His attention being attracted to the antiquities of the Scioto Valley, he made an exploration of similar monuments through the Mississippi Valley, an account of which was published in 1848, forming the first volume of the *Smithsonian Contributions to Knowledge*. He made similar explorations in New York and Connecticut; and on being appointed *chargé d'affaires* to Guatemala and other states of Central America, he used his official position as a means of making extensive geographical and archæological explorations in those interesting regions. On visiting Europe in 1851, he was honored with the gold medal of the French Geographical Society, and made a member of other learned societies. Returning to America (1853), he surveyed a railway route through Honduras, and drew up the treaty between that country and England for the retrocession of the Bay Islands. Among his works are—*Nicaragua: its People, Scenery, Ancient Monuments, and Proposed Interoceanic Canal* (1862); *The Serpent Symbol, or Worship of the Reciprocal Principles of Nature in America* (1852); *Notes on Central America* (1854); *Waikna, or Adventures on the Mosquito Shore* (1855); *Question Anglo-Americaine* (1856); *The States of Central America* (1857); the Report of the Honduras Survey (1859); a work on Tropical Fibres (1861); *Honduras* (1870); *Peru* (1876); articles in the *Encyclopædia Britannica;* &c.

SQUILL (*Scilla*), a genus of bulbous-rooted plants of the natural order *Liliaceæ*, nearly allied to Hyacinths, Onions, &c., and having a spreading perianth, stamens shorter than the perianth,

smooth filaments, a 3-parted ovary, and a 3-cornered capsule with three many-seeded cells. Many of the species are plants of humble growth, with scapes like those of Hyacinths, and beautiful flowers. Of these, two are natives of Britain: *S. verna*, which is common on the western and northern coasts, and particularly in Orkney and Shetland, and has fragrant flowers of a deep blue color; and *S. autumnalis*, which grows chiefly on the coasts of the south of England, and has pinkish purple flowers. *S. bifolia*, is a very doubtful native of Britain, but adorns hill-pastures and borders of woods in many parts of Europe with its blue flowers in early spring. *S. amœna* is another very beautiful species found in many parts of Europe. Few plants are better adapted than these for the adorning of flower-borders, or for house-culture.—Very different in habit from these is the OFFICINAL S. (*S. maritima*, or *Urginea Scilla*), a native of the sandy shores of the Mediterranean, which has a scape from two to four feet high, with a raceme of many whitish flowers, and large leaves. The bulb is of the size of a man's fist, or sometimes as large as a child's head, and contains a viscid juice so acrid as to blister the fingers if much handled, whilst the vapor arising from it irritates the nose and eyes. Squill was used in medicine by the ancients, and continues to be so still. The bulb is dug up in autumn, divided into four parts, the center being cut out as being inert, and the remainder being cut into thin slices, which are quickly dried by a gentle heat. It is imported from Malta and other Mediterranean ports; also from St. Petersburg and Copenhagen. The dried slices are white, or yellowish white, slightly translucent, scentless, disagreeably bitter, brittle, and easily pulverizable if very dry.

Squill.

The chemical composition of squill is not accurately known, its most active principle being a very acrid, poisonous, resinoid substance, soluble in alcohol, but not in ether. Whatever its active ingredients may be, they are taken up by alcohol, vinegar, and the dilute acids. This medicine is prescribed as a diuretic and expectorant, and occasionally as an emetic; but it must be recollected that in moderately large doses it acts as a narcotico-irritant poison, 24 grains having proved fatal. When given as a diuretic, it is usually prescribed in combination with digitalis and calomel, when it seldom fails to produce an increased secretion of urine, while at the same time it promotes the absorption of the effused fluid in the dropsy, which is generally present when diuretics are ordered. Its use is counter-indicated if inflammatory symptoms are present. Its dose as a diuretic is from one to three grains of the powdered bulb, or about twenty minims of the tincture. As an expectorant, it is much employed in the subacute stages and chronic forms of pulmonary affections, and is very serviceable in bronchitis and pneumonia of children. From its property of promoting the secretion of mucus, it gives relief by facilitating the expectoration in cases of asthma, &c., in which the sputa are viscid. In these cases, it is usually associated with some of the more stimulating expectorants, as senega or susquicorbonate of ammonia. As an expectorant, the dose of the powdered squill should not exceed one grain, repeated several times daily. For children, the syrup, in doses of from ten to thirty minims, may be given. As its action as an emetic is uncertain, it should not be prescribed with the view of inducing vomiting, if other and more certain remedies are at hand.

SQUI'LLA, a genus of Crustaceans of the order *Stomapoda*, the type of a family, *Squillidæ*, to which the names *Mantis Crab*, *Mantis Shrimp*, and *Sea-mantis*, are popularly given, from the strong general resemblance to the insects of the genus *Mantis* (q. v.). The form is elongated; the carapace only covers the anterior part of the thorax, the latter part of which is formed of rings like the abdomen; the eyes are carried on stalks; the claws are very large, and furnished with spines, forming powerful instruments of prehension; the tail is expanded into a broad fin. The species are numerous, and mostly inhabit tropical seas. A species about seven inches long, *S. mantis*, is found in the Mediterranean. The *Squillæ* are extremely active, and very bold and voracious.

SQUINCH, small arches or corbelled courses across the angles of square towers, to bring in the form to carry an octagonal spire, lantern, &c. See PENDENTIVE.

SQUI'NTING, or STRABI'SMUS, is a well-known and common deformity, which may be defined as a want of parallelism in the visual axes, when the patient endeavors to direct both eyes to an object at the same time. The squint is said to be *convergent* when the eye or eyes are directed towards the nose, and *divergent* when they are directed towards the temple, and is termed *single* or *double* according as only one eye or both are displaced. The divergent form is comparatively rare, except in consequence of a prolonged loss of sight of one eye. The causes of this affection are various. Intestinal irritation, such as the presence of worms, will often induce it slightly in children. In other cases it may be traced to the temporary cerebral irritation produced by teething; and it is a very common symptom in hydrocephalus and other serious head-affections. Amongst other causes are a want of equal normal visual power in both eyes, in extreme short-sight; but from extensive observation with the ophthalmoscope, Mr. Dixon, surgeon to the Royal Ophthalmic Hospital, Moorefields, has come to the conclusion, that 'in the great majority of instances of confirmed squint existing in children, the optic nerves themselves are ill-developed, being usually smaller than natural, of a more or less oval form, and of a dusky color.'—Holmes's *System of Surgery*, vol. ii. p. 890. If the squint is only temporary and possibly arises from intestinal irritation, the bowels must be well cleared out, and tonics subsequently given. If it is due to some peculiarity in the visual focus of the eyes, it may be removed by the judicious use of glasses. 'In every case,' says Mr. Dixon 'a careful ophthalmoscopic examination is the first duty of the surgeon; and he should also take every possible care to ascertain that no organic disease exists in the brain or orbital nerves; and that there is no tumor in the orbit, mechanically burdening the movements of the eye.' The surgical operation for the cure of squint consists in the division of the muscle which, by permanently drawing the eye inwards or outwards, and overpowering its antagonistic muscle induces the deformity. It is better to dispense with the use of chloroform in this operation, if the patient have sufficient nerve to bear the operation without flinching, as in that case the doubt that sometimes arises as to whether the muscle has been sufficiently divided can be at once solved by directing the patient to attempt inversion of the eye; but in the great majority of cases, chloroform is found necessary.

SQUINTS, narrow apertures cut in the walls of churches (generally about two feet wide), to enable persons standing in the aisles to see the high altar. These openings are always in the direction of an altar.

SQUIRE, an abbreviated term for Esquire (q. v.). The same word is also popularly applied in England to country gentlemen; and in the United States of America to magistrates and lawyers, and sometimes to judges and justices of the peace.

SQUIRREL (*Sciurus*), a Linnæan genus of rodent quadrupeds, now the family *Sciuridæ*. They belong to the section of Rodentia having perfect clavicles, and are further characterized by a long bushy tail; the fore-paws furnished with four toes, which have curved claws, and a tubercular thumb; the hind-legs long, their feet with five toes; two incisors in each jaw; four molar teeth on each side in each jaw, simple, with tuberculous crowns, and a fifth in the front of the upper jaw, which soon falls out. Most of the species commonly carry the tail curved over the body, whence the Greek name *Skiouros* (*skia*, a shade, and *oura*, a tail), of which the English *squirrel* is a corruption. The species are numerous, and are found in almost all parts of the world, except Australia; some inhabiting temperate and even cold regions, whilst some belong to tropical countries. Squirrels are very active and lively creatures, at once shy and pert, very adroit in hiding themselves on the appearance of danger, but resembling monkeys in their inquisitive curiosity. They inhabit woods, and mostly spend their lives in trees, which they climb with wonderful agility, running along the branches, and leaping from tree to tree. Their running is a kind of bounding, and the tail is then stretched out, as it is also in their leaps from branch to branch, which are often to great distances. The Flying Squirrels are already noticed. Even the true squirrels resemble them in spreading out their limbs and tail to the utmost in leaping, particularly when they descend from a high branch to the ground, and they thus leap from a great height without injury.

Some species, however, seldom ascend trees, but burrow in the ground, and are further distinguished by having cheek-pouches, whilst the tail is shorter than in the tree squirrels, and its hair not so distinctly arranged in two lateral rows. These *Ground Squirrels* form the genus *Tamias*. All the squirrels feed on fruits and seeds, the young shoots of trees, and other such vegetable substances; although they sometimes vary their diet by plundering birds' nests, and not only sucking eggs, but devouring young birds. They are also fond of the larvæ of insects. In eating, they often sit erect, and hold the food in the fore-paws. The hardest nut presents no difficulty to their sharp strong teeth. Many of the species, and probably all those of temperate and cold climates, lay up stores for winter.—The COMMON S. (*S. vulgaris*) of Europe is a beautiful little animal, about eight inches and a half in length

without the tail, which is fully six inches long, besides being apparently lengthened by its long hair. It is brownish red on the upper parts, and white beneath; the color changes more or less in winter to a grayish brown, and in northern countries to gray, and even to white. The long hairs which fringe the ears, and are drawn up into a fine point, are longer in winter than in summer. The Common S. is widely distributed over the northern parts of

Common Squirrel.

the Old World, and is plentiful in England, and in some of the southern parts of Scotland, into which, however, it is said to have been introduced. It is generally protected and its presence desired in the vicinity of mansions; although it often does considerable injury in plantations by gnawing off the top-shoots of trees, particularly of firs and pines. Morning is generally the time of the squirrel's greatest activity, except in winter, when it prefers the warmest hours.

Although numbers are often seen together, they live mostly in pairs, which seem to continue attached throughout life. The S. makes a beautiful nest of moss, twigs, and dry leaves, curiously interwoven, most frequently in the fork of a tree at a considerable height from the ground. Here the young are produced, three, four, or five at a birth, in the middle of summer. They continue with their parents till the spring of next year. The winter hoards of the S., containing nuts, beech-mast, grain, and the like, are usually in holes in the ground about the roots of trees, not far from its ordinary abode, the same pair of squirrels having often a number of these hoards. The seeds of firs form a very considerable part of the winter-food of squirrels, and to obtain them, the scales are gnawed away from the cones. The S. is easily tamed, and is an amusing pet. It is almost in constant motion, except when asleep.—The only other European species is the ALPINE S. (*S. alpinus*), a native of the Alps and Pyrenees, about the same size with the Common S., deep brown, speckled with yellowish white.—North America abounds in species of squirrels. The GRAY S. (*S. migratorius*) occurs in the northern parts of the United States, and as far north as Hudson's Bay. It is much larger than the European S., the whole length with the tail being nearly two feet. It is usually light gray, with yellowish-brown head, and logitudinal stripes of yellowish brown, but it is often found almost entirely black. Its habits are very similar to those of the Common S., but it is more gregarious. Gray squirrels sometimes visit corn-fields in large numbers, and make great devastation. In Pennsylvania, an old law gave a reward of threepence a head for every S. destroyed, and in the year 1749 no smaller a sum than £8000 was paid out of the treasury on this account, so that 640,000 squirrels must have been killed. Hosts of S. sometimes leave their native woods, and migrate like Lemming (q. v.) of Northern Europe, whether urged by scarcity of food or through some other unknown impulse. These migrations usually occur in autumn, and are regarded with great horror by farmers.

The squirrels advance in a straight course; mountains are no impediment, and although they swim with difficulty, they cross large rivers and the narrow bays of lakes.—The CAROLINA GRAY S. (*S. Carolinensis*) is a rather smaller species, abundant in the south-eastern parts of the United States, where its flesh is highly esteemed. A number of other species are found in different parts of North America, and very beautiful species occur in tropical countries, some of which live mostly in palms.—Of Ground Squirrels, several species are natives of North America, of which the best known is the CHIPPING S., HACKEE, or CHIPMUCK (*Tamias Lysteri*), abundant in almost all the eastern parts of the United States, and as far as 50° N. lat. Its length, with the tail, is fully ten inches; the general color gray, longitudinally striped with black and yellowish white. It derives its name from its *chipping* or chattering cry, which is like that of a young chicken. It seldom ascends trees; and is not troublesome to the farmer, as it does not attack standing corn, but gleans the fields, and feeds on fallen nuts in the woods. It burrows near the roots of trees, and several squirrels generally inhabit one burrow, which is deep and winding, and in which stores are laid up for winter use. In carrying nuts or other food to its retreat, it makes use of its cheek-pouches, cramming and distending them to the utmost.—A very similar species (*T. striatus*) inhabits Siberia.

The fur of some of the American squirrels is an article of commerce. It is one of the chapest kinds of fur.

SQUITCH. See COUCH GRASS.

S'RADDHA (from the Sanscrit *s'raddhâ*, faith, belief) is the name of the funeral ceremony of the Hindus, in which balls of food, and water, are offered to the deceased ancestors of the sacrificer, or to the *Pitr'is* or manes collectively. It is especially performed for a parent recently deceased, or for three paternal ancestors, and is supposed necessary to secure the ascent and residence of the souls of the deceased in a world appropriated to the manes. But this ceremony is observed also on occasions of rejoicing as well as of mourning; and hence various S'râddhas are enumerated—viz. 1. S'râddhas which are *constant*, or the daily offerings to the manes in general, and those offered on the eighth lunation of every month; 2 S'râddhas which are *occasional*, as those for a relative recently deceased, or those to be performed on various domestic occurrences, as the birth of a son, &c.; and 3. S'râddhas which are *voluntary*, performed for a special object. such as the hope of religious merit, &c. The proper seasons for the worship of the manes collectively are the dark fortnight or period of the moon's wane, the day of the new moon, the summer and winter solstices, eclipses, &c. The presentation of the ball of food to the deceased, and to his progenitors in both lines, is the office of the nearest male relative *and is the test and title of his claim to the inheritance.*—See for further detail, H. H. Wilson's *Glossary of Judicial and Revenue Terms* (Lond. 1855), under *S'râddha.*

S'RAVAKA (from the Sanscrit *s'ru*, to hear) is the name of the disciples of Buddha, who, through the 'hearing' of his doctrine, and by practising the four great Buddhistic truths, attain to the qualification of an Arhat, or Buddhist saint. From among the number of the disciples of Buddha, 80 are called the *Mahâs'râvakas*, or the great S'râvakas. The S'râvakas are entitled to the predicate *Ayushmat*, or 'one possessed of (long) life.'

S'RUTI (from the Sanscrit *s'ru*, here, hence, literally, the hearing, or that which is heard) is, in Sanscrit Literature, the technical term for all those works which are considered to have been revealed by a deity. It applies, therefore, properly speaking, only to the Mantra and Brâhmana portion of the Vedas; but at a later period it is applied likewise, if not especially, to the Upanishads. See VEDA.

SS, COLLAR OF, a collar composed of a series of the letter S in gold, either linked together or set in close order, on a blue and white ribbon, with the ends connected by two buckles and a trefoil-shaped link, from which hangs a jewel. Such collars have been much worn in England by persons holding great offices in the state, as well as by the gentry of various ranks, from esquires upwards. They are of frequent occurrence on sculptured monuments; but the origin of the device has not been satisfactorily explained. Among the numerous conjectures which have been formed regarding its meaning, one is, that the letter S stands for 'souveraigne,' the favorite motto of Henry IV.; others have suggested 'seneschal;' and Mr. Planché hints that it may, with equal probability, owe its origin to the swan of the De Bohuns, that badge being found in one of the earliest examples of this collar (1402), pendent round the neck of the poet Gower, in St. Saviour's Church, Southwark. The collar had, without doubt, originally a Lancastrian character. Collars of SS are still worn, with certain recognized distinctions, by the Lords Chief Justices, the Lord Chief Baron of the Exchequer, the Lord Mayor of London, the Heralds and the Sergeants-at-Arms.

STA'BAT MA'TER, a celebrated Latin hymn on the Crucifixion, beginning

Stabat mater dolorosa
Juxta crucem lacrimosa
Dum pendebat filius.

The *Stabat Mater* forms part of the service of the Roman Catholic Church during Passion-week. Its authorship has been assigned to Jacopone, a Franciscan who flourished in the 13th century. It has been set to music by many composers of eminence. Pergolese's *Stabat Mater*, written by that eminent musician on his deathbed, is justly celebrated for its pathos and expression. Rossini's more secular *Stabat Mater* is also well known to all lovers of music.

STABI'LITY AND INSTABI'LITY. When a body rests upon a surface, in such a manner that a vertical from its center of gravity falls within the largest polygon which can be formed by joining the various points of contact of base and surface, it will stand; but if the contrary is the case, it will fall, unless extraneously supported. If the base of the body be a plane, and the supporting surface convex, or *vice versâ*, or if both base and surface be convex, there will be only one point of support, and if the

body be at rest its center of gravity must be vertically over the point of contact. Should a body so placed receive a slight impulse, it will either oscillate to and fro, ultimately returning to its original position, or remove further and further from its original position, showing a tendency not to return, or appear indifferent to any one position. In the first case, the body is said to be in *stable*, in the second case, in *unstable*, and in the third, in *neutral* equilibrium. Fig, 1 shows various illustrations of these

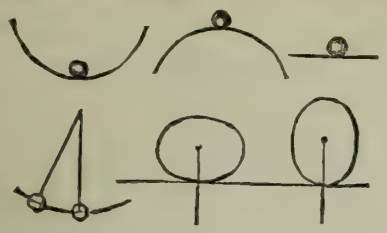


Fig. 1.

three species. It will appear at once that the predetermining cause of equilibrium being of one rather than of another of these species, is the tendency of the center of gravity of every body to seek a lower position; and the illustrations show that in stable equilibrium the center of gravity of the body may, and in unstable equilibrium may not, attain a lower position, while in neutral equilibrium its position continues unaltered.

In illustration of the mode in which the species of equilibrium possessed by a body which has received a slight impulse is determined, let us take the case of a body with a spherical base resting upon a spherical surface (fig. 2); let S and O be the the centers of

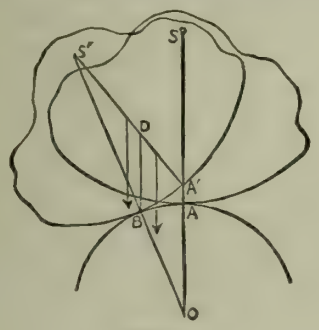


Fig. 2.

the spherical surfaces respectively, and let A be their point of contact (the center of gravity being consequently in the line SA, or in it produced towards S, and after displacement, in the line S'A', produced if necessary), let the new position of S, after the body has been slightly displaced, be S', and the new point of contact B; join OS, OS', S'A', and draw BD vertically, that is, parallel to OC. Then $A'D : A'S' :: OB : OS'$, or $A'D = \frac{A'S \times OB}{OS'}$, that is, A'D = the product of the radii of the two surfaces divided by their sum. Now, should the center of gravity of the displaced body fall between D and A', it will have a moment round B tending to restore the body to its former position (*stable equilibrium*); should the center of gravity be beyond D from A', its moment round B will tend to increase the displacement (*unstable equilibrium*); while, if it fall in the line BD, it will still be above the point of contact, as it was at first, and there will be no tendency either to return to, or to move further from, the original position (*neutral equilibrium*). These conditions may be briefly expressed by the following formulæ, in which R is the radius of the supporting surface, r of the spherical base of the body, and X the distance of the center of gravity from the point A; when equilibrium is stable, X is less than $\frac{R \times r}{R + r}$; when unstable, X is greater than $\frac{R \times r}{R + r}$; and when neutral, $X = \frac{R \times r}{R + r}$. From these formulæ, the conditions of equilibrium of a body, with a spherical base on a plane surface, can be at once deduced by making $R = \infty$, the three species of equilibrium being then represented in order by X less than r, X greater than r, and $X = r$; the simplest illustrations of these being respectively a segment of a sphere, a tall cone on a spherical base, and a sphere.

STACCA'TO (Ital. detached), in Music, a term implying a detached, abrupt mode of performance. A certain amount of time is subtracted from the proper value of any note played staccato, and a rest substituted. A dot placed over a note indicates that it is to be played staccato: . A dash implies a greater degree of staccato: , and a very slight degree of staccato is expressed by uniting the dot with the slur: ; the slur being the sign of a *legato* expression, the converse of staccato.

STA'CHYS, a genus of plants of the natural order *Labiatæ*, containing a great number of species, mostly European, having a ten-ribbed calyx, with five nearly equal teeth, the upper lid of the

Betony (*Stachys officinalis*).

corolla entire, and the lower lip three-lobed. Several species are natives of Britain. *S. sylvatica* is very common in shady places, a coarse herbaceous plant, sometimes called *Hedge Nettle*, with stem 2—3 feet high, ovate heart-shaped leaves on long stalks, whorls of purple flowers, and unpleasant smell. *S. palustris* is another very common British species, growing in moist places, and sometimes proving a very troublesome weed in meadows. The plant was formerly used as a vulnerary, and has therefore the English name *Woundwort*. Several species are not unfrequently to be seen in flower-gardens. To this genus some botanists refer the COMMON BETONY or WOOD BETONY (*S. betonica*, or *Betonica officinalis*), plentiful in woods and thickets in the southern parts of Britain, a plant one or two feet high, with hairy stem, oblong heart-shaped leaves, whorls of purple or white flowers, and a fetid smell. It was formerly much used in medicine. The roots, in small doses, are emetic and aperient.

STA'DÉ, a small but very ancient town, formerly fortified, in Prussian Hanover, near the mouth of the Schwinge, a tributary of the Elbe. Pop. (1880) 9700.

The *Stade Dues* were a toll or duty which used to be charged by the Hanoverian government on all merchandise carried up the Elbe to Hamburg. The original duties, as regulated by a treaty of date 1691, were comparatively light, but they had been gradually increased till they brought to Hanover a revenue of £40,000. After several modifications in 1844 and 1854, this vexatious toll was finally abolished in 1861, Hanover receiving a compensation equivalent to £30,000 annually, of which Great Britain paid one-third, another third was contributed by Hamburg, and the remaining third divided proportionally among the other countries that traded to the Elbe.

STA'DIUM, the course set apart for foot-races and all the other games excepting horse-racing, which were wont to be celebrated at Olympia and other places in Greece; the horse and chariot races being held in the *Hippodrome*, (q. v.). The stadium was of the same form as the hippodrome, and the arrangement of the spectators was similar. The distance between the starting-point and the goal was, in the Olympic stadium, about 600 Greek feet, and the stadia of other places adopted the dimensions of that at Olympia. This distance of 600 Greek feet was adopted as the chief Greek measure of length, and called a *stadium*. It was equivalent to 625 Roman feet, or 125 Roman paces; hence the Roman mile of 1000 paces contained exactly 8 stadia.

STA'DTHOLDER (Ger. *statthalter*, Dutch *stadhouder*, lieutenant or governor of a province). In the German cantons of Switz-

erland, the name is given to the second civil officer, who ranks next to the landamman. In the republic of the Seven United Provinces, the chief magistrate or president of the union was called the stadhouder. In the 16th c., when the tyranny of Ferdinand, Duke of Alva, governor under Philip II., drove the principal towns into revolt, they chose William, Prince of Orange, for their governor, and with the view of letting it be understood that the revolt was not against Philip, but against Alva, they conferred on William no higher title than that of Stadhouder. On the assassination of William in 1584, the provinces of Holland, Zeeland, and Utrecht agreeing to have one stadhouder, appointed Maurice of Nassau to that office, which came tacitly to be looked on as hereditary. The stadhouderate thus instituted was considered to be at an end or in abeyance on the extinction of the line of William I., by the death of William III. However, on the triumph of the Orange party over the Republican in 1747, William IV., descended from a collateral branch of the House of Nassau, was proclaimed stadhouder, captain-general, and admiral-in-chief of the Seven United Provinces, those dignities being made hereditary in his family. His son, William V., the seventh stadhouder, was driven from his country by the French in 1795, and resigned his office in 1802; since which time, the stadhouderate has never been revived, the Netherlands having, at the Congress of Vienna, been formed into a kingdom.

STAEL-HOLSTEIN, Anne Louise Germaine Necker Baronne de, was born at Paris, April 22, 1766. Her father was the celebrated M. Necker (q. v.), finance minister of Louis XVI., in the times immediately preceding the Revolution. Her mother was a woman of severe character, and from her earliest years subjected her to a discipline almost puritanic in its rigor. The daughter, in consequence, had no very warm attachment for her; but for M. Necker, who softened as he could by his indulgent tenderness the harsh rule of his spouse, she entertained the most ardent affection, regarding him then and always with what was almost an idolatry of fondness and admiration. Her talents were precociously developed, and whilst yet the merest girl, she would listen with eager and intelligent interest to the conversation of the Parisian *savans* who used to frequent the house of her father. In 1786, she was married to the Baron de Staël-Holstein, Swedish minister at Paris, an elderly gentleman with whom her happiness was probably not great, inasmuch as, a few years after, a separation between them took place, two sons and a daughter having been meantime the fruit of their union. In 1788, she issued her first work *Lettres sur les Ecrits et le Caractère de J. J. Rousseau*, which are rather a passionate eulogy of a girlish idol than a just and discriminating criticism.

Her sympathy with the Revolution in its earlier stage of promise was profound, but gave place, as its later enormities were developed, to a reaction of horror, which is vividly set forth in her subsequent *Considérations sur la Révolution Française*. Her grief was extreme on the failure of the attempt to escape on the part of the royal family, and she engaged in a secret scheme for securing them a flight to England. This, however, came to nothing; and she then, along with her father, betook herself to Switzerland, his native country. The news of the king's execution inexpressibly shocked her; and she sought to save the life of the queen by publishing *Réflexions sur le Procès de la Reine, par Une Femme*, which, however, was too late to be effective. In 1795, she published at Lausanne, under the title *Recueil de Morceaux Détachés*, a collection of her juvenile writings; and the year after, a treatise *De l'Influence des Passions sur le Bonheur des Individus et des Nations*, a work full of originality and genius. In 1797, order having been re-established under the Directory, she was once more in Paris. From the first, she distrusted the designs of Napoleon, and her *salon* became the headquarters of the anti-Bonapartist faction. In vain she was offered restitution of two million livres since 1788 due to her father from the royal treasury; she scornfully declined the bribe; and as neither fear nor favor could lead her to disguise her hostility to him, it seemed well for Napoleon to rid himself of her. She was forbidden to live in Paris, and subsequently (1802) exiled from France itself. Meanwhile, she had greatly increased her reputation by the publication of her romance of *Delphine*, and a work *Sur la Littérature considerée dans ses Rapports avec l'Etat Moral et Politique des Nations*. She now, for two years, traveled in Italy and in Germany, making at Weimar the acquaintance of Goethe, Schiller, Herder, Wieland, &c. The death of her father in 1804 recalled her to Coppet, in Switzerland. Subsequently, she was permitted to return to Paris, and there, in 1807, she published her famous *Corinne, ou l'Italie*, the success of which was instant and immense, and won for her a really European reputation.

As a bitter in the sweet of fame, however, fresh difficulties with Napoleon occurred, and she was banished anew to Coppet. Her son, the Baron Auguste, then 17 years old sought to intercede for his mother in a personal interview granted him by the emperor, whose inexorable deliverance on the occasion is too characteristic and amusing to be omitted: 'Avec l'exaltation de sa tête la manie qu'elle a d'écrire *sur tout et à propos de rein*, elle pouvait se faire des prosélytes; j'ai dû y veiller.' And in candor it is to be admitted, despite of the shrieks which have ever since been put forth about Napoleon's so-called 'ungenerous persecution,' that he acted on the dictate of a sound prudential policy. A woman who would keep no terms with him, who was uncompromising and fearless, and an influence by the weight of her genius and reputation, was clearly in Paris, of all places, a phenomenon not to be tolerated by the head of a government such as his, more or less the sport of the hour, as always in its basis precarious. After this, when disgusted with Coppet, where she found herself subself subjected to a petty *surveillance*, Madame de S. rushed restlessly over Europe to Vienna, Moscow, St. Petersburg, thence through Finland to Stockholm, and afterwards to London, where, in 1813, she published her great book, *De l'Allemagne*, which had previously been suppressed in Paris. As the first decisive revelation of the genius of Germany to the French people—somewhat as the earlier writings of Mr. Carlyle revealed it to the reading public of Britain—this may perhaps rank as the most important and influential of her works. Of her various experiences of travel, an interesting record is preserved in her *Dix Années d'Exil*.

At the Restoration, she returned to her beloved Paris; from Louis XVIII. she met with a most gracious reception; and restitution was granted her of the two millions on her father's account before mentioned. Soon after, her health failed; she sought its restoration in a visit to Italy in 1816, but without effect, and on July 14, 1817, she died at Paris. She was buried at Coppet; and by her will the fact was revealed that, in 1812, she had privately married M. de Rocca, a French officer of hussars, aged 25; which may be looked upon as something of an *escapade* for a mature matron of 46. In this wedlock, she gave birth to a son. M. de Rocca survived her only a few months. On the whole, she had scantly been happy, as cursed with the 'desires infinite and hopes impossible' which make life little better than a sad unfulfilled longing to many of her peculiar temperament and genius. Her touching wail of '*Jamais, jamais, je ne serai jamais aimé comme j'aime*' was a cry out of her inmost heart. In this light, there may perhaps seem some element of pathos in this marriage, which looks otherwise a little ridiculous.

Madame de S.—all just deduction from her claims being made—must be ranked in the first class of female genius. Without question of her real power and originality, in the combination she presents of such a force of intellect as women have but rarely exhibited, with depth and tenderness of sentiment seeking its natural outlet in a rich and impassioned rhetoric, she may curtly, yet with clearness sufficient, be defined as a sort of Rousseau in petticoats.

Her son published an edition of her works in 18 vols. in 1821, with a biographical notice by Madame Necker de Saussure. See Norris, *Life and Times of Madame de S.* (1853).

STAFF, in Music, the name given to the five parallel lines and four intermediate spaces on which the characters indicating musical sounds are placed, the degrees of the staff indicating differences of pitch.

STAFF, in a Military sense, consists of a body of skilled officers, whose duty it is to combine and give vitality to the movements and mechanical action of the several regiments and drilled bodies composing the force. The distinction between an officer on the staff of an army and a regimental officer is that the latter is concerned with his own regiment alone, while the former deals with his army, or section of an army exceeding a regiment, and regulates the combined action of the several arms and bodies of men. A good staff is all-important to the success of a military enterprise.

The *General Staff* of an army comprises the general in actual command, with the subordinate generals commanding the several divisions and brigades; as assistants to these, the officers of the adjutant-general's department—i. e., the adjutant-general, his deputy, assistants, and deputy-assistants, if the army be large enough to require all. Similarly the officers of the quartermaster-general's department; the brigade-major; the provost-marshal; and the judge-advocate; and the controller (at the head of the civil departments); the functions of all of whom are described under their respective heads. The head of the general staff of the British army is at present a field-marshal commanding-in-chief, whose headquarters are at the War Office, of which department he is an *ex officio* member. He is responsible for the discipline of the army, and is assisted by the general officers in command of the military districts in England and Scotland, the semi-independent commander-in-chief in Ireland, and the commanders-in-chief in the various foreign possessions and colonies. India forms a nearly independent command, under a commander-in-chief, whose headquarters are in Bengal. There are subordinate commanders-in-chief in Bombay and Madras; and in each presidency there are

several military divisions. A certain period of military service, and certain qualifications, are required in an officer before he can be appointed to the general staff, and a proportion of the posts is given to officers who have passed the Staff College. The fact of having passed through it, however, is not held to constitute any claim to a staff appointment.

The *Personal Staff* consists of the aides-de-camp and military secretaries to the respective general officers. These officers are appointed, within certain limits, by the generals whom they serve.

The *Garrison Staff* consists of the officers governing in fortresses and garrisons; as Commandants (q. v.), Fort-majors (q. v.), Town-majors (q. v.), Fort-adjutants (q. v.), and Garrison-adjutants.

The *Civil or Departmental Staff* includes those non-combatants officers who have to provide for the daily requirements of the troops. These are the commissaries for supplies and stores, chaplains, medical and veterinary departments. These departments are described under their several names.

The *Recruiting Staff* consists of an inspector-general (at the War Office), and of the officers of the several brigade depots. The *Pensioner Staff* includes only the staff-officers of the enrolled force. The *Regimental Staff* includes the colonel, lieutenant-colonel, adjutant, paymaster, quarter-master, inspector of musketry, and medical officers. See RECRUITING, PENSIONERS, REGIMENT.

In the French and most continental armies, the staff is divided into the *état-major*, or general staff and the *intendance*, under an *intendant-général*, which comprises all the civil departments. There is a regimental staff in addition. The want of concentration of the civil departments often felt in the British service, led to the creation, in 1869, of the Control Department, subsequently split into two branches, the Commissariat (q. v.) and the Ordnance Store Departments. See INTENDANT.

In the Navy, the staff of a fleet consists of the Flag-officers (q. v.), the Flag-lieutenants (q. v.), and Secretaries (q. v.); also of the inspector-general of hospitals (see MEDICAL DEPARTMENT, NAVY), and an inspector of machinery.

STA'FFA, a celebrated islet on the west of Scotland, lies about 7 miles off the west coast of Mull. It forms an uneven tableland, rising at its highest to 144 feet above the water, 1¼ miles in circumference, and oval in shape. In the north-east, in the lee of the prevailing winds, is a tract of low shore, stretching out in beeches, and forming a landing-place. The other parts of the coast are girt with cliffs of from 84 to 112 feet high. Regarded in section, the rocks show themselves to be of three kinds—conglomerated tufa forming the basement; columnar basalt, arranged in colonnades, which form the façades and the walls of the chief caves; and amorphous basalt, overlying the columnar basalt, but pierced here and there by the ends of columns and by angular blocks. The most remarkable feature of the island is Fingal's or the Great Cave, the entrance to which is formed by columnar ranges on each side, supporting a lofty arch. The entrance is 33 feet wide, and 60 feet high, and the length of the cave is 212 feet. The floor of this marvelous chamber is the sea, which throws up flashing and many-colored lights against the pendent columns, whitened with calcareous stalagmite, which form the roof, and against the pillared walls of the cave.

STAFF COLLEGE is a government institution founded in 1858, about two miles from Sandhurst, for the purpose of giving higher instruction to 30 (increased in 1870 to 40) officers aspiring to appointments on the staff. It thus took the place, though more effectively, of the old senior class at the Royal Military College. To be entitled to compete for entrance, an officer must have been five years in active service, must have passed the qualifying examination for a captaincy, and must have the recommendation of his commanding officer. A very serious examination decides which among the competitors shall be admitted to the college, one only being eligible from any battalion. While at college, the students receive their regimental pay, and the whole educational charges (about £8000 annually) are borne by the public. The course lasts two years. At the end of each year, there is an examination, not competitive. After passing the Staff College, the officer is attached for duty, for a short period, to each of the arms with which he may not have already served. He then becomes eligible for appointment to the staff as opportunity may occur.

STAFF CORPS. During the wars of Wellington, the generals and staff officers were aided by a staff corps composed of intelligent officers and men who performed camp duties, made reconnoissances, and executed other necessary labors for which regimental officers or soldiers were unsuited. This corps died out after the peace. After the Crimean war, there were three staff corps—the Commissariat Staff Corps, Army Hospital Corps, and Military Store Staff Corps—which consisted of artificers, laborers, and orderlies, to aid in the work of their respective departments—as butchers, wardmasters, armorers, copyists, &c. The first and last were merged in 1870 into the Army Service Corps. S. C. is also the name given to the English Officers serving on the permanent Indian establishment.

STA'FFORD, an inland county of England, between the counties of Cheshire and Warwick, has an area of 732,434 acres, and a pop. of (1871) 858,326; (1881) 981,385. The most elevated portion of the county is the north, where wild moorlands in long ridges, separated by deeply cut valleys, extend from north-west to south-east, and subside as they near the valley of the Trent. The surface is low or undulating in the midland regions, but becomes hilly again in the south. New red sandstone occupies the whole of the central parts; the Pottery coal-field occupies the north, and the Dudley coal-field, remarkable also for its abundant and rich iron ores, occupies the south. The Trent, flowing first south-west through the county, then north-east along its eastern border, is the chief river. The climate is cold and humid, and though three-fourths of the area are arable, much of the soil is cold and clayey, and agriculture is in a backward condition. The Potteries lie around Stoke (q. v.), Burslem, and Hanley, and here most extensive manufactures of china and earthenware are carried on. See POTTERY and WEDGWOOD. In the south, iron is very largely manufactured in all its branches, from mining to the production of articles in iron and steel. The numerous canals (including the Grand Trunk Canal) and railways which intersect and traverse the county, afford abundant and most useful means of conveyance. The county of S. returns six members to the House of Commons.

STAFFORD, the county town of Staffordshire, stands on the Sow, 25 miles north-north-west of Birmingham. The usual municipal institutions of county towns are the chief buildings, and there are two fine and partly ancient parochial churches. Tanning, cutlery, and the manufacture of shoes are the chief branches of industry. S. sends two members to the House of Commons. Pop. (1881) 19,901.

STAG, a name familiarly given to a person who applies for an allocation of shares in a joint-stock concern, with a view of selling the allocation letter to another party for a small consideration. When no such consideration or premium is obtainable, the *stag* does not pay the deposit, which by his application he had become bound to do, and relinquishes any further interest in the undertaking. Persons acting thus, however, are liable to prosecution and exposure as defaulters. During the great railway mania of 1846, the stock-market was thronged with stags.

STAG, or RED DEER (*Cervus elaphus*), a species of Deer (q. v.) with round antlers, which have a snag at the base in front. The female has no horns, and is called a *Hind*. The young male, during the first year, acquires mere knobs in place of horns. In

Stag, Hind, and Calf (*Cervus elaphus*).

the second year, they are longer and pointed, when the animal is called a *Brocket*. The branching of the horns increases every year till the sixth, when the name Hart (q. v.) begins to be applied. After this, the age is no longer indicated by an increased number of branches, but the antlers become larger and thicker, their furrows deeper, and the *burr* at the base more projecting. The oldest stags have seldom more than ten or twelve branches, although an instance has occurred of 33 on each antler. A fine S. is four feet or more in height at the shoulder. The color is reddish brown in summer, the rump pale; in winter, it is brownish gray. The female is smaller than the male. The young is at first spotted with white. The S. is a native of Europe and the north of Asia. It was anciently common in all parts of Britain, but is now almost extinct, except in the Highlands of Scotland, where large herds still exist, particularly on the Grampians, and the sport of deer-stalking is pursued, in which the rifle is now

generally used; although, in former times, the S. was hunted, hounds of a peculiar breed, called Staghounds (q. v.), being employed for the purpose.

The forest laws of England were extremely strict for the preservation of this noble game, the unauthorized killing of a S. being even a more unpardonable offence than the killing of a man. The S. feeds on the buds and young shoots of trees, and on grass; or, in the severe weather of winter, on bark and mosses. The speed of the S. is very great. It has also great powers of swimming, and has been known to swim ten miles. When hard pressed by hunters, it turns to bay, and is not approached without danger. At the pairing season, which is in August, even tame stags become so excited that it is not safe to approach them. The domestication of the S. is never very complete. In fighting, the S. uses not only its horns, but its forefeet, with which it gives severe blows to an adversary. The flesh of the S. is not so good as that of the Fallow Deer.—Among the species of deer most nearly allied to the S. are the Wapiti (q. v.), an American species, and several species belonging to the warmer parts of Asia and the north of Africa. They all have round branched antlers, with a basal snag in front, and a tuft of hair on the hind legs, above the middle of the metatarsus.

STAG BEETLE (*Lucanus*), a genus of coleopterous insects, of the family *Lamellicornes*, remarkable for the large projecting mandibles of the males, which have large denticulations, and somewhat resembles stags' horns. The antennæ terminate in a club composed of many leaflets, disposed on an axis like the teeth of a comb. The COMMON S. B. (*L. cervus*) is one of the largest of

Stag Beetle (*Lucanus cervus*).

British insects, the males being fully two inches long. It flies about in the evening in the middle of summer, chiefly frequenting oak-woods. The larva feeds on the wood of the oak and willow, and is injurious to the trunks of trees, into which it eats its way very rapidly. It is supposed to be the *Cossus* of the ancient Romans, much esteemed by them as a delicacy. It lives for several years before undergoing its transformations. In its perfect state, the S. B. is a formidable-looking insect, and its powerful mandibles are capable of inflicting a pretty severe bite, if it is incautiously seized, but it is not venomous. Some of the tropical stag beetles are remarkable for their brilliancy of color.

STAG-HOUND, a large and powerful kind of Hound (q. v.), formerly much used in England for hunting the stag, but now almost

Staghound.

extinct. It is supposed to be a breed of the old English Southern Hound. In scent, it is almost equal to the bloodhound; in fleetness it is inferior to the foxhound. It has great power of endurance, and has been known to run 50 miles after the stag. It is also courageous, and does not hesitate to attack the stag when at bay.

STAGE. See THEATER.

STA'GGERS is a popular term applied to several diseases of horses. Mad or Sleepy Staggers is inflammation of the brain, a rare but fatal complaint, marked by high fever, a staggering gait, violent convulsive struggling, usually terminating in stupor; and treated by bleeding, full doses of physic, and cold applied to the head. Grass or Stomach Staggers is acute indigestion, usually occasioned by overloading the stomach and bowels with tough hard grass, vetches, or clover, a full meal of wheat, or other indigestible food. It is most common in summer and autumn, is indicated by impaired appetite, distended abdomen, dull aspect, unsteady gait; and is remedied by full doses of purgative medicine, such as six drachms of aloes and a drachm of calomel rubbed down together, and given in a quart of thin well-boiled gruel. Frequent clysters, with hand-rubbing and hot water to the belly, are likewise useful. Where the dullness increases, stimulants should be freely given. See HYDATIDS.

STAHL, GEORG ERNST, a celebrated German physician and chemist, was born at Anspach, 21st October 1660, studied medicine at Jena, and after practising successfully for some time, was called, in 1694, to the chair of Medicine, Anatomy, and Chemistry, in the newly-founded university of Halle; whence he removed to Berlin in 1716, where he was appointed physician to the king of Prussia. He was a member of the Berlin Academy, and died in that city 14th May 1734. According to Blumenbach, S. is to be considered as one of the greatest and most profound physicians the world has ever seen, though the mysticism with which his works are imbued is to be reprehended. S.'s system of medicine, which was a combination of the physiology of Van Helmont (q. v.) with the psychology of Descartes, is founded upon the supposition of the existence of a mysterious force residing in, but independent of, and superior to matter; this force, the *anima* (or 'soul'), not only forms the body, but directs it in the exercise of all its functions, and this, too, sometimes unconsciously; though the way in which this influence is exercised he does not explain. Being subject to error by nature, the 'anima,' by negligence or maladroit action, originates diseases in the body, which it then attempts to cure, through the functional action of the various parts. S. held that art ought only to commence where nature had ended, and to be useful, it should follow a similar course of action; he was also of opinion that plethora, either local or general, was one of the chief causes of disease. His system of therapeutics corresponded with his pathological principles, and was confined mostly to bleeding and the use of mild laxatives. His psychological theory of the connection between the soul and body led him into a discussion with Leibnitz (who had falsely charged him with propounding materialism), from which he emerged victorious on the essential points of their respective theories; though Leibnitz had the advantage in matters of detail.

Subsequent physiologists have made S.'s opinions the object of ridicule, though his doctrine of the 'anima' is, under the name of 'vital principle' and 'nature,' generally adopted at the present day; but his supercilious contempt for chemistry as a medical agent has long ceased to be generally upheld. Nevertheless, S. was one of the ablest chemists of his time, destroyed in his usual trenchant style, numberless absurd opinions which had found their way into the science, and propounded the first theory of combustion (see PHLOGISTON), which was universally accepted till the time of Lavoisier (q. v). His works, according to Haller, number 250, but the chief are—*Theoria Medica vera* (Halle, 1707, 1708, 1737), which contains his medical theory, and *Zymotechnia Fundamentalis, seu Fermentationis Theoria Generalis* (Halle, 1697), in which his chemical opinions are set forth. An account of his opinions is found in Haller's *Bibliotheca Medicinæ Practicæ*, vol. iii.; Sprengel's *Histoire de la Médecine;* A. Lemoine's *le Vitalisme et l'Animisme de Stahl* (Paris, 1864).

STAINED GLASS. See GLASS.

STAINS FOR WOOD. A variety of stains have recently been invented for the purpose of giving to the cheaper kinds of wood, such as deal, &c., the appearance of the more costly kinds. These are chiefly solutions of certain metallic salts, combined with vegetable infusions.

STAIR, EARLS OF. See DALRYMPLE.

STAI'RCASE. This feature, now so important in all houses, was of small note till about the time of Queen Elizabeth. Previously, stairs were all constructed on a circular plan, revolving round a central axis or newel, and were called turret or corkscrew stairs. During the 16th and 17th centuries, staircases with wide straight flights were first introduced, and were made leading features in the mansions of the Elizabethan style. They had usually massive oak balusters with carved pedestals, and were ornamented with carved panels, pendants, &c. Staircases of this description are still in common use, but are lighter in style, light cast-iron railings being substituted for the heavy oak balustrades.

STAKE NETS. See SALMON.

STALA'CTITES AND STALAGMITES are found in caves and other places where water charged with carbonate of lime is subject to evaporation. Water impregnated with carbonic acid is able to dissolve lime, and as all rain and surface water contains more or less carbonic acid, it takes up in its passage through the earth to the roofs of caves a certain amount of lime. When the water is exposed on the roof or floor of the cave, evaporation takes place, and so both the bulk of the water and its solvent power are reduced, and a thin pellicle of solid carbonate of lime is deposited. When this takes place on the roof of the cave, long icicle-like pendants are formed, which are called stalactites; and when the water drops upon the floor, a stalagmitic layer is formed, which rises at the points where the largest supply of material exists, in the form of pillars to meet the overhanging stalactites. In some caves, the descending and ascending points have met, and formed a series of natural columns as if supporting the roof. The color of the limestone thus formed is affected by the superincumbent strata, but it is generally white or yellowish. The stalactites have a rich subcrystalline structure, being composed of acicular radiating crystals, arranged in concentric layers from their exogenous growth. Sometimes, from metamorphic changes that have taken place subsequent to their formation, they become more truly crystalline. The amount of the deposition is very great in some caves, and the wonderful variety and singular groupings of the stalactites give them a peculiar beauty. The caves most remarkable in this way are the Cave of Adelsberg in Styria, the Grotto of Antiparos in the Grecian Archipelago, Wyver's Cave in the United States, and the caves of the Peak in Derbyshire.

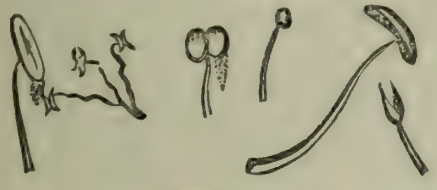
The remains of primeval man found in the caves in France, and the fossils from the bone caves in Britain and elsewhere, are generally cemented together into a stalagmitic deposit on the floor of the cave.

STALL, a fixed seat enclosed at back, and with elbows at the sides. One or more rows of these extended along each side of the choir of most churches before the Reformation, and fine examples still remain in nearly all the cathedrals. They are generally enclosed at back with a high screen, and covered with canopies ornamented with pinnacles, &c.

STA'LYBRIDGE, a market-town and parliamentary and municipal borough, partly in Lancashire and partly in Cheshire, stands on the Tame, eight miles east of Manchester. It is remarkable chiefly for its cotton manufactures. The print-works, iron-foundries, and machine-shops are also numerous and important. Free communication by railway is afforded in every direction. There are in S. 39 mills employing 10,000 hands, and 28 foundries and machine-shops, employing 1100 hands. Pop. (1871) of mun. borough, 21,092; (1881) 22,784.

STAMBOU'L. See CONSTANTINOPLE.

STA'MENS are those parts in the flowers of phanerogamous plants which excite the pistil to the formation of the fruit, and thus effect fertilization of Fecundation (q. v.), A stamen consists of a receptacle—the *anther;* which contains a dust—the *pollen*—various in color, but generally yellow, and is generally supported on a stalk called the *filament;* the anther being the blade of a metamorphosed leaf, and the filament the leaf-stalk. The filament is, however, sometimes awanting, and the anther is then said to



Stamens.

be *sessile*. Each anther generally consists of two cells forming two lobes, which, before they open to give forth the pollen, are again divided into two cell-like parts, and at the time of their maturity open by longitudinal clefts, by pores, or by valves, to scatter the pollen, which is conveyed to the stigma either by its own falling, by the wind, or by the insects which seek honey in flowers. See PISTIL. The pollen consists of single cells, which are usually free; more rarely, the pollen of each cell is united into a mass, called the *pollen-mass* or *pollinium*, as in the *Orchideæ* and *Asclepiadaceæ*. The stamens are either found along with the pistil in the same flower, and are then arranged around it, in which case the flower is *hermaphrodite;* or they are placed by themselves in separate flowers, which are therefore called *male* flowers.

The stamens are sometimes united together, generally by the filaments, which form a tube, and the flower is *monadelphous;* sometimes, by their union, they form two sets, when the flower is *diadelphous;* sometimes three or more, when it is *polyadelphous;* and the filaments are sometimes united with the pistil into a column, from which the anthers spring, as if they grew from the pistil, when the flower is *gynandrous*. See BOTANY. The stamens form either one or more whorls, and when in one whorl are either opposite to the petals or alternate with them. The latter is regarded as their normal position. Sometimes, by abortion, there is only one stamen. Being leaf-organs, stamens arise from the axis; but they very frequently grow upon the corolla, so that they seem to derive their origin from it. When the stamens seem to arise from the corolla or from the calyx, they, and also the flower are said to be *perigynous* (Gr. *peri*, around, and *gyne*, a wife); when they grow from the pistil, they are *epigynous* (Gr. *epi*, upon); and when from beneath it, *hypogynous* (Gr. *hypo*, under). These distinctions have been much made use of, by Jussieu and others, in classification. The transition of petals into stamens can be easily traced in some flowers, for example, in the Water Lily. In double flowers, the stamens have been changed into petals. Linnæus adopted the stamens as the means of his division of plants into classes (see BOTANY); but in so far as the classification was founded on their mere number, it was artificial, the number of stamens being various in plants very closely allied. Stamens are among the organs of plants which most frequently display Irritability (q. v.).

The filament assumes a great variety of forms. Sometimes it is short and thick, sometimes long and slender; sometimes dilated at the base; sometimes petal-like, with the stamen at its tip; sometimes forked, or divided into three teeth, of which the central one bears the anther; sometimes bent or jointed, sometimes spiral. The form of the anther varies still more than that of the filament; indeed, the variety of forms is endless. The *connective* is a body which unites the lobes of the anther. When the filament is continuous with the connective, the anther-lobes seeming to be united to it through their whole length, the anther is said to be *adnate* or *adherent;* when the filament ends at the base of the anther, the anther is *innate* or *erect*. In many flowers, as in those of grasses, the anther is attached to the filament by a mere point, and is very movable, easily turned by the wind. It is then said to be *versatile*.

STA'MFORD, an ancient market-town and a parliamentary and municipal borough of Lincoln, on the Welland, which is navigable hence to the sea, 11 miles north-west of Peterborough. Agriculture is almost the exclusive pursuit of the inhabitants of the district around, and S. is chiefly remarkable for its ancient remains. It first appears in history in 449, when the Britons and Saxons here defeated the Picts and Scots. Many of the Jews of S. were slain, and the whole community plundered in 1190 by those who had enlisted for the Crusade. In the middle ages several parliaments and councils were held here, and the town contained about 16 churches, and a number of religious houses. In 1572, a number of Flemish Protestant refugees settled here, and introduced the weaving of silk and serge. Portions of the walls and gates of the Carmelite and Franciscan priories, as well as other curious remains, are still extant. There are numerous schools and other important institutions. Pop. (1871) 8086; (1881) 8995. S. returns a member to the House of Commons.

STAMFORD, a town of Connecticut, U. S,, at the entrance of Mill River into Long Island Sound, 36 m. N.-E. of New York, on the New York and New Haven and New Canaan and Stamford Railways. It is a favorite residence and summer resort of opulent New Yorkers. It has 2 banks, 2 newspapers, 14 churches, a small coasting-trade, and manufactures of iron, boots and shoes, dye-stuffs, carriages, coal oil, &c. Pop. (1870) 9714; (1880) 11,297.

STA'MMERING AND DEFECTIVE SPEECH. Stammering is an affection of the vocal and enunciative organs, causing a hesitancy and difficulty of utterance, and respecting the nature and the origin of which a variety of different opinions has been entertained. Stammerers themselves often attribute the varying conditions of their impediment to causes which must be purely imaginary, such as the state of the wind, the changes of the moon, &c. There can be no doubt that the impediment is aggravated by depression of spirits, derangement of the digestive organs, physical debility, &c.; but these influences have nothing to do with the primary cause of the infirmity. A nervous dread of speaking is usually associated with stammering; but this is rather the result than the cause of the impediment. If constitutional nervousness were productive of stammering, the number of sufferers would be vastly greater, and it would include a larger proportion of females than of males; whereas the robust sex furnishes by far the greater number of cases; and it is noticeable, besides, that stammerers are not in general persons of weak nerves, otherwise than in connection with the act of speaking. Any physical defect will render a person nervous when the peculiarity is made a subject of observation, and it is in this way only that nervousness is associated with speech in cases of stammering. The strength of this impediment lies in *habit*, in mismanagement of the breath and the organs of utterance, rendered habitual before the development of reason and observation; and the removal

of the defect depends on the acquirement of voluntary control over the mechanical agents of speech. The nervousness which unfits the stammerer for self-direction gradually subsides as his will attains a mastery over the processes of speech; and perseverance in a discipline of systematic and guarded utterance rarely fails to remove the impediment, and the fear which accompanied it.

The first manifestations of stammering usually take place during the weakness attendant on disease, or after a fall or sudden fright; but sometimes the impediment appears to arise from imitation, and children have been known to be infected by even the most casual example. Thus, when one member or visitor of a family stammers, the younger members of the family are very apt to be similarly affected. From this cause defects of speech run so much in families, that many persons have thought them to be hereditarily transmitted. This, however, is altogether a mistake. In the early stages, a little patient direction on the part of parents and nurses would suffice to check the tendency to stammer, and prevent the formation of the unfortunate habit.

Stammering generally begins about the fourth or fifth year of age; but harshness in checking children, or impatience in connection with messages or lessons, may induce the impediment at a considerably later period. Boys of ten or eleven years of age have been excited into the habit by injudicious hurry and peremptoriness at school. The little stammerer, when he cannot be more directly assisted, should be kindly counselled to take time and speak slowly, and he should by no means be ridiculed or reproved for what he cannot help, and is not taught how to avoid.

The varieties of stammering are so great, that scarcely two cases are found precisely alike. In some there is but little outward manifestation of effort; in others, the futile attempts are painfully demonstrative. The silent straining to speak causes the eyeballs to protude, and the veins of the face and neck to swell, till relief from apparent choking comes in fitful ungovernable bursts of sound. In almost all cases the head oscillates loosely on the neck, and is forced upwards by the misdirected current of breath; while the larynx, the organ of sound, is from the same cause agitated in continual efforts to ascend, and the voice is consequently abrupt and intermittent, and unnaturally acute. The muscles of the face participate in the general upward action, and sometimes the spasmodic contortions extend over the whole body, causing the stammerer to rock in his chair, or start wildly to his feet. These muscular disturbances arise simply from disordered respiration, and they disappear when the habit of closing the glottis and compressing the organs of articulation is overcome and the air is allowed to pass freely in or out of the lungs.

The terms stuttering and stammering are often used synonymously, but the former term is properly, or, at least, conveniently, limited to a loose and imperfect action of the organs of articulation, as distinguished from the irregularity of breathing and the convulsive and choking symptoms which invariably accompany stammering. In stuttering, the organs meet and rebound again and again in reiteration of syllables before words can be fully formed. The source of this difficulty lies mainly in the lower jaw. When this organ is brought under control, and the effort of speech is transferred from the mouth to the throat—where all voice is formed—the power of fluency is readily obtained. But stuttering is rarely unaccompanied by some degree of spasmodic stammering, and the two forms of impediment, while theoretically distinct, are generally blended in mutual aggravation.

Stammering is, in nearly every case, perfectly curable, as it seldom arises from organic defect. The means of cure must, however, often be continued for a length of time before the stammerer is free from the danger of relapse. The best time for the cure is undoubtedly the earliest, before the habit has acquired full strength, and before the sufferer has endured the most grievous mortifications and drawbacks of the impediment. But the adult stammerer generally brings to the curative task a higher appreciation of its importance, and a greater care and concentration of effort than the child is capable of; and these qualities almost compensate for the disadvantage of long-established habit. Parents often unwisely defer the attempt to correct impediments of speech, in the hope that the defects will disappear as the child gains strength and reaches riper years. But the hope is very rarely realized; and were it otherwise, the misery of years of impediment, and the hindrance to education which stammering certainly involves, are evils to be avoided by all possible means. With this, as with all habits, 'prevention is better than cure;' and stammering would be easily and certainly prevented by timely advice carried out with ordinary care in the nursery.

The means that have been proposed for the cure of stammering have been as various as the theories of the nature of the defect; and sometimes the 'cure' has been apparently but little better than the disease. Drawling, singing, interpolations or elisions of letters, speaking with the teeth closed, or with the tongue pressed to the roof of the mouth, sniffling, whistling between words, beating time to utterance, stamping the foot, jerking the body, forks on the tongue, pebbles in the mouth, or tubes fixed between the organs, bands compressing the larynx, and other absurd and uncouth devices, have been under cover of expedient secrecy, practised on unhappy stammerers. But the removal of this defect, as above shown, depends on the skilful application of scientific principles, respecting which there is no mystery save that which arises from the little attention that has been paid to the science of speech.

From the preceding account of the nature of stammering, it is almost superfluous to add that the cure of this impediment does not fall within the province of surgery. Yet the barbarous operation of cutting a wedge from the root of the tongue—introduced from Germany about 25 years ago—and the equally futile and cruel operation of excising the tonsils, have been, within no distant date, extensively practised by surgeons in this country.

The habit of stammering can only be counteracted by the cultivation of a habit of correct speaking; and the latter can only be acquired by studying the processes of speech, the relation of breath to articulate sounds, the positions of the tongue and the other oral organs in moulding the outward stream of air; and by a patient application of these principles in slow and watchful exercise. The lungs constitute a pair of bellows, and the mouth, in all its varying shapes, the nozzle of the bellows. The passage of the throat must be kept open, and the breath expelled by means of the ascent of the diaphragm, not by downward pressure of the chest. All sound originates in the throat, and all effort in speech must be thrown back behind the articulating organs, which must be kept *passive*, yielding to the air, always opening to give it exit, and never resisting it by ascent of the tongue or of the jaw. The head must be held firmly on the neck, to give free play to the attached organs; and the great principle must never be lost sight of that *speech is breath;* and that, while distinctness depends on precision and sharpness of the oral actions *fluency* depends on the unrestrained emission of the material of speech—the air we breathe.

Besides stammering and stuttering, there are many other forms of vicious articulation, which are rather defects than impediments of speech. The elementary sounds most subject to mispronunciation are those of *r* and *s*, giving rise to the common defects of burring and lisping. Burring consists in vibrating the uvula or the edge of the soft palate, instead of the tip of the tongue; and lisping consists in applying the tongue to the teeth or the gum, so as to intercept the breath, and force it over the sides instead of the center of the tongue. The sound of *l* also is often defective, *w*, *y*, *ng*, or a *vowel* being substituted for the lingual articulation. Other substitutions of one element for another are common, such as *t*, *d*, and *n*, for *k*, *g*, and *ng; s* or *z* for *th; s* for *sh*, &c. There are also defects which arise from organic malformation, and require the aid of surgery; as when fissure exists in the palate, and the breath cannot be enclosed behind the lips or tongue, but escapes into the nostrils; when the tongue is too closely tied to the bed of the mouth, and the tip cannot be raised to the palate; when the teeth are so irregular or abnormally numerous as to leave the tongue too little room to act, &c. In some cases the breath escapes into the nostrils when there is no organic cause for the peculiarity, and *r*, *l*, *s*, and other elements are nasally affected, merely from habit. The nasal passages are, in other cases, insufficiently free, and *m*, *n*, and *ng* are scarcely distinguishable from *b*, *d*, and *g*.

There are comparatively few persons who have perfect command over their vocal organs. Speaking, which is in reality an art, is exercised only as an instinct; and thus, as an eminent American author (Dr. Rush) observes, 'some men only bleat, bark, whinny, or bray a little better than others.' It is some consolation to those who have been compelled by defects to study the art of speech, that they exercise the crowning faculty of man's nature more worthily than others, and thus become, perhaps, better speakers than they would have been without the stimulus of defect or impediment.

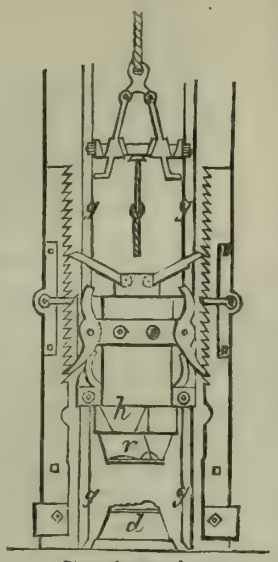
Speaking, when the respiration is properly conducted, is one of the most healthful exercises; but violent or long-continued effort is injurious to the chest, when the lungs are not kept well inflated. Frequently, also, under such circumstances, the vocal chords become permanently relaxed, and total loss of voice sometimes ensues.

The acquirement of the power of speaking in infancy is dependent on the possession of hearing, so that deaf children are also mute. Under proper training, however, they may be taught to articulate, as the organs of speech are very rarely imperfect. Children who have been subject to fits or other cerebral affections, or who are deficient in imitative power, are sometimes very backward in learning to speak. In such cases, great care is requisite to direct the early attempts, and prevent the formation of bad habits. Many of the worst forms of defect and impediment owe their origin simply to the want of proper direction in the production of elementary sounds, when the little sufferers have failed to enounce them correctly by natural imitation.

It is unnecessary to enumerate the various English, American, and foreign authors who have propounded conflicting theories of

the cause, and schemes for the cure of impediments of speech. Of the systems practised in this country at the present day, those of Dr. Hunt and Mr. Melville Bell have been most fully published. The views of these authors differ but little, and are in substance the same as those contained in this article.

STAMPING OF METALS. There are different kinds of stamping. The plan adopted for producing coins or medals is described under MINT, and the preparation of the dies used, under DIE-SINKING. For the ordinary stamped brass-work, so extensively made in Birmingham, a stamping-machine is employed, of which the essential parts are a *die*, a *reverse* or counter-die, and a *hammer*. It is shown in the annexed figure; but the toothed rack, with arrangement for catching the hammer after it rebounds, is only used for special purposes. The die *d*, which is made of cast iron or steel, is fixed to the bottom of the stamp, and the reverse, *r*, is attached to the hammer *h*, which works between two guides *g*, *g*, pieces of thin rolled brass are cut to size, and one placed upon the die; the hammer, with the counter-die, is now raised to a sufficient height by a windlass and rope, or other means, and allowed to fall, and thus force the thin plate into the die. The plates from the first blow are then annealed. Repeated blows and annealings follow until the article is 'brought up,' slight alterations in the reverse being from time to time required. Sometimes as many as 30 blows are necessery, but 10 or 12 strokes will suffice for an object with a considerable depth of raising. Globular articles are stamped in two or more pieces, and then soldered together.



Stamping-machine.

The stamping process was first adapted to the production of hollow shapes in sheet-iron by Mr. T. Griffiths, in 1841; and since then, the manufacture of such goods as dish-covers, basins, and teapots has been improved and extended to a surprising extent. In the case of a dish-cover, for example, a single sheet of iron is brought to the required shape by repeated stampings and burnishings upon a chuck. It is afterwards tinned with great ease, there being no joints to interfere with the operation; for the same reason, iron basins stamped out of a single sheet can be readily enamelled. The old way of forming these articles by hand-labor was very tedious and clumsy.

German silver is too brittle a metal to be stamped like brass or iron, consequently it has only hitherto been made into small objects, such as spoons and forks by this process. But the Messrs. Elkington of Birmingham are now making articles of considerable size in this material, by means of a stamping-press worked by hydraulic power. A number of graduated dies are used for one object, each pair coming gradually nearer the desired shape, but none of them making an impression deep enough to strain the metal.

For stamping-machines used in dressing metallic ores, see METALLURGY.

STAMPS, or STAMP DUTIES, are taxes imposed on all parchment and paper whereupon private deeds or other instruments of almost any nature are written. It is a convenient mode of raising the public revenue, and was first instituted by a statute of 5 and 6 Will. and Mary, c. 21. The subsequent statutes are varied and complicated, and embrace nearly every kind of legal document.

STA'NCHIONS, or STANCHELS, upright iron bars fixed in the stonework to protect windows. They are sometimes let into the stone at top and bottom; sometimes at bottom only, and ornamented with fleurs-de-lis, &c., at top.

STA'NDARD. In its widest sense, a standard is a flag or ensign under which men are united together for some common purpose. The use of the standard as a rallying-point in battle takes us back to remote ages. The Jewish army was marshalled with the aid of standards belonging to the four tribes of Judah, Reuben, Ephraim, and Dan, and the Egyptians had ensigns with representations of their favorite animals. The flag of Persia was white, and, according to Xenophon, bore in his time a golden eagle with expanded wings; it was fixed on a chariot, and thus conveyed to the field of battle. Æschylus, in enumerating the six chiefs who headed by Polynices, set themselves in battle array against Thebes, describes the device on the standard of each.

In the earliest era of Roman history, a bundle of hay or fern is said to have been used as a military standard, which was succeeded by bronze or silver figures of animals attached to a staff, of which Pliny enumerates five—the eagle, the wolf, the minotaur, the horse, and the boar. In the second consulship of Marius, 104 B.C., the other animals were laid aside, and only the eagle retained; and down to the time of the later emperors, the eagle, often with a representation of the emperor's head beneath it, continued to be carried with the legion. On the top of the staff was often a figure of Victory or Mars. Each cohort had also an ensign of its own, consisting of a serpent or dragon woven on a square piece of cloth, and elevated on a gilt staff with a cross-bar. Under the Christian emperors, the *Labarum* (q. v.) was substituted for the imperial standard. Various standards of great celebrity occur in medieval history, among which may be enumerated the Flag of the Prophet (q. v.); the standard taken from the Danes by Alfred of England; and the Oriflamme, originally belonging to the Abbey of St. Denis, and borne by the Counts of Vexin, which eventually became the standard of the French kingdom.

In strict language, the term standard is applied exclusively to a particular kind of flag, long in proportion to its depth, tapering towards the fly, and, except when belonging to princes of the blood-royal, slit at the end. Each baron, knight, or other commander in feudal times, had a recognized standard, which was distributed among his followers. The length of the standard varied according to the rank of the bearer. A king's standard was from 8 to 9 yards in length; a duke's, 7 yards; a marquis's, 6½ yards; an earl's, 6 yards; a viscount's, 5½ yards; a baron's 5 yards; a banneret's, 4½ yards; and a knight's 4 yards. There was never a complete coat-of-arms on the standard; it generally exhibited the crest or supporter with a device or badge of the owner, and every English standard of the Tudor era had the cross of St. George at the head. Standards were registered by the heralds, and the charges on them selected and authorized by an officer of arms.

The so-called Royal Standard of Great Britain is more properly a Banner (q. v.), being a square flag with the national arms covering the entire field without any external accessories. The so-called cavalry standards in use in the British army are also in strictness banners. They are small in size; their color is determined by the color of the regimental facings, and they are charged with the cipher, number, insignia, and honors of the regiment. The banners of the household troops are, however, all crimson and richly embroidered with the royal insignia of England. Corresponding to the standards of the cavalry are the colors of the infantry regiments, of which each has 'a pair,' one, called the Queen's color, being the Union Jack (q. v.), charged with some ornamental device; the other, the regimental color, with the cipher, number, device, motto, and honors of the corps, cantoned with a small union jack. When a regiment obtains new colors, they are usually given by the wife of the colonel, or some lady of distinction.

STANDARD, BATTLE OF THE, a battle between the English and Scots which took place on Cutton Moor, near Northallerton, when the latter were defeated with great loss. On the usurpation of Stephen, David I. of Scotland, who, along with Stephen, had sworn to defend the rights of Matilda, daughter of Henry I., invaded England in pursuance of his oath, and compelled the barons of the northern part of the kingdom to swear fealty to that princess. After a war of nearly three years' duration, David encountered the English troops at Cutton Moor, on 22d August 1138, with a large but undisciplined army, who, partly in consequence of a rumor that the king was slain, were thrown into confusion, and the most disastrous route followed, in which the Scots are said to have lost 10,000 men. The battle derived its name from the circumstance that a ship's mast, bearing on its summit the consecrated host, and surrounded by the banners of St. Peter of York, St. John of Beverley, and St. Wilfred of Ripon, elevated on a wagon, marked the center of the English army.

STANDARDS. In Carpentry, the quarters or upright posts in wooden partitions are so called. The upright timbers to which doors are hung are called door standards.

STANDING ORDERS is the name given to those permanent regulations which may be made by either House of Parliament for the conduct of its proceedings, and are binding on the House by which they are made as continual by-laws enduring from parliament to parliament unless rescinded. A standing order of the House of Lords, when rescinded, is said to be *vacated*; in the Commons the corresponding term is *repealed*. In the Lords, a motion for making or dispensing with a standing order cannot be granted on the same day that the motion is made, or till the House has been summoned to consider it; and every standing order, as soon as agreed to, is added to the 'Roll of Standing Orders,' which is carefully preserved and published from time to time. In the House of Commons there was, until 1854, no authorized collection of standing orders, except such as related to private bills. In that year a manual of rules, orders, and forms of proceeding relative to public business was drawn up and printed by order of the House.

Standing orders are occasionally suspended when it is desirable that a bill should be passed with unusual expedition.

STANDING STONES. Large rude unhewn blocks of stone, artificially raised to an erect position at some remote period, have been found in almost every part of the world where man has fixed his habitation. We find them in Britain, in continental Europe, in Assyria, India, Persia, and even in Mexico, and they are generally of such a size that their erection presupposes some degree of skill in the use of mechanical power. They are especially abundant in the British Isles, where they sometimes stand singly, and sometimes in more or less regular groups; and it was long the general opinion of archæologists that they were connected with the Druidical worship of the Celtic races. The result of modern investigation has been to throw doubts on the Druidical theory, while no other explanation has been given which is in all cases satisfactory. The erection of a large stone not easily shifted from its place is perhaps the earliest mode which man's instinct would contrive of preserving the memory of an event or of a hero; and there can be no doubt that many of these monoliths mark the site of a grave or of a battlefield. Human skeletons, and bronze and iron weapons, have been in numerous cases found underneath them. A traditional remembrance of this origin is preserved in the name of 'Cat Stane' (from Celtic *cath*, battle), given to some of them in Scotland, and 'bauta stein' (battle stone) in Norway. Another possible purpose is preserved in the Scotish name of 'hair stane,' or boundary stone, by which they are occasionally known; not a few of them, whatever their original object, having been long used as landmarks, and being alluded to as such in very early charters. A third use of these monoliths is at least as old as the historical books of the Old Testament.

We read in Judges ix. 6, of Abimelech being made king 'by the pillar which was in Shechem,' and in 2 Kings xi. 14, of Joash, when he was anointed king, standing 'by a pillar, as the manner was;' and a like usage prevailed in ancient Britain, where the king or chief was elected at the 'Tanist stone' (from *Tanist*, the heir-apparent among the Celts), and there took a solemn oath to protect and lead his people. A very celebrated stone of this kind was the Lia Fail of Ireland, which was brought to Icolmkill for the coronation of Fergus Ere; and after being removed to Scone, became the coronation stone of Scotland, till conveyed away by Edward I. to Westminster, where it now forms part of the coronation chair of the sovereigns of the United Kingdom. In all these cases there is an idea of a solemn religious sanction attached to the stone; and a peculiar degree of sacredness seems to have invested any contract entered into at one of those perforated stones which are or were occasionally to be met with in England and Scotland. Such a stone, with an oval hole large enough to admit a man's head till lately adjoined the monolithic group of Stennis in Orkney. It was known as the 'Stone of Odin,' and continued till the middle of last century to be the scene of the interchange of matrimonial and other vows, he who broke the vow of Odin being accounted infamous. It is said to have been the popular belief that any one who had in childhood been passed through the opening would never die of palsy. The power of curing rheumatism was ascribed to a perforated stone at Madderty in Cornwall. While many of the monoliths in Britain are undoubtedly of a very remote age, there are some indications that the practice of erecting them continued for a time after the introduction of Christianity, and that they were used to subserve purposes connected with the new faith. A series of monoliths in the island of Mull are traditionally said to have been guide-posts to pilgrims visiting Iona, and it has been suggested that they point out the route which St. Columba must have pursued on his way to the residence of the Pictish king, Brude Mac Meilochon.

Still more puzzling to archæologists than the single monoliths are the large symmetrical groups of them, of which the most remarkable are Stennis in Orkney, Stonehenge and Avebury in Wiltshire, and Carnac in Brittany; all which, till lately, existed comparatively entire, though they have all been in the memory of the present generation more or less despoiled for building purposes. The most imposing of these monuments is Stonehenge (q. v.). At Stennis, from 70 to 80 stones were grouped in two separate circles of 360 and 100 feet diameter respectively, the largest stones being in the smaller circle. At Avebury, two double concentric circles were surrounded by an outer circle of 100 stones, the whole being approached by two long avenues of stones in double lines. In all these, and other instances, the circles were surrounded by a trench and mound. At Carnac the stones are placed not in circles but in straight lines, with a curved row at one end—an arrangement which has suggested the idea of a burial-place on the site of a great battle-field. All around Carnac, as well as Stonehenge, Barrows and Cromlechs (q. v.) are to be found. While the popular notion of all these monuments is that they were Druid temples, the circular form so frequent among them has also suggested that they may originally have been connected with sun-worship, and it is not impossible that they may have been used in turn for the successive religious worship of different races. They seem also to have served the purpose of courts of justice, or battle-rings for the duel and judicial combat See STONEHENGE.

Standing Stones of Stennis.

A remarkable description of monument, whose purpose is utterly unknown to us, is the *Rocking-stone* or *Logan-stone* (q. v.). For a notice of a class of standing stones of considerable interest, ornamented with a peculiar description of sculpture, and found largely in Scotland, see SCULPTURED STONES.

STANFIELD, CLARKSON, a distinguished painter, was born of Irish parents, in the town of Sunderland, about the year 1793. At an early period of his life, he went to sea, and made frequent long voyages, among which was that to China. In the China seas, he passed some years of his life, and served for a time in the same ship with Douglas Jerrold; S. in the capacity of a common sailor, and Jerrold as a midshipman. While thus engaged, S. exhibited considerable talent both in painting and drawing. The first person of public note, however, to observe S.'s genius as a painter was the celebrated Captain Marryat, who met with him in the Mediterranean, serving in a king's ship as captain's clerk. S. and Marryat afterwards became intimate; and in 1840 the novelist employed the painter, then become famous, to illustrate his *Poor Jack*. S. left the navy, in consequence of an injury to his feet, through a fall from the fore-topgallant mast-head of his ship. He then took to scene-painting as a means of earning his bread. His first efforts in this direction were made in the Old Royalty Theater, Wells Street, Wellclose Square, in the east end of London, about the year 1818. He was afterwards employed at Drury Lane Theater, and here it is said that he produced some of his most extraordinary effects. He carried on this occupation until the year 1827, when he finally abandoned it, except on rare occasions. S., while painting for the theaters, had by no means neglected easel-painting. The first picture by him that attracted any considerable notice was 'Market-boats on the Scheldt,' exhibited at the British Institution in 1826. The picturesque grouping, variety of figures, and gay costumes were much admired. His 'Wreckers off Fort Rouge, Calais,' exhibited in the following year, also at the British Institution was even more successful. In 1828, he obtained from the British Institution a prize of fifty guineas for another of his pictures.

In 1830, S. made his first excursion on the continent, and in the same year exhibited at the Academy his 'Mount St. Michael, Cornwall,' which placed him at once in the foremost rank as a marine painter. In 1823, S., in conjunction with David Roberts and others, founded the Society of British Artists. His election to the Academy as Associate took place in 1832; and in 1835 he was chosen R.A., in conjunction with Sir William Allan. In 1833, S. exhibited at the Academy the first of a series of pictures of Italian scenery, painted for the Marquis of Lansdowne for the banqueting-room at Bowater. In 1834, he commenced a similar series for the Duke of Sutherland. In 1836, he exhibited 'The Battle of Trafalgar,' painted for the Senior United Service Club; and in 1841, his celebrated 'Castello d'Ischia,' engraved by the Art-union in 1844. In 1843, he sent to the Academy 'Mazerbo and Lucello, Gulf of Venice,' said to be one of the finest landscapes he ever painted. 'A Skirmish off Heligoland' (1867) was S.'s last contribution to the exhibitions of the Academy, of which he was so distinguished a member. His great merit lies in the skilful combination of land and sea in the same view. Man and the works of man are not disdained by him in his portraiture of nature, and there is frequently a poetic feeling of the highest order in some of his conceptions, as in his pictures of 'The Abandoned,' and 'The Wreck of a Dutch East Indiaman.' S. died on the 18th of May 1867.

STANHOPE, LADY HESTER LUCY, the eldest daughter of Charles, third Earl Stanhope, and his wife Hester, daughter of the great Lord Chatham, was born on the 12th March 1776. She grew up to be a woman of great personal charm, and of unusual force and originality of character Very early she went to reside

with her uncle, William Pitt, and as mistress of his establishment, and his most trusted confidant during his season of power, and till his death, she had full scope for the exercise of her imperious and queenly instincts. On the death of Pitt, a pension of £1200 a year was assigned her by the king. Mr. Fox proposed to provide for her much more munificently, but she proudly declined his offers, as unwilling to accept benefit at the hands of the political enemy of her dead uncle.

The change from the excitements of a public career, as it might almost be called, to the life of an ordinary woman of her rank with means somewhat insufficient, was naturally irksome to her, and in 1808, she was tried still further by the death, at Coruña, of her favorite brother Major Stanhope, and of Sir John Moore, for whom she is known to have cherished an affection. The precise relations between them have never been made known; but the last words spoken by the dying hero were: 'Stanhope' (a Captain Stanhope of his staff, who stood by him), 'remember me to your sister.' Conceiving a disgust for society, she retired for a time into Wales, and in 1810, she left England never to return to it. In mere restlessness of spirit she wandered for a year or two on the shores of the Mediterranean, and finally settled herself among the semi-savage tribes of Mount Lebanon. Here she led the strangest life, adopting in everything the Eastern manners, and by the force and fearlessness of her character, obtaining a curious ascendency over the rude races around her. She was regarded by them with superstitious reverence as a sort of prophetess, and gradually came so to consider herself. With the garb of a Mohammedan chieftain, she adopted something of the faith of one, and her religion, which seems to have been sincere, and profound, was compounded in about equal proportions out of the Koran and the Bible. Her recklessly profuse liberalities involved her in constant straits for money; and her health also giving way, her last years were passed in wretchedness of various kinds, under which, however, her untamable spirit supported her bravely to the end. She died in June 1839, with no Frank or European near her, and was buried in her own garden. The main sources of information about her are the notes of the frequent travelers who visited her in her strange seclusion, and the *Memoirs* derived from her own lips, and afterwards (3 vols. Lond. 1845—1846) published by a medical gentleman who went abroad with her, and from time to time lived with her in her retirement.

STANHOPE, PHILIP HENRY, EARL, historian and biographer, was representative of a branch of the family of the Stanhopes, Earls of Chesterfield. Its founder, a distinguished diplomatist in the reigns of William III. and Queen Anne, was son of the first Earl of Chesterfield. James, first Earl Stanhope, was an eminent military commander, who effected the reduction of Port Mahon, in the island of Minorca, and was the favorite minister of George I. His grandson, the third earl, distinguished for his scientific researches, and inventor of a printing-press which bears his name, died 1816. The subject of this notice, only son of the fourth earl, was born at Walmar, 1805. His courtesy title was Viscount Mahon. He received a private education, but graduated at Oxford, where he took his B.A. degree, 1827; created D.C.L., 1834. He entered the House of Commons in 1830. He was greatly instrumental in 1842 in securing the passing of the Copyright Act (q. v.); was Under-secretary for Foreign Affairs during the brief Peel administration, 1834—1835; and Secretary to the Indian Board of Control under the same minister, 1845—1846. He was a moderate Conservative in politics, and was warmly attached to Sir R. Peel, who named him one of his literary executors. His contributions to history are numerous and valuable. Macaulay, in a review of one of his earliest works, the *War of the Succession in Spain*, accredits him with some of the most valuable qualities of a historian, viz., perspicuousness, conciseness, 'great diligence in examining authorities, great judgment in weighing testimony, and great impartiality in estimating characters.'

His most considerable work is *A History of England from the Peace of Utrecht to the Peace of Versailles*, 1713—1783, in 7 vols. His other works include a *Life of the Right Hon. W. Pitt;* a *History of Spain under Charles II.;* a *Life of the Great Condé;* a *Life of Belisarius;* a volume of *Historical and Critical Essays;* and a volume of *Miscellanies*. Of the *Life of Condé*, it may be remarked that it was originally written by the author in the French language, and that the English work is really a translation, executed under his superintendence. In conjunction with the Right Hon. E. Cardwell, he edited the *Memoirs of Sir R. Peel;* and he also published an edition of *Lord Chesterfield's Letters*. He was elected President of the Society of Antiquaries, 1846; Lord Rector of the university of Aberdeen, 1858. He was mainly instrumental in procuring the appointment of the Historical Manuscripts Commission. He was elected one of the six foreign members of the Academy of Moral and Political Sciences at Paris in 1872. His death took place at Bournemouth on Dec. 24, 1875.

STANISLA'WOW, or STANISLAU, a town in the Austrian crownland of Galicia, pleasantly situated between two branches of the Bistricza, 75 miles south-east of Lemberg. It is the seat of active trade and manufactures. Pop. (1880) 18,626.

STANLEY, HENRY M., American journalist and explorer of Africa, was born in 1841. The place of his birth has been matter of dispute. He became notable as special correspondent of the *New York Herald*, and in that capacity traveled in various parts of the world, accompanying for example the English expeditions to Abyssinia and Ashantee. But it was as the 'discoverer of Livingstone' that S. suddenly obtained a world-wide reputation. Commissioned by the proprietor of his newspaper, S. started from Zanzibar in April, 1871, and succeeded in meeting Livingstone at Ujiji on Nov. 10—what an expedition equipped by English 'Livingstone Relief Committees' had failed to accomplish. On his arrival in England in July, 1872, S. was received with universal acclamation; but by his subsequent exploration of the lake region of equatorial Africa and of the Lualaba-Congo (see CONGO) in 1874–7 he has placed himself in the front rank of African travelers. Under a joint commission from the *New York Herald* and the London *Daily Telegraph*, S. started from the east coast of Africa in 1874, circumnavigated the Victoria N'yanza, marched across country to the Albert N'yanza, and then coming south again, examined part of Tanganyika and its outlet towards the Lualaba. From Unyanyembe he pushed onwards along the course of the Lualaba, supported by a large party of followers; and arriving at the mouth of the Congo in Aug. 1877, he proved that the Congo (q. v.) and Lualaba were identical. In 1879, he became a leader of the Belgian International Society's expedition for establishing commercial and civilizing stations on the Congo. Of S.'s works, *How I found Livingstone* appeared in 1872; *My Kalulu*, in 1872; *Coomassie and Magdala*, in 1874; *Through the Dark Continent*, in 1878.

STANLEY, THE RIGHT HON. EDWARD HENRY SMITH, now Earl of Derby, an eminent English statesman, eldest son of the fourteenth Earl of Derby (q. v.), was born at the family seat, Knowsley Park, Lancashire, July 21, 1826, was educated at Rugby, and at Trinity College, Cambridge, where he concluded a distinguished university career by taking a first-class in classics in 1848, together with a declamation prize and mathematical honors. He early adopted the profession of statesmanship, and especially applied himself to the study of social and economical questions. During his absence on a tour in Canada, the United States and the West Indies, he was elected (December 1848) M.P. for King's Lynn, on the death of Lord G. Bentinck. He afterwards visited the East, and was still in India when his father received the Queen's commands to form an administration, in which S. was appointed Under-secretary for Foreign Affairs. In 1855, on the death of Sir W. Molesworth, Lord Palmerston paid him the compliment of offering him the seals of the Colonial Office. The offer was declined; but in 1858 he was appointed to the Secretaryship of the Colonies in Lord Derby's administration, and was soon called upon to succeed the Earl of Ellenborough (q. v.) as President of the Board of Control for the affairs of India. The great Indian mutiny had not yet been quelled, and it devolved upon S. to frame resolutions and bring in a bill abolishing the East India Company (q. v.), and transferring their Indian possessions to the direct government of the crown. This duty he performed with consummate ability. The great mutiny was put down during his secretaryship, and in February 1859 he had to meet the legacy of financial disorganization which it bequeathed.

The Derby government resigned before S. could carry out his plans for establishing the finances of India on a sounder basis, but he gave effective support to his successor in office, in reducing the military expenditure, and other measures of administrative improvement. In his father's third administration, formed in July 1866, he was invested with the office of Secretary of State for Foreign Affairs, and the ability and tact he displayed in conducting the negotiations for the settlement of the Luxemburg difficulty, obtained for him a considerable amount of popularity. He continued in this office till the accession of the Gladstone Ministry to power in 1868. In April 1869, he was installed Lord Rector of the university of Glasgow, and in October of the same year, on the death of his father, he took his seat in the House of Lords. He was again made Foreign Secretary by Mr. Disraeli in 1874; but on account of divergence from the views of the Premier on the Eastern Question, he, like his colleague the Earl of Carnarvon, retired from the Ministry early in 1878; and in 1882 he became Secretary of State for the Colonies in Mr. Gladstone's Liberal administration. In 1874, he was elected Lord Rector of Edinburgh University. His speeches are remarkable for admirable good sense.

STANLEY, THE VERY REV. ARTHUR PENRHYN, D.D., an eminent scholar and divine of the Church of England, was the son of the late Edward Stanley, D.D., Bishop of Norwich, and nephew of the late Lord Stanley of Alderley. He was born 13th December 1815, while his father was rector of Alderley, and resided there. Educated at Rugby under the care of Dr. Arnold,

he passed (1834) as an Exhibitioner to Balliol College, Oxford, where he achieved a brilliant reputation, winning the Ireland Scholarship, and taking a first class in classics (1837) the Latin essay prize (1839), and the English essay and theological prizes (1840). In 1838 he was chosen a Fellow of University College, of which he was tutor and examiner for many years. Appointed Canon of Canterbury (1851), Professor of Ecclesiastical History at Oxford, Canon of Christ Church, and Chaplain to the Bishop of London (1858), he succeeded Archbishop Trench in 1864 as Dean of Westminster. He was also chaplain to the Queen. In 1874 he was elected Rector of St. Andrews University. His wife, a daughter of the Earl of Elgin, died in 1876. He died 18th July 1881, and was buried in the Abbey he loved so well. S., one of the most liberal theologians of this age, was for great part of his life leader of the 'Broad Church' party; in virtue of his literary genius, varied accomplishments, and sympathetic and generous piety, he ranks among the most eminent of recent Christian teachers. His principal writings, besides his contributions to reviews and to Smith's classical dictionaries, are the *Life of Dr. Arnold* (1844); *Sermons and Essays on the Apostolical Age* (1846); *Memoir of Bishop Stanley* (1850); *The Epistles to the Corinthians* (1854); *Sinai and Palestine* (1855); *The Unity of Evangelical and Apostolical Teaching* (1859); *Lectures on the Eastern Church* (1861); *Lectures on the Jewish Church* (1863—1865 and 1876); *Sermons preached before the University of Oxford* (1860—1863); *Historical Memorials of Westminster Abbey* (1867); *The Three Irish Churches* (2d ed., 1869); *Essays on Church and State* (1870); *The Athanasian Creed* (1871); *Lectures on the Church of Scotland* (1872); a work on the Utrecht Psalter (1874); *Christian Institutions; Essays on Ecclesiastical Subjects* (1881).

STA'NNARIES (Lat. *stannum*, tin), the mines from which tin is dug. The term is most generally used with reference to the peculiar laws and usages of the tin mines in the counties of Cornwall and Devon. By an early usage peculiar to these counties, the prerogative of the crown, elsewhere reaching only to gold and silver mines, is extended to mines of tin, which are the property of the sovereign, whoever be the owner of the soil. A charter of King John to his tinners in Cornwall and Devonshire, of date 1201, authorized them to dig tin, and turf to melt the tin, anywhere in the moors, and in the fees of bishops, abbots, and earls, as they had been used and accustomed—a privilege afterwards confirmed by successive monarchs. When Edward III. created his son, the Black Prince, Duke of Cornwall, he at the same time conferred on him the Stannaries of Devon and Cornwall, which were incorporated in perpetuity with the duchy. Their administration is committed to an officer called the Lord Warden of the Stannaries, who has two substitutes or vice-wardens, one for Cornwall, and one for Devon. In former times, representative assemblies of the tinners (called parliaments) were summoned by the warden under a writ from the Duke of Cornwall, for the regulation of the stannaries and redress of grievances: the last of them was held in 1752. The Stannary Courts are courts of record held by the warden and vice-warden, of the same limited and exclusive character as the Courts-palatine, in which the tinners have the privilege of suing and being sued. They were remodelled and regulated by acts 6 and 7 Will IV. c. 106, 2 and 3 Vict. c. 58, and 18 and 19 Vict. c. 32. The last-mentioned statute provides, that from all the decrees and orders of the vice-warden on the common law side, there shall be an appeal to the Lord Warden, who is to be assisted by two assessors, members of the Judicial Committee of the Privy Council, or judges of the High Court of Chancery, or Court of Common Law at Westminster; and from the Lord Warden there is a final appeal to the Judicial Committee of the Privy Council.

In the county of Cornwall, the right to dig tin in unenclosed or 'wastrel' lands within specified bounds may be acquired by one who is not the owner of the lands, on going through certain formalities, the party acquiring this right being bound to pay one-fifteenth to the owner of the lands. An ancient privilege, by which the Duke of Cornwall had the right of pre-emption of tin throughout that county, has long fallen into abeyance; and certain duties to which he was entitled on the stamping or coinage of tin were abolished by 1 and 2 Vict. c. 120.

STA'NNIC ACID. See TIN.

STANOVOI', or STANOWOI KHREBET (Framework Mountains), an extensive mountain chain in Siberia, in the extreme north-east of Asia, forms the watershed between the rivers which flow north into the Arctic Ocean, and those which are tributary to the Amur. The chain extends in an east-north-east direction from the Transbaikal territory along the shores of the Sea of Okhotsk, separating into several branches, one of which stretches east to Behring's Strait. Of this great mountain chain, the length of which is estimated at 3000 miles, little is known further than that it is elevated and rugged, and that its peaks are covered with perpetual snow.

STA'NZA. See RHIME.

STAPE'LIA. See CARRION FLOWERS.

STAPHYLE'A AND STAPHYLEA'CEÆ. See BLADDERNUT.

STAPHYLO'MA (from the corresponding Greek word, derived from *staphyle*, a bunch of grapes, or in this case, rather a grape at the end of a stalk) is a term employed by the oculist to signify any protrusion on the anterior surface of the eye. Staphyloma of the iris occurs when there is a protrusion of the iris through a perforation of the cornea, consequent either on ulceration or on a wound. Staphyloma of the cornea occurs when that coat of the eye is more or less completely destroyed, and when the cicatrix with which the iris has become covered is caused to protrude by the pressure of the fluids of the eye, in the form of an opaque white prominence. It is unnecessary to enter into details of the treatment of these affections, which must be left entirely to the hands of the surgeon.

STAPLE (A.-S. *stapel*, a prop, support; a heap, and hence a place where goods are stored up or exposed for sale), a term applied, in the commerce of the middle ages, in the first instance, to the towns in which the chief products of a country were sold, and afterwards to the merchandise that was sold at the staple towns. The staple towns, at first chosen from convenience, came in the course of time to be invested with important privileges. The staple merchandise of England has been enumerated as wool, woolfells (i. e., sheepskins), leather, lead, and tin, to which have sometimes been added butter, cheese, and cloth. *Wool* was, however, in point of fact, a far more important article of export than any of the rest, and was really the subject of those multitudinous regulations which fixed the staple in particular towns, both of England and of the continent. Goods intended for exportation had, in the first instance, to be exposed for sale at the staple town; the principal purpose of this regulation being, probably, to restrict commerce to those places where the officers who collected the king's customs could superintend it. Another object kept in view in the provisions made in the 13th and 14th centuries with respect to the staple, was the encouragement of the resort of foreign merchants; indeed, greater privileges seem to have been accorded to the foreign than to the English merchants who attended the staple.

A tribunal of great antiquity, called the Court of the Staple, had cognizance of all questions which should arise between merchants, native or foreign. It was composed of an officer, called the Mayor of the Staple, re-elected yearly by the native and foreign merchants who attended the staple; two constables, appointed for life, also chosen by the merchants; a German and an Italian merchant; and six mediators between buyers and sellers, of whom two were English, two German, and two Lombard. The law administered was the *lex mercatoria*, and there was a provision that causes in which one party was a foreigner, should be tried by a jury one half of whom were foreigners. The most important legislative enactments regarding the Staple and the Court of Staple were the Statute of Acton Burnel (11 Edward I.), by which merchants were enabled to sell the chattles of their debtor, and attach his person for debt; 13 Edw. I. c. 3; and 27 Edw. III. c. 2, called the Statute of Staple, one object of which was to remove the staple formerly held at Calais to certain towns in England, Wales, and Ireland. With the growth of commerce the staples became more and more neglected, and at last fell altogether into disuse.

STAR, in Heraldry. The star is of frequent occurrence as a heraldic bearing; it sometimes represents the heavenly body so called, and sometimes the rowel of a spur. In the latter case, it

Stars.

is blazoned a *Mullet* (q. v.). Stars of more than five points should have the number of points designated, and the points may be wavy. A star, or *estoile*, with wavy points, is often designated a blazing star; and when the points are more than six in number, it is usual to represent only every second point as waved.

The star is a well-known ensign of knightly rank. A star of some specified form constitutes part of the insignia of every order of knighthood.

STAR, ORDER OF THE, an order of knighthood formerly existing in France, founded by John II. in 1350, in imitation of the then recently instituted order of the Garter in England. The ceremony of installation was originally performed on the festival of the Epiphany, and the name of the order is supposed to have been allusive to the Star of the Magi.

STARAI'A-RU'SSA, a town of Russia, in the government of Novgorod, 184 miles south-south-east of St. Petersburg. The town is remarkable for its salt springs, which attract many visitors in

summer. The means of communication between St. Petersburg and S., by the Moscow Railway and the river Volkhov, are easy and rapid. Resident pop. (1880) 14,750.

STAR ANISE. See ANISE.

STAR APPLE (*Chrysophyllum*), a genus of trees and shrubs of the natural order *Sapotaceæ*. The species are natives of tropical and subtropical countries. The S. A. of the West Indies (*C. Cainito*) is a shrub about eight or ten feet high. The fruit is large, rose-colored, mixed with green and yellow; and has a soft sweet pulp of an agreeable flavor. Other species produce edible fruit.

STA'RBOARD. See LARBOARD.

STARCH, or AMYLACEOUS MATTER ($C_{12}H_{10}O_{10}$), is an organized substance of the class known as carbo-hydrates, which occurs in roundish or oval grains in the cellular tissue of certain parts of plants. It is very widely diffused through the vegetable kingdom, and is especially abundant in the seeds of the cereals, in the seeds of leguminous plants such as peas and beans, in the tuber of the potato, in the roots of arrowroot and tapioca, in the pith of the sago palm, &c. The grains of starch from the same kind of plant are tolerably uniform in size and shape, but vary in different species of plants from $\frac{1}{180}$th to less than $\frac{1}{300}$th of an inch in diameter; and while some are circular or oval, others are angular: moreover, amongst other differences, some (chiefly the larger grains) exhibit a series of concentric rings, while in others no rings are apparent; and while the grains of potato-starch, if illuminated by polarized light, with a Nicol's prism placed between the object and the eye, present a well-marked black cross, in wheat-starch no such cross is perceptible.

Ordinary commercial starch occurs either as a white glistening powder, or in masses which are readily pulverized; and when pressed between the fingers it evolves a slight but peculiar sound. It is heavier than water, and is insoluble in cold water, alcohol, and ether. If, however, it be placed in water at a temperature of 150°, its granules swell from the absorption of fluid, and the mixture assumes a viscid, pasty consistence. Dilute acids rapidly induce a similar change, even without the agency of heat; and if heated with dilute sulphuric acid, the starch is first converted into dextrine, and finally into glycose or grape-sugar; and manufacturing chemists avail themselves of this property to obtain glycose on a large scale from starch. Starch dissolves in cold nitric acid, and on the addition of water to this solution, a white, tasteless, insoluble precipitate falls, which is known as *Xyloidin*, and explodes violently when struck by a hammer, or when heated up to about 350°. The composition of this substance is not positively known, but in all probability one or two equivalents of the hydrogen of the starch (most probably two) are replaced by a corresponding number of equivalents of peroxide of nitrogen (NO_4).

The reactions of starch with iodine and bromine are very remarkable. Iodine communicates to it a very beautiful purple color, and hence starch-paste serves as a delicate test for free iodine. The purple color which the iodine gives to the starch granules appears not to depend on a chemical combination, because on the application of heat the color disappears, and reappears on cooling. Bromine communicates a brilliant orange tint to starch—a reaction by which the presence of free bromine may be readily detected. When heated to a temperature of from 340° to 400°, dry starch is converted into Dextrine (q. v.), or British gum. At a higher temperature, it undergoes decomposition, and yields on dry distillation the same products as sugar. When heated in steam under pressure, it also passes into dextrine, and finally into glycose. The addition of a little sulphuric acid hastens these changes.

During the germination of seed, the starch undergoes a kind of fermentation, and is converted into a mixture of dextrine and glycose. This change is due to the action of a peculiar ferment termed Diastase (q. v.), which exists in all germinating seeds during the process of growth, and is probably a mixture of albumen and gluten in a special stage of decomposition. Various animal matters, as, for example, saliva, pancreatic juice, the serum of the blood, bile, &c., exert the same action on starch as diastase. On treating starch with chlorine, a remarkable, colorless, oily fluid *Chloral* (q. v.), is obtained. On prolonged exposure to the air, starch paste becomes acid, in consequence of the formation of lactic acid.

Starch is usually obtained by a simply mechanical separation of it from the other ingredients with which it is associated; advantage being taken of its insolubility in cold water. The details of the mode of separation vary according to the source from which it is procured. We extract from Miller's *Organic Chemistry* the method of procuring *potato-starch*: 'This variety is prepared on a large scale from potatoes, which contain about 20 per cent. of amylaceous matter. The cellular tissue of the tuber does not exceed 2 per cent. of the mass; whilst of the remainder about 76 per cent. consists of water, and the rest of small quantities of sugar, salts, and azotized matters. In order to extract the starch, the tubers are first freed from adhering earth by a thorough washing, and are then rasped by machinery. The pulp thus obtained is received upon a sieve, and is washed continuously by a gentle stream of water so long as the washings run through milky. This milkiness is due to the granules of starch which are held in suspension. The milky liquid is received into vats, in which the amylaceous matter is allowed to subside; the supernatant water is drawn off, and the deposit is repeatedly washed with fresh water until the washings are no longer colored. The starch is then suspended in a small portion of water, run through a fine sieve to keep back any portions of sand, and after having been again allowed to settle, is drained in baskets lined with ticking; the mass is then placed upon a porous floor of half-baked tiles, and dried in a current of air, which is at first of the natural temperature; the drying is completed by the application of a moderate artificial heat' (pp. 100, 101).

To obtain starch from wheat or rice, a more complicated process is required, as the large quantity of gluten which is associated with the starch in these grains requires to be removed either by fermentation, or, according to Jones's patent, by a weak alkaline solution, which dissolves the gluten, but does not affect the starch granules.

Commercially, there are two classes of starch—those used for food, and those used for manufacturing purposes. The former are treated under ARROW-ROOT (q. v.); the latter are chiefly made from wheat, rice, and potatoes; but in addition, large quantities of sago-starch are prepared in India and sent to Europe, and small quantities are from time to time prepared from other sources, such as the fruit of the horse-chestnut, &c.

The importance of starch becomes at once obvious when we consider that it may be regarded as the starting-point in the preparation of brandy and other forms of spirit, and of beer and porter, and that it enters largely into the great *saccharine* group, constituting one of the leading subdivisions of food. See DIGESTION. It is, moreover, largely employed as an article of domestic use for laundry purposes, and also in the manufacture of dextrine and grape-sugar.

We shall conclude with a few words on starch in its physiological and medical relations. It might have been inferred *a priori* that starch was an essential article of diet, from the fact of its abundant occurrence in edible vegetables, even if the fact had not been established by numerous physiological experiments. Thus various kinds of potatoes yield from 12 to 27 per cent. of starch; peas, 32½ per cent.; beans, 34 to 36 per cent.; wheaten bread, 53½ per cent.; wheaten flour, 56½ to 72 per cent.; oatmeal, 59 per cent.; ryemeal; 61 per cent.; barley-meal, 67 per cent.; maize, 81 per cent.; rice, 83 to 85 per cent.; and it occurs in even larger proportions in arrowroot, sago, and tapioca.

In a state of health, the proper diet consists in the due admixture of the albuminous saccharine (or starchy), oleaginous, and saline groups; but in certain forms of disease, an excess or a diminution of the starchy element is expedient. Thus, in cases of weak gastric digestion, it is not advisable to mix starchy food with the albuminous, as it soaks up the too scanty gastric juice without making any use of it. In such cases, moreover, articles of food like potatoes, new bread, pastry, &c., are apt to turn acid in the stomach, and check digestion. There are, again, some cases of gastric disorder in which a purely starchy diet is expedient. Thus, according to Dr. Chambers, it is the best form of food 'during acute catarrhal bilious attacks at the commencement of treatment, in even chronic gastric cases, and whenever a dusky complexion, hypochondriasis, or general distress show that arrested moulting has caused a collection in the body of effete tissues' (*Dietetics* in *Clinical Lectures*, 4th ed., p. 539). In the early stages of rheumatic fever and other acute diseases, it is usually expedient to limit the diet of the patient for a day or two to a purely starchy diet, such as arrowroot, tapioca, panado, &c. In returning from a purely starchy to a mixed diet, Dr. Chambers suggests that such an arrangement shall be adopted as to prevent starchy and albuminous foods from being together in the stomach. For example, let the morning and evening diet be vegetable, with a mid-day meal of purely animal food. It should be recollected that although starch is converted into sugar by the saliva, pancreatic fluid, and intestinal juice (see DIGESTION), the change principally takes place from the action of the two last-named fluids in the small intestine. Hence, when the duodenum, jejunum, or ileum are morbidly affected, as in typhoid or enteric fever, in enteritis, in diarrhœa, &c., little or no starch should be given in the food.

Wheat-starch is the only variety of starch admitted into the Pharmacopœia. It is employed in medicine chiefly in the form of mucilage (prepared by triturating 120 grains of starch with 10 fluid ounces of distilled water gradually added, and boiling for a few minutes, constantly stirring). This preparation is used either alone or as a vehicle for more active agents, as an enema, in dysentery, diarrhœa, flatulent distention of the bowels, &c.; externally, it is used as an application to excoriations, to prevent bedsores, &c., and as a basis for dusting-powders in various forms of

discharging skin-diseases. Its use in Surgery for the construction of immovable bandages has been noticed in the article SPLINTS.

STAR-CHAMBER, a tribunal of considerable note in English history, which met in the old Council-chamber of the palace of Westminster, and is said to have its name from the circumstance that the roof of that apartment was decorated with gilt stars. It is generally supposed to have originated in early times out of the exercise of jurisdiction by the king's council, acting as the *concilium ordinarium* and not *privatum*. The powers of the council, however, had been abridged by several acts of Edward III., and had altogether greatly declined when act 3 Henry VII. c. 1, either revived and remodelled them, or instituted, according to the view taken by Mr. Hallam, an entirely new tribunal. This statute conferred on the Chancellor, the Treasurer, and the Keeper of the Privy Seal, with the assistance of a bishop and a temporal Lord of the Council, and Chief-justices, or two other justices in their absence, a jurisdiction to punish, without a jury, the misdemeanors of sheriffs and juries, as well as riots and unlawful assemblies. Act 21 Henry VIII, c. 20, added to the other members of the court the President of the Council.

Whether or not the above-cited act of Henry VII. meant to constitute a court distinct from the council, it is certain that, by the time of Elizabeth, the two jurisdictions were merged in one; and the resulting tribunal was, during the Tudor age, of undoubted utility as a means of bringing to justice great and powerful offenders who would otherwise have had it in their power to set the law at defiance. The civil jurisdiction of the Star-chamber, at that period, comprised controversies between English and foreign merchants, testamentary causes, disputes between the heads and commonalty of corporations, lay and ecclesiastical, and claims to deodands. As a criminal court, it could inflict any punishment short of death, and had cognizance of forgery, perjury, riots, maintenance, fraud, libels, conspiracy, misconduct of judges and others connected with the administration of the law, and all offences against the state, in so far as they could be brought under the denomination of contempts of the king's authority. Even treason, murder, and felony could be brought under the jurisdiction of the Star-chamber, where the king chose to remit the capital sentence. The form of proceeding was by written information and interrogatories, except when the accused person confessed, in which case the information and proceedings were oral; and out of this exception grew one of the most flagrant abuses of this tribunal in the later period of its history. Régardless of the existing rule, that the confession must be free and unconstrained, pressure of every kind, including torture, was used to procure acknowledgments of guilt; admissions of the most immaterial facts were construed into confessions; and fine, imprisonment and mutilation inflicted on a mere oral proceeding, without hearing the accused, by a court consisting of the immediate representatives of prerogative. The proceedings of the Star-chamber had always been viewed with distrust by the commons; but during the reign of Charles I., its excesses reached a height that made it absolutely odious to the country at large; and in the last parliament of that sovereign, a bill was carried in both Houses (16 Car. I. c. 10), which decreed its abolition.

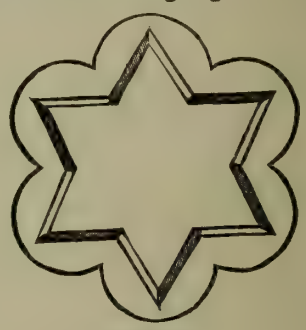
STAR-FISH (*Asteriadæ*), a family of *Echinodermata* (q. v.), having in the center of the body a stomach with only one aperture, but extending by two much-branched cæca, into each of the rays into which the body is divided. In some, the central disc extends so as to include the rays, so that the general form is angular or lobed; in others, the disc is very small in comparison with the length of the rays. Locomotion is effected by very numerous Ambulacra (q. v.) placed in rows on the under side of the rays. A bony framework, of a vast number of pieces, extends to the extremity of each ray. The nervous system has its center around the mouth, and sends a filament to each ray. Star-fishes are hermaphrodite, and produce vast numbers of eggs, which are retained for a time under the body of the parent, resting on the points of its rays at the bottom of the sea, and raising up the center of the body, in order as it were to hatch them. The young are destitute of rays, and very unlike the mature form, so that their real nature was long mistaken. The mouth of star-fishes being on the under side, they seek their food—as indeed they perform all their motions—by crawling at the bottom of the sea, or on rocks, &c. They are very voracious, and are troublesome to fishermen by devouring their bait. They possess, in a very high degree, the power of reproducing lost members; a disc with a single ray left will reproduce the other rays, and become a perfect star-fish. More extraordinary is the readiness which many of them display, particularly those with long and slender rays, in breaking off these members.

Some species—BRITTLE STARS—can scarcely be procured for a museum in a tolerably perfect state, because they throw off ray after ray, and, in fact, break themselves to pieces upon any alarm. Star-fishes abound in the seas of all parts of the world. Almost no object is more familiar on the sea-coast of Britain than the COMMON S., CROSS-FISH, or FIVE FINGERS (*Asterias* or *Uraster rubens*), thrown up on the beach by the tide, or thrown out of fishing-boats in harbors. Some of the species are much

Star-fishes:
1, Common Cross-fish (*Uraster rubens*); 2, Gibbous Starlet (*Asterina gibbosa*); 3, Common Cross-fish, reproducing rays; 4, Eyed Cribella (*Cribella oculata*); 5, Lesser Sand-star (*Ophiura albida*).—From Forbes's *British Star-fishes*.

larger; and some exhibit very beautiful colors; whilst others are interesting from their structure—the long serpent-like form of their rays, or the division of the rays by successive forkings, so that the whole creature is a globular mass, the surface of which is formed of a countless multitude of living tendrils.

STAR-FORT, in Field Fortification, is a strong work consisting of alternate salient and re-entering angles, arranged on a regular



Star-fort.

or irregular polygon. It is a common work for defending an eminence on a battle-field, or at the wing of a line, or as protection for the reserve-stores of an army.

STA'RGARD (Slav. *Starograd* or *Starigrod*, i. e., Old Town), a town of Germany, province of Pomerania, is situated on the navigable river Ihna, 23 miles east-south-east of Stettin, with which, as with Posen, and the whole east of Prussia, it is connected by railway. S. was formerly the capital of Lower Pomerania. It has various but not very important manufactures. Pop. (1880) 21,816. S. was raised to the rank of a town in 1129.

STAR JELLY. See NOSTOC.

STA'RLING (*Sturnus*), a Linnæan genus of birds, of the order *Insessores;* now the family *Sturnidæ;* nearly allied to *Corvidæ*, but in general of smaller size; the bill more slender and compressed, its point nail-like; the wings long and pointed. They are natives of almost all parts of the world, very generally gregarious, and some of them migratory. They feed on worms, insects, larvæ and fruits. Some of them follow herds of quadrupeds on account of the insects which attend them. The COMMON S. (*Sturnus vulgaris*) is a beautiful bird, rather smaller than the song-thrush or mavis, brown, finely glossed with black, with a pale tip to each feather, giving the bird a fine speckled appearance, particularly on the breast and shoulders; in advanced age it is more uniform in color. The plumage of the female is less beautiful than that of the male. Both sexes are more speckled in winter than in summer. The S. is abundant in most parts of Britain, and nowhere more so than in the Hebrides and Orkneys. It is very abundant in the fenny districts of England. It is found in all parts of Europe, and throughout great part of Africa; and is also common in the north of Asia. Starlings make artless nests of slender twigs, roots, and dry grass, in hollow trees, in holes of

cliffs, under eaves of houses, or, readily enough, in boxes, which are often placed for them in trees or elsewhere near houses. They frequently breed twice in a season, and in autumn they unite in large flocks. The S. becomes very pert and familiar in confinement, displays great imitative powers, and learns to whistle tunes, and even to articulate words with great distinctness. Its natural

Starling (*Sturnus vulgaris*).

song is soft and sweet.—The AMERICAN S., or MEADOW LARK (*S. Ludovicianus*), is larger than the Common Starling. It is common in the United States, migrating northwards in spring, and southwards in autumn, and congregating in great flocks in autumn and winter.

STARLINGS, in Architecture, are large piles driven in outside the foundations of the piers of bridges to break the force of the water and save the piers.

STAR-NOSE (*Condylura*, or *Astromyctes*), a genus of the Mole (q. v.) family, *Talpidæ* having much general resemblance to moles, but with a longer tail, and an elongated slender muzzle, which bears at its extremity a remarkable structure of fleshy and somewhat cartilaginous rays disposed in a star-like form. The habits are very similar to those of moles. All the species of this genus are natives of North America. The best known is *Condylura cristata*, which inhabits Canada and the eastern parts of the United States.

STARODOU'B, a town of European Russia, in the government of Tchernigov, and 100 miles north-east of the town of that name. It stands in the middle of a fertile district, but at a distance from any commercial highway. Pop. (1880) 16,820.

STAR OF BETHLEHEM (*Ornithogalum*), a genus of bulbous-rooted plants of the natural order *Liliaceæ*, nearly allied to Squills and Hyacinths. These species are pretty numerous, natives almost exclusively of the eastern hemisphere, many of them of the Cape of Good Hope, and some of the south of Europe. The Com-

Star of Bethlehem (*Ornithogalum umbellatum*).

mon Star of Bethlehem (*O. umbellatum*), a native of France, Switzerland, Germany, the Levant, &c., is very common in flower-gardens. Its flowers are large, six to nine, in a corymbose raceme, white and somewhat fragrant. *Gagea lutea*, formerly, *O. luteum*, with yellow flowers, is found in some parts of Britain in woods and pastures.

STAR OF INDIA, THE MOST EXALTED THE ORDER OF THE, an order of knighthood instituted by Queen Victoria in June 1861, with the view of affording the princes, chiefs, and people of the Indian Empire, a testimony of her Majesty's regard, commemorating her Majesty's resolution to take on herself the government of India, and rendering honor to merit and loyalty. The order consists of the Sovereign, a Grand-master, who is to be the Governor-general of India for the time being, and 25 knights, together with such extra and honorary knights as the crown may appoint. The members of the order are to be military, naval, and civil officers who have rendered important service to the Indian Empire, and such native chiefs and princes of India as have entitled themselves to her Majesty's favor. The insignia consists of a collar, badge, and star. The *collar* of the order is composed of the heraldic rose of England, two palm branches in saltire tied with a ribbon, and a lotus-flower alternating with each other, all of gold enamelled, and connected by a double golden chain. From an imperial crown, intervening between two lotus-leaves, depends the *badge*, consisting of a brilliant star of five points, and hanging from it an oval medallion, with an onyx cameo profile bust of Queen Victoria, encircled by the motto: 'Heaven's light our Guide,' in gold letters, on an enriched border of light-blue enamel. The *investment badge* is similar to the collar-badge, but

Star of India.

with the star, the setting of the cameo, and the motto all of diamonds: it is worn pendent from a ribbon of pale blue with white borders. The *star* of the order is a five-pointed star or mullet of diamonds on an irradiated field of gold. Around it, on an azure fillet bordered with gold, is the same motto in diamonds, the whole encircled by wavy rays of gold.

STARS are distinguished from planets by remaining apparently immovable with respect to one another, and hence they were early called fixed stars, a name which they still retain, although their perfect fixity has been completely disproved in numerous cases, and is no longer believed in regard to any. Twinkling, or Scintillation (q. v.), is another mark which distinguishes stars from planets.

The first thing that strikes the observer is the apparent daily motions of the stars. The greater part appear to rise in the east, describe smaller or greater arcs in the heavens, and set in the west; while others describe complete circles round a point north of the zenith, that described by the so-called polar star being the smallest visible to the naked eye. These apparent motions arise from the rotation of the earth on its axis. Had the earth only this rotatory motion, the aspect of the starry heavens at any spot on the earth's surface would be the same at the same hour of the night all the year round; which is known not to be the case. In consequence of the earth's motion round the sun, or the apparent advance of the sun among the stars, the aspect of the heavens at a particular hour is always changing. The same position of the stars recurs four minutes earlier each night, and only at the same time after the lapse of a year.

With few exceptions, the *distance* of the fixed stars is still unknown, and must in all be enormously great. Since the time of Bradley, many attempts have been made to measure what is called the *yearly parallax* of the stars, and thus determine their distances. When we consider that the motion of the earth round the sun brings us at one time a whole diameter of its orbit (184 millions of miles) nearer to a particular region of the heavens than we were six months before, we should expect a change in the relative distances of the stars as seen from the two points—that as we approach them they should seem to separate. But no such change is seen to take place; and this was one of the early objections to the theory of Copernicus. The only answer that the Copernicans could give was, that the distance of the stars from us is so great that the diameter of the earth's orbit is as a point compared with it. The detection of the parallax of the fixed stars depended upon the perfection of instruments.

The parallax of a star is the minute angle contained by two lines drawn from it, the one to the sun, the other to the earth. If that angle amounted to a second, the distance of the star would be 206,000 times that of the sun; and when the measurement of angles came to be reliable to a second, and still no parallax was discernible, astronomers could say that the distance of the nearest stars must be more than 206,000 times that of the sun—i. e., 206,000 times 92 millions of miles, or about 20 billions of miles. It is only since between 1832 and 1838 that anything like positive determinations of parallax have been made, chiefly by Henderson, Bessel, and Peters. The first published (Dec. 1838) was that of the double star 61 in the constellation of the Swan, by Bessel, who made the parallax 0″·37, giving a distance over 550,000 times that of the sun, or 52 billions of miles, so that the light of this star is about 8½ years in reaching the earth. The nearest of all the stars yet measured is *α Centauri*, the finest double star in the southern heavens, whose parallax was determined by Henderson and Maclear at the Cape of Good Hope to be 0″·9128 (the observations were made in 1832—1833; the result read before the Astronomical Society, Jan. 1839), or as subsequently corrected, 0″·976, corresponding to a distance of about 20 billions of miles, and requiring 3¼ years for its light to reach us. To Sirius, the brightest of the stars, a parallax of 0″·15, has been assigned, implying a distance six times that of α Centauri. 'It has been considered probable, from recondite investigations, that the average distance of a star of the *first* magnitude from the earth is 986,000 radii of our annual orbit, a distance which light would require 15½ years to traverse; and further, that the average distance of a star of the *sixth* magnitude (the smallest distinctly seen without a telescope) is 7,600,000 times the same unit—to traverse which, light, with its prodigious velocity, would occupy more than 120 years. If, then, the distances of the majority of stars visible to the naked eye are so enormously great, how are we to estimate our distance from those minute points of light discernible only in powerful telescopes? The conclusion is forced upon us that we do not see them as they appeared within a few years, or even during the lifetime of man, but with the rays which proceeded from them several thousands of years ago!'—Hind's *Astronomy*.

The stars have been divided into groups called Constellations (q. v.) from the earliest times. The several stars belonging to the same constellation are distinguished from one another by Greek letters, beginning the alphabet with the brightest; and when these are not sufficient, by Roman letters and by numbers. Many of the most brilliant stars have special names. They are also divided according to their brightness into stars of the first, second, third, &c., magnitudes—a division which is necessarily somewhat arbitrary. The smallest stars discernible by a naked eye of ordinary power are usually called stars of the fifth magnitude; but an unusually sharp eye can discern those of the sixth and even seventh magnitude. All below are *telescopic* stars, which are divided in a very undetermined way down to the twentieth magnitude. Sir J. Herschel has determined that the light of Sirius, the brightest of all the stars, is 324 times that of a mean star of the sixth magnitude. By processes of photometric observation and reasoning, it is concluded that the intrinsic splendor of α Centauri is more than twice that of our sun, and that of Sirius 394 times. Among stars of the first magnitude in the northern hemisphere are usually reckoned Aldebaran (in Taurus), Arcturus (in Bootes), Atair (in Aquila), Betelgeux (in Orion), Capella (in Auriga), Procyon (in Canis Minor), Regulus (in Leo), Vega (in Lyra). In the southern hemisphere are Achernes (in Eridanus), Antares (in Scorpio), Canopus (in Argo), Rigel (in Orion), Sirius (in Canis Major), Spica (in Virgo), and α Centauri and α Crucis that have no special names.

No apparent magnitude, in the proper sense of the word, has yet been observed in any star. In the best and most powerfully magnifying telescopes, even the brightest stars of the first magnitude, appear, not with small discs as all the planets do, but as luminous points without any visible diameter, and always the smaller the better the telescope. We are therefore totally ignorant of the real size of the fixed stars; nor could it be determined though we were sure of their distances, for the apparent diameter is an essential element in the calculation. We cannot, then, say whether the greater brilliancy of one star, when compared with another, arises from its greater nearness, its greater size, or the greater intensity of its light. It is certain that all the fixed stars are self-luminous. By the spectroscope several facts regarding their physical constitution have been made out; there are great differences in their spectra; the existence of several known elements is considered demonstrated. Sirius, e. g., contains hydrogen, sodium, and magnesium.

The *number* of the stars is beyond determination. Those visible by the naked eye amount only to a few thousands. Stars of the first magnitude are usually reckoned at 15—20, of the second at 50—60, of the third about 200, of the fourth at 400—500, of the fifth at 1100—1200. But in the following classes, the numbers increase rapidly, so that stars of the sixth and seventh class amount to above 12,000. Stars are most dense in that region of the heavens called the Milky Way, which is mostly composed of stars of the eleventh and twelfth magnitudes. W. Herschel observed 116,000 stars pass the field of his telescope in a quarter of an hour, while directed to the densest part of the Milky Way.

That the fixed stars are not really immovable, as their name would imply, is seen in the phenomenon of *Double* or *Multiple Stars* which are systems of two or more stars that revolve about one another, or rather about their common center of gravity. As they can be seen separate only by means of a telescope, and in most cases require a very powerful one, their discovery was possible only after the telescope was invented. Galileo himself discovered their existence, and proposed to make use of them in determining the yearly parallax of the fixed stars. After a long lapse of time, Bradley, Maskelyne, and Mayer again directed attention to the phenomena of double stars; but nothing important was made out respecting them till the elder Herschel made them the subject of a protracted series of observations, which led to the most remarkable conclusions as to their nature. The united observations of Struve, Savary, Encke, South, and especially those of Herschel the younger, continued for four years in the southern hemisphere at the Cape of Good Hope, have raised the number of observed double, or rather multiple, stars to more than 6000, of which the greater part are binary, or composed of two, but many are triple, some quadruple, and a few even quintuple, or consisting of five stars. The distance between the stars composing these systems is always apparently small (varying from less than 1″ up to 32″); but apparent nearness does not always constitute a double star, for two really distant stars are not unfrequently so nearly in the same line, as seen from the earth, that they appear to be close together. In real multiple stars, the individuals are not only comparatively near to one another, but they revolve around one another. Among stars of the first three magnitudes, every sixth is a multiple star; among the smaller stars, the proportion is much less. In some cases, one of the stars is much larger than the other, as in the star Rigel in Orion, and in the polar star; but oftener the connected stars are nearly equal in luminous power. The two members of double stars are mostly of one color, but a difference of color is observed in about one-fifth of the whole number. In many of these cases, the one color is the complement of the other, and it is possible that the color of the smaller star may be subjective, arising from the action of the other upon the eye.

It was in 1803, after 20 years' observation, that Sir W. Herschel advanced the view, which has been more and more confirmed since, that double stars are connected systems of two or more stellar bodies, revolving in regular orbits around one another, or rather round their common center of gravity. Their motions are found to follow the same laws as prevail in the solar system, and the orbits are elliptical. These distant bodies are therefore subject to the Newtonian law of gravitation. The period of revolution has, in several cases, been roughly approximated: among the shortest is that of ζ Herculis, estimated at 30 years; others are set down at hundreds. In cases where the parallax is known, the size of the orbits can be determined; and thus the astronomer is able to assert in regard to the double star 61 Cygni that the orbit described by these two stars about each other undoubtedly greatly exceeds in dimensions that described by Neptune about the sun. Even the masses of these stars have been calculated as being together 0·353, that of our sun being 1. It is a consequence of these revolutions that many stars are now seen double that formerly seemed single, and *vice versâ*. If the plane of revolution have its edge presented to the earth, the stars will seem to move in a straight line, and at times to cover one another. The star ζ Herculis, seen by Herschel double in 1781, appeared single in 1802, and was first seen double again by Struve in 1826. The

Fig. 1.

figure represents the relative positions of the two stars composing γ in Virgo, at different times since the earliest observations. The period of revolution is presumed to be 182 years.

The *proper motion* of stars, discovered by Halley, is of another kind. It consists in a displacement in various directions of the

individual stars, so that the configuration of constellations is slowly changing. 'The Southern Cross,' says Humboldt, 'will not always shine in the heavens exactly in its present form; for the four stars of which it consists move with unequal velocity in different paths. How many thousand years will elapse before its total dissolution cannot be calculated.' The proper motions yet observed vary from $\frac{1}{10}$th of a second to 7″·7. According to Bessel, the proper motion of the binary star 61 Cygni amounts to 5″·123, so that in 360 years it would pass over a space equal to the moon's diameter. It must thus take thousands of years to alter sensibly the aspect of the heavens; although, taking into account the enormous distances, the actual velocities must be great. Of 3000 stars observed by Bessel, 425 had a perceptible motion. Argelander has recently published a list of 560 stars having a proper motion.

It was first observed by Sir W. Herschel that there is a perceptible tendency in the stars generally to diverge or open up in one quarter of the heavens, and to draw together in the opposite quarter; and this he attributed to a proper motion of our sun with his planets in the direction of the former point. The apparent motion thus caused is complicated with the real independent motions of individual stars. The point towards which this motion is directed, which is called the 'solar apex,' was fixed by Herschel in the constellation Hercules; and the result of subsequent and independent researches gives a nearly coincident point. The velocity has been calculated at upwards of 150 millions of miles a year, or 17,600 miles an hour—i. e., rather more than one-fourth of the earth's velocity in its orbit.

The spectroscope has been applied to investigate the physical constitution of the stars, with the result of identifying many of the elements composing our sun and earth. The spectra of the stars differ greatly among one another; some consisting mainly of simple lines, others having complex bands. The simple spectra are believed to indicate great intensity of heat, keeping the molecules of matter in a state of extreme dissociation; while the complex spectra show the molecules to be more associated in groups or compounds, owing to the repulsive force being less. The bluish stars are the hottest; a red tinge indicates a comparative coolness. Our sun would seem to be a decaying star.

Several stars exhibit well-marked periodic alterations of a striking nature, and are hence called *variable stars*. A considerable number have been observed, of which the most remarkable are Mira (the 'wonderful') in Cetus, and Algol in Perseus. The first attains its greatest lustre every 334 days, and appears for 14 days as a star of the second, and even at times of the first magnitude; it then decreases for two or three months, till it becomes of the

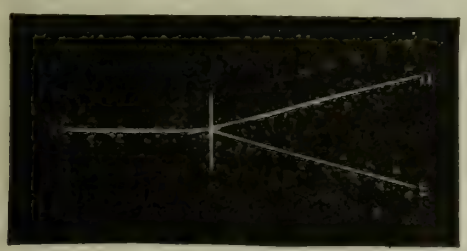


Fig. 2.

sixth and even tenth magnitude, so as to be for half a year invisible to the naked eye and usually to telescopes. After this it begins again to increase, but more rapidly than it decreased. It is visible to the naked eye for three or four months of its period. Of all the variable stars yet observed in Perseus, Algol has the shortest period, being 68 hours 49 minutes. It appears for about 60 hours a star of the second magnitude, then decreases for four hours, and appears for a quarter of an hour of the fourth magnitude, after which it increases again for four hours. Various explanations have been offered of these mysterious appearances; the stars are supposed to turn on their axes, and to have their surfaces unequally luminous in different places; or a large dark body is assumed to be revolving about the luminous one, so as to intercept more or less of its light in different positions; or the stars are lens-shaped, &c. There is nothing, however, inadmissible in the supposition that the intensity of the light itself may vary; and if in other suns, why not in our own?

Fig. 3.

Allied to the variable stars are the *new* or temporary stars that appear suddenly in great splendor, and then disappear without leaving a trace. A number of instances are on record. It is not impossible that these also may be periodic.

Star Systems.—From the appearances connected with the Milky Way or Galaxy (q. v.), Sir W. Herschel came to the conclusion that the stars forming our firmament do not extend indefinitely into space, but are limited in all directions, the mass having a definite shape. He conceived the shape to be something like that of a huge millstone, having one side cleft, and the two laminæ set apart at a small angle. Let the diagram (fig. 2) represent a vertical section of such a broad flat stratum, and suppose the solar system situated as at S, to a spectator looking on either side, in the direction of the thickness, as SB, the stars would appear comparatively sparse, but all round in the direction of the breadth (as SA) there would appear a dense ring, which would separate into two branches (SE, SD) in the direction of the cleft side. This supposition accounts for the appearance of the Milky Way, and all subsequent observations have tended to confirm the conjecture. Situated as we are within the system, we cannot hope ever to attain more than a rude notion regarding it; to get a definite outline, we must be placed without it.

But this star system, which we may call our own, as our sun belongs to it, is but an item in the stellar universe. The appearances known as nebulæ, in many cases at least, are believed to be similar agglomerations of suns, separated from our system and from one another by unfathomable starless intervals (see NEBULÆ). Their forms are very various, but in general pretty well defined, and not without symmetry. The aspect of some of them is even startling. A few specimens are given in the woodcut (fig. 3).

STAR-THISTLE. See CENTAUREA.

START POINT (A.-S. *steort*, a tail or promontory), a rocky headland in the south of Devonshire, with a lighthouse 204 feet above the sea, in lat. 50° 13′ 4″ N., and long. 3° 38′ W.

STARVA'TION, or INANI'TION, are terms applied to the phenomena resulting from an entire deficiency, or an insufficient supply of food. From M. Chossat's well-known experimental investigations of this subject (*Recherches Expérimentales sur l'Inanition*, Paris, 1843), it appears that the average loss of weight in mammals and birds, between the commencement of fasting and the death of the animal, was 40 per cent., the loss varying above and below 40 per cent. in the different organs and tissues, as shown in the following table:

PARTS WHICH LOSE MORE THAN FORTY PER CENT.		PARTS WHICH LOSE LESS THAN FORTY PER CENT.	
Fat	93·3	Muscular coat of Stomach	39·7
Blood	75·0	Pharynx and Œsophagus	34·2
Spleen	71·4	Skin	33·3
Pancreas	64·1	Kidneys	31·9
Liver	52·0	Lungs	22·2
Head	44·8	Bones	16·7
Intestines	42·4	Eyes	10·0
Muscles of Locomotion	42·3	Nervous System	1·9

Hence it appears that there is an almost complete removal of the fat, and a great reduction of the blood, while the nervous system is scarcely affected; and hence it would seem as if the supervention of death was coincident with the consumption of all the combustible materials of the body, and that previously the remaining nutritive force was concentrated on the nervous system.

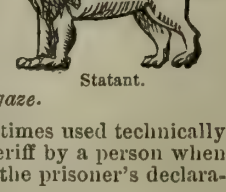
The following are amongst the most prominent phenomena which Chossat observed either during the experiments or after the death of the animals: 1. Dropsical effusions. 2. Softening and destruction of the mucous membrane. Blackening of the viscera, especially of the liver. 4. Bluish, livid, yellow, and reddish stains during life in the transparent parts of the skin. 5. Hectic fever, and a continuous decrease in the power of the body to resist cold. 6. At first a scanty excretion of dry, bilious, grass-green fæces, and afterwards diarrhœa of liquid saline matter. 7. Convulsions similar to those in death by hæmorrhage. 8. Death

by starvation seems to be in reality death by cold; since the temperature of the body is not much diminished until the fat is nearly consumed, when it rapidly falls, unless it be kept up by heat applied externally. 9. Young animals succumbed far sooner than adults. 10. The results of insufficient food were in the end the same as those of total deprivation; the total amount of loss being almost the same, but the rate being less, so that a longer time was required to produce it.

Chossat did not find that much influence was exerted on the duration of life by permitting or withdrawing the supply of water; but there is no doubt that in man, and probably in mammals generally, death supervenes much earlier when liquids as well as solid food are withheld. For a full account of the symptoms of starvation as they occur in the human subject, we must refer the reader to the writings on hygiene and forensic medicine of Orfila, Rostan, Caspar, Taylor, &c.; and especially to Dr. Donovan's account of the Irish famine of 1847, in the *Dublin Medical Press*, Feb. 1848, p. 67. The following are the most striking symptoms: In the first place, pain is felt in the stomach, which is relieved on pressure. The countenance becomes pale and cadaverous; the eyes are wild and glistening; the breath hot, the mouth parched, and the saliva thick and scanty. An intolerable thirst surpervenes, which, if there be no access to water, becomes the most distressing symptom. The body becomes gradually emaciated, and begins to exhale a peculiar fœtor, while the skin becomes covered with a brownish dirty-looking, and offensive secretion almost as indelible as varnish, which Donovan at first mistook for encrusted filth. The bodily strength rapidly declines; the sufferer totters in walking, like a drunken man; his voice becomes weak and whining, and he is ready to burst into tears on the slightest occasion. In the cases recorded by Donovan, imbecility, and sometimes almost complete idiocy, ensued, but in no instance was there delirium or mania, which has been described as a symptom of starvation in cases of shipwreck. On examination after death, the condition of the body is such as might be expected from Chossat's experiments, viz., extreme general emaciation; loss of size and weight of the principal viscera; almost complete bloodlessness, except in the brain; and the gall-bladder distended with bile, which tinges the neighboring parts. Moreover, decomposition rapidly ensues.

It is impossible to fix the exact time during which life can be supported under entire abstinence from food or drink. Dr. Sloan has given an account of a healthy man, aged 65, who was found alive after having been shut up in a coal mine for 23 days, during the first ten of which he was able to procure a small quantity of foul water. He was in a state of extreme exhaustion, and notwithstanding that he was carefully nursed, he died three days after his rescue. Dr. Willan records the case of a young gentleman who, under the influence of religious delusion, starved himself to death. He survived for sixty days, during which time he took nothing but a little orange juice. In this case life was probably abnormally prolonged in consequence of the peculiar emotional excitement of the patient. Judging from the cases of abstinence owing to disease of the throat and impossibility of swallowing, Dr. Taylor infers 'that in a healthy person under perfect abstinence, death would not commonly take place in a shorter period than a week or ten days.'

It is worthy of notice that a deficient supply of food seems to check the elmination and removal of the effete materials of the of the body. This fact accounts not only for the tendency to putrescence, which is exhibited during the process of starvation, and for the rapidity with which putrefaction ensues after death, but for the pestilential diseases which almost always follow a severe famine; the excess of disintegrated matter in the blood rendering the system especially prone to the reception and multiplication of the diseases characterized as zymotic, such as fever, cholera, &c.



Statant.

STA'TANT, in Heraldry, a term applied to an animal standing still, with all the feet touching the ground. If the face be turned to the spectator, it is said to be *statant gardant*, or in the case of a stag, *at gaze*.

STA'TEMENT, in Scotch Law, is sometimes used technically to denote the account given before the sheriff by a person when arrested on a criminal charge. It is called the prisoner's declaration in England.

STA'TEN ISLAND, a beautiful and picturesque island, which forms the W. shore of the bay and narrows, and the S. shore of the harbor of New York. It contains 58¼ sq. m., forming the county of Richmond, divided into 5 townships. Its shores are dotted with villages, and its heights crowned with villas. A narrow sound, the Kill van Kull, separates it from New Jersey. Four strong forts guard, with those on the opposite shores of Long Island, the entrance to the harbor, and the Hudson and East Rivers. There are asylums for sick or disabled seamen and families of seamen. Pop. (1880) 38,991.

STA'TEN ISLAND, an island off the south-east point of Tierra del Fuego, from which it is separated by the Strait of Le Maire. It is about 45 miles in length from east to west, and about 10 miles at its greatest breadth, its shores much indented. Its eastern extremity is Cape St. John, in lat. 54° 42′ S., and long. 63° 43′ W. The surface is mountainous, descending to the sea in steep slopes and precipices; its general character similar to that of Tierra del Fuego.

STATES, or ESTATES, in Politics, the name given to the classes of the population who either directly or by their representatives take part in the government of a country. In all European countries where the northern conquerors established themselves, the rudiments of representative government appeared in the form of assemblies brought together to deliberate with the sovereign on the common weal. These assemblies at first consisted of the two estates of the clergy and the nobility or baronage, who together constituted the whole free population of the realm; the nobility including not merely the greater barons, but the whole freeholders. As the burgesses gradually emancipated themselves, and rose into importance, they formed a third estate.

In France, we find the *tiers état*, or citizens, recognized in the States-general (q. v) in 1302. In Scotland, the earliest occasion on which the burghs are mentioned as attending and concurring in a grant of taxation, is in the Parliament held at Cambuskenneth in 1326, in which Robert Bruce set forth to the assembled estates the diminished condition of the royal income in consequence of the protracted struggle through which the country had come. The burgesses, represented by the commissioners for the burghs, continued in Scotland to be a separate estate, and were not, as in England, amalgamated with the knights and lesser barons, who, in the Scots parliament, were always classed with the baronage. The lesser barons were, however, first allowed, and latterly enjoined, to appear by representatives; and the three estates of clergy, barons, and burgesses all sat and deliberated in one house. In England, on the other hand, the knights and lesser barons were at an early period separated from the greater barons, and conjoined with the burgesses into the third estate, which occupied a separate chamber from the Lords Spiritual and Temporal. This peculiarity in the original constitution of the *tiers état* of England necessarily gave it a weight which it did not possess elsewhere, and exercised an important influence on the constitutional history of the country. As the peasants became emancipated, we also find them in some countries taking a share in the legislative power, either as a part of the *tiers état*, or, as in Sweden, forming a fourth estate. The four estates of nobles, clergy, citizens, and peasants were recognized in Sweden till 1866; and in the Swedish legislature, as constituted, each had its separate chamber.

Throughout Europe, except in Russia (though in some small German States, such as Mecklenburg, the diet, representing only the landed gentry and the towns, has very little authority), the co-operation of the estates with the sovereign in the legislative power is more or less recognized. Some assemblies have but one chamber, but more of them have two. The lower chamber is always wholly, or partly, elective, but sometimes consists of separate delegates from the different orders of the community, and has representatives of landed proprietors, of towns, of peasants, and of traders and manufacturers. The upper house or senate is in some constitutions hereditary; in some, it consists of members named by the sovereign or by the nobility, or some other class of the community, and often it combines these elements. In a few instances, as in Brazil, it is elected by the same constituency as the lower house, and differs only in the higher property qualification required of its members.

STATES-GENERAL (Fr. *états généraux*), the name which was given to the convocation of the representative body of the three orders of the French kingdom; so named in contradistinction from the *états provinciaux*, or assemblies of the provinces. As far back as the time of Charlemagne, there were assemblies of clergy and nobles held twice a year to deliberate on matters of public importance; and in these assemblies the extensive body of laws bearing the name of the Capitularies of Charlemagne was enacted. The succeeding centuries, however, were adverse to free institutions; and these national convocations, becoming gradually less important, seem to have ceased to be held about 70 years after Charlemagne's death. From that time forward there is no trace of any national assembly in France till 1302, when the *états généraux*, including the three orders of clergy, nobles, and citizens, were convened by Philippe le Bel, with the view of giving greater weight to the course adopted by the king in his quarrel with Pope Boniface VIII.

In 1314, we find the States-general granting a subsidy: during the reigns of Philippe IV. and his successor, the imposition of taxes by arbitrary authority was the subject of general discontent;

and in 1355, the states were strong enough to compel the government to revoke the taxes so imposed. The States-general, however, though their consent seems in strictness to have been considered requisite for any measure imposing a general taxation, had, unlike the assemblies under the Carlovingian kings, no right of redressing abuses except by petition, and no legislative power. Under Charles VI. and Charles VII. the States-general were rarely convened, and it was often found more convenient to ask supplies from the provincial states. But as the royal authority increased, the formality of any convention of states general or provincial gradually ceased to be regarded as indispensable, and a final and unsuccessful struggle for immunity from taxation took place at the States-general of Tours in 1484. Louis XIII. convoked the States-general, after a long interval, in 1614, but dismissed them for looking too closely into the finances; and from that time down to the Revolution, the crown, with the tacit acquiescence of the people, exercised the exclusive powers of taxation and government. In 1789, the memorable convention of the States-general took place, which ushered in the Revolution. As soon as they had assembled, a dispute arose between the two privileged orders and the third estate as to whether they should sit and vote in one chamber or separately. The *tiers état*, of its own authority, with such deputies of the clergy as chose to join them—none of the nobles accepting their invitation—assumed the title of the *Assemblée Nationale*, a name by which the States-general had previously been sometimes designated. See ASSEMBLY, NATIONAL.

The name States-general is also applied to the now existing legislative body of the kingdom of the Netherlands (q. v.). It is so called in contradistinction from the provincial states, which are legislative and administrative assemblies for the several provinces.

STA'TICÉ, a genus of plants of the natural order *Plumbagineæ*, having a funnel-shaped, membranaceous, and plaited corolla; the flowers in spikes on one side of a panicled, leafless, flowering stem (*scape*). Several species are natives of Britain, growing near the sea, most of them on muddy shores and in salt marshes. The root of *S. Caroliniana*, called Marsh Rosemary, is used in North America for all the purposes of kino and catechu, and is a very powerful astringent.

Staticé Simonum.

STA'TICS (Gr. root *sta*, to stand), the science of the equilibrium or balancing of forces on a body or system of bodies, has gradually advanced from the days of Archimedes to the vast developments it has now acquired. Singularly enough, though most of its simpler theorems are very generally known, are almost popular, in fact, there is no science in which elementary teaching is so defective. The ordinary proofs of its fundamental principles, such as the *Parallelogram of Forces*, the *Principle of the Lever*, &c., are usually founded on the supposition that a body in equilibrium is *absolutely at rest*. Now, any one who knows that the earth rotates about its axis, that it revolves about the sun, that the sun is in motion relatively to the so-called fixed stars; that *they* are, in all probability, in motion about something else which is itself in motion, &c., will at once see that there is no such thing as absolute rest, and that *relative rest* or motion, unchanged with reference to surrounding bodies, is all that we mean by equilibrium. He will then, at once, see that the foundations of statics are to be sought in the LAWS OF MOTION (q. v.). And, in fact, Newton's Second Law of Motion gives us the necessary and sufficient conditions of equilibrium of a single particle under the action of any forces; while his Third Law, with the annexed Scholium, gives these conditions for any body or system of bodies whatever.

The simplest statement of the conditions of equilibrium of a rigid body which can be given, is that furnished by this Scholium of Newton's, which is now known by the name of the Principle of Energy (see FORCE) or Work (q. v.). It is as follows: A rigid body is in equilibrium if, and is not in equilibrium unless, in *any* small displacement whatever, no work is done on the whole by the forces to which it is subject. In the case of what are called the *Mechanical Powers* (q. v.). this is equivalent to the statement, that work expended on a machine is wholly given back by the machine—or that the work done by the *power* is equal to the work spent in overcoming the *resistance*.

It is shown in the geometrical science of Kinematics that any motion whatever of a rigid body can be reduced to *three* displacements in any three rectangular directions, together with *three* rotations about any three rectangular axes—so that the equilibrium of a rigid body is secured if no work be done on the whole in any of these *six* displacements. There are thus six conditions of equilibrium for a rigid body under the action of any forces—and these are reduced to *three* (two displacements and one rotation), if the forces are confined to one plane; and to *one* (a displacement), if the forces act all in one line.

Equilibrium may be *stable*, *unstable*, or *neutral*. It is said to be stable, if the body, when slightly displaced in any way from its position of equilibrium, and left free, tends to *return* to that position. It is unstable, if there is any displacement possible, which will leave the body in a position in which it tends to *fall further away* from its position of equilibrium. It is neutral, if the body, when displaced, is still in equilibrium. It is easily shown, but we cannot spare space for the proof, that a position of stable equilibrium is, in general, that in which the Potential Energy (see FORCE) of the body is a minimum—of unstable equilibrium, where it is a maximum (for some one direction of displacement at least) —of neutral equilibrium, where the potential energy remains unchanged by any small displacement. Thus, a perfect sphere, of uniform material, is in neutral equilibrium on a horizontal plane—while an oblate spheroid, with its axis of rotation vertical, is in stable equilibrium; and a prolate spheroid, with its axis vertical, is in unstable equilibrium on the plane. Similar statements hold for other than rigid bodies. Thus, a chain, or a mass of fluid, is in stable equilibrium when its potential energy is least, i. e., when its center of gravity is as low as possible. This simple statement is sufficient for the mathematical solution of either question.

STA'TIONERY, a very general term applied to the materials connected with writing, such as paper, books for accounts, drawing, &c., envelopes, sealing materials; and even writing-desks, blotting-books, albums, porte-feuilles, pocket-books, red tape, and many other necessaries of the writing-desk, are included.

STATIONERY OFFICE, an office in London established by the Lords of the Treasury in 1786, for the purpose of purchasing, wholesale, writing materials for the supply of the government offices at home and abroad. It also contracts for the printing of all Reports and other matters laid before the House of Commons. The duties are performed by a comptroller, a storekeeper, and about thirty clerks or other subordinate officers. There is a branch establishment in Dublin. The appointments are made by the Lords of the Treasury.

STATIONS (Lat. *statio*), a name applied in a Roman Catholic Church to certain places reputed of special sanctity, which are appointed to be visited as places of prayer. The name is particularly applied in this sense to certain churches in the city of Rome, which, from an early period, have been appointed as churches which the faithful are particularly invited to visit on stated days. The names of these churches are found on the several days in the Roman missal prefixed to the liturgy peculiar to the day. The word, however, is employed in a still more remarkable manner in reference to a very popular and widely-received devotional practice of the Roman Catholic Church, known as that of 'The Stations of the Cross.' This devotion prevails in all Catholic countries; and the traveler often recognizes it even at a distance by the emblems which are employed in directing its observance—the lofty 'Calvary' crowning some distant eminence, with a series of fresco-pictures or bas-reliefs arranged at intervals along the line of approach. These representations, the subjects of which are supplied by scenes from the several stages of the Passion of our Lord, are called Stations of the Cross, and the whole series is popularly known as the *Via Calvaria*, or Way of Calvary. The origin of this devotional exercise, like that of local pilgrimages, is traceable to the difficulty of access to the Holy Places of Palestine, consequent on the Turkish occupation of Jerusalem and the Holy Land; these representations being designed to serve as some analogous incentive to the piety and faith of the Christian worshiper of our Lord in his Passion. The number of the so-called 'stations' is commonly 14, although in some places 15, and in others, as Vienna, only 11; but whatever may be their number, the subject of all is a sort of pictorial narrative of the Passion. The devotional exercise itself is performed by kneeling at the several stations in succession, and reciting certain prayers at each. Forms of prayer are prescribed to those who can read. The poor and ignorant recite the Lord's Prayer and Hail, Mary! all being directed to fix their thoughts in grateful memory upon 'the sufferings which each representation describes our Lord as having undergone, in atonement for the sins of mankind.' Many 'indulgences' are granted to those who having duly repented of their sins, shall piously perform this exercise. Many of these stations are celebrated as works of art, especially one near Bologna. Some of those in the Alps and along the precipitous banks of the Rhine, Danube, and other German rivers, are exceedingly striking and picturesque.

STATI'STICS, that branch of Political Science which has for its object the collecting and arranging of facts bearing on the condition, social, moral, and material of a people. The word statistics was first employed in the middle of last century by Professor Achenwall of Göttingen, who may be considered the founder of the science. The principle lying at its foundation is, that the laws which govern nature, and more especially those which govern the moral and physical condition of mankind, are constant, and are to be discovered by the investigation and comparison of phenomena extending over a very large number of instances. Accidental diversities tend to neutralize each other, their influence diminishing as the area of investigation increases; and if that area be sufficiently extended, they so nearly disappear, that we are entitled to disregard them altogether. While the length of a single life cannot be counted on, an average of 1000 or 10,000 lives gives us a constant quantity, sufficiently near the truth to answer the purposes of insurance companies. Even the acts which are the most purely voluntary as regards individual men, have been found to be subject to laws which, in respect of the masses which make up society, are invariable in like circumstances, and discoverable.

The science of statistics has a twofold relation to political and social economy. The facts collected by the statist are the bases on which political economy rests; their application to social and economical problems is an appeal from imagination to fact. But the statist must be guided by the political economist in what direction to extend his investigations: without political economy, we should have had no statistics.

It would be difficult to give any exhaustive enumeration of the multifarious topics which may be the subject of statistical inquiries. The results of statistics have been classified as—1. Problems regarding the nature of wealth and its production and growth in a community; 2. Problems relating to inland and foreign trade; 3. Problems relating to taxation and finance; 4. Problems regarding currency, banks, and prices; 5. Problems relating to the wages and hire of labor, and the division of employments; and 6. Problems relating to the functions of the state as regards interference with the economic relations of its subjects.

The Statistical section added to the British Association for the Advancement of Science in 1833, and the London Statistical Society founded in 1834, have made some valuable contributions to this science, and helped to diffuse a knowledge of its principles and its importance. But while in some branches there is undoubtedly room for the labors of individuals or associations, statistics are, generally speaking, more appropriately the province of the state. The most important of the subjects with which this science is cognizant, cannot be investigated without unrestricted access to government offices, and authority to demand information; and the ordinary administration of government is continually affording opportunities for the collection of the most valuable statistical facts. For some time past, statistics have largely occupied the attention of the more enlightened governments of Europe. The statistical reports issued by the various departments of the French government deserve especial praise for the comprehensiveness of their basis, and the clearness of their arrangement. The government of Belgium has, since 1841, engaged with much diligence in statistics, and Austria and Prussia have also their Statistical departments. In the United Kingdom, a department of the Board of Trade has, since 1832, been charged with collecting and publishing detailed and classified information obtained from various departments of government regarding the revenues, population, commerce, wealth, and moral and economical condition of the country and colonies, as well as a selection from the statistics of foreign countries. Every session of parliament, there are also numerous statistical returns called for, which no doubt sometimes contain valuable material, but being drawn up to suit the particular purpose of those who move for them, they have too often a desultory, fragmentary character, and from the absence of any general plan, are of little use but for the moment. It has been suggested that, by establishing a separate Statistical department of government, we might, at a hardly greater cost, obtain a yearly *résumé* of administrative statistics complete enough to supersede to a large extent the present system of moving for returns whenever they are wanted.

The frequent connection of statistics with political theories renders it important to guard against premature statistical conclusions, of which two very fertile sources are calculations from an insufficient number of data, and neglect to make allowance for disturbing causes.

STA'TUARY AND STATUE. See SCULPTURE.

STA'TUTE OF FRAUDS, in English Law, is a statute which required certain contracts and agreements to be in writing, in order to be binding in such cases. The object of the statute, 29 Char. II. c. 3, was to prevent the perjury which so frequntly takes place where the proof of the contract is left to the memory of the parties. All leases for more than three years, and their assignments, must be in writing; and no freehold estate in lands can be created except by writing. So promises and agreements to bind an executor or administrator personally must be in writing; as well as to bind one party for the debt of another. So as to contracts made for the sale of land, or of interests in land; and for the sale of goods above £10 in price, unless part of the goods have been accepted and received, or partly paid for.

STATUTE OF LIMITATIONS. See LIMITATION.

STATUTES OF DISTRIBUTIONS. See DISTRIBUTIONS.

STATUTES, or ACTS OF PARLIAMENT, are those laws made from time to time by the legislature, which qualify and alter the common law or previous statutes. All laws may be divided into common law and statutory law, the former being unwritten, the latter being written. The theory as to the common law is, that it consists merely of ancient usages, accepted by all, of which the written exposition has perished, but which tradition has kept alive; and much of the common law necessarily consists of what has sometimes been called judge-made law—a department of law which has often been ignorantly denounced as illegal or unconstitutional, but which is a necessary part of every code, under whatever name it is disguised.

The legislature of England consists of the Queen, Lords, and Commons in parliament assembled, and the statutes which they pass have been likened by Sir Matthew Hale to written contracts or indentures, the general public being bound, by their respective agents, as if by solemn deed. There is no legal mode of altering the previously existing law, except by a statute passed with the consent of parliament; but there are other ways of modifying the law, so far as mere details of administration are concerned—as, for example, by orders in council, by ordinances, by charters, and by by-laws issued under some inherent or statutory power belonging to corporations. The mode in which a statute is made belongs properly to the head of Procedure in Parliament. Statutes or acts of parliament are all founded on the theory that the legislature has an inherent right to alter all previous laws or statutes; and though sometimes great and leading statutes have been declared to be unalterable by any future parliament, this restriction is obviously utterly futile, and inconsistent with the idea of a legislature. Statutes are usually divided, according to the number of persons affected by them, into public and private—the former applying to the whole public, the latter only to the persons named or described. There is also a subdivision of both into local and personal statutes. Statutes are also divided into declaratory, penal, or remedial, according to the nature of their object. There are certain important rules as to the interpretation of statutes, the chief business of the various courts of law and equity being to construe or interpret the statutes. A statute begins to operate from the time when it receives the royal assent, unless it state some other time for its commencement; but formerly each statute was presumed to take effect from the beginning of the session of parliament in which it passed, until the rule was changed, in 1793, by the act 33 Geo. III. c. 13.

The leading rule in construing statutes is, that the words are to be taken in their ordinary grammatical sense, unless the context shows that they are used in some other sense. All other rules resolve more or less into this. There is also a well-known rule that penal statutes are to be construed less strictly than other statutes of a remedial kind. Another rule is, that a subsequent statute repeals one that is prior, either expressly or by necessary implication, if the prior one is inconsistent in substance. Though it might seem an easy task to construe or interpret what is meant by a statute, it is in practice so far from being easy, that it requires a special training and long experience to arrive at an accurate mode of construction, the chief business of lawyers being to acquire this art; and one excels another solely or chiefly by virtue of the tact, skill, and accuracy of thinking which are required to do such work in perfection. All the main disputes in litigation turn chiefly on the different interpretations put by parties on statutes or contracts, both of which are construed according to precisely the same rules. Another rule applicable to statutes is, that each remains in force until it is repealed, either expressly or impliedly. So much confusion, however, has arisen out of the multiplicity of statutes, and it is so difficult for lawyers to discover what statutes have been so impliedly repealed, that, of late years, a process of revision and examination has been instituted by the government with a view to repeal expressly all that is obsolete and that is already only impliedly repealed, so as to reduce the bulk of the statutes, which have now grown to an inconvenient size. This task is preliminary to a codification of those statutes which remain after such revision and expurgation.

STAUBBACH, FALL OF, a celebrated waterfall in the southern part of the canton of Bern, Switzerland, a mile from the village of Lauterbrunnen, and 8 miles south of Interlaken. It is one of the loftiest in Europe, having a descent between 800 and 900 feet, but it often disappoints visitors, who expect a swift loud-roaring cataract, and find instead a slender stream of water, concealing

the face of the precipice like a 'beautiful lace veil, and imitating in its center the folds of the drapery.' Long before it reaches the bottom, it is blown into a dust of silver spray, whence its name *Staubbach* (Dust-stream). Both Byron and Wordsworth have praised it in verse.

STAUNTON, a rapidly increasing town of Virginia, U. S., on a branch of the Shenandoah River, 100 miles west-north-west of Richmond. It was incorporated in 1749, and is the site of the Western State Lunatic Asylum, and the Deaf and Dumb and Blind Asylums. It contains 9 churches, 3 newspapers, several academies and seminaries, mills, foundries, and manufactories. Pop. (1880) 6664.

STAVANGER, a seaport town of the west coast of Norway, in the stift of Christiansand, 35 miles north-west from the Naze, and 100 miles south from Bergen, on the west side of a wide and sheltered bay of the Bukne-fiord. It is a very ancient town, with a very fine old Gothic cathedral, built in 1013. S. has cloth-manufactories and distilleries. Ship-building is carried on. There is a considerable export trade in timber, oak-bark, lobsters, herring, and stock-fish. Pop. (1876) 20,288.

STAVESACRE. See LARKSPUR.

STAVESACRE (*Delphinium staphisagria*), a species of Larkspur (q. v.), a native of the south of Europe. The seeds have been used in medicine from ancient times. They are too violently emetic and cathartic to be safely employed; but in powder they are pplied to cutaneous eruptions, and are used for killing lice. Their properties depend upon an alkaloid *Delphinia* ($C_{27}H_{19}NO_7$), which is now used in medicine instead of the seeds, chiefly in rheumatism and neuralgia.

STAVROPOL, a government in Russian Caucasia, bounded by the Caspian Sea, on the E., and by the Caucasus on the S. Area, 27,000 sq. m.; pop. (1880) 475,000. The chief rivers are the Kuban and Terek, and the Kuma. In the southwest, where the soil is fertile, and produces millet and wheat, agriculture is the chief employment; in the north-east, the inhabitants lead a nomad life. Vineyards line the banks of the Terek and Kuma, and mulberry trees are cultivated for the rearing of silk-worms.

STAVROPOL, capital of the government, stands on the chief highway from Europe to the Caucasus, 200 miles south-east of Rostov. Pop. (1880) 34,350.

STAY, STAYSAIL. See RIGGING, SAIL.

STEALING. See LARCENY.

STEAM. Steam is water in the gaseous form (see HEAT). When dry, it is invisible and transparent, like air, and is not to be confounded with *vapor*, which is steam returned to the state of water, and thus become visible—water-dust, as it were. As steam has become the most important of all motive powers, the properties on which its action depends deserve careful consideration. The development of steam is, naturally enough, connected popularly with a high temperature, but the two things do not necessarily go together. Water (or snow, or ice) gives off vapor or steam at *every* temperature—a low temperature not preventing the formation of steam, but only decreasing its density. The only limit to this evaporation is when the air surrounding the water (or snow, &c.) is already saturated with vapor of the maximum density which the water can give off at the existing temperature. Thus water at 32° F. will give off vapor of a pressure equal to 0·085 pound per square inch; but if the air above it is already saturated with vapor of that density, the tendency of the particles of water to fly apart is exactly balanced by the pressure of the vapor on its surface, and no more evaporation takes place.

It is a remarkable fact, that while no atmospheric pressure can prevent the water or ice passing into vapor, the previous presence in the air of vapor of the required density (even when so small as in the instance just given) entirely stops it.

We may make this more clear by an illustration. Suppose *a* to be a cylinder, and *pp* a piston moving steam-tight within it; and suppose also that the end of the cylinder above *p* is open to the atmosphere, and that below *p* there is in the cylinder a perfect vacuum. There is then a downward pressure upon the piston equal to the whole force of the atmosphere, or about 14·7 pounds per square inch. If, now, a little water could be introduced into the bottom of the cylinder, without admitting any air, a quantity of vapor would rise from it, and press with more or less force on the lower side of the piston, so as to sustain a portion of the weight of the atmosphere. How much vapor would rise, and how much elastic force or pressure it would exert, would depend upon the temperature of the water and cylinder.

At 32° F., as we have already said, the vapor in the space *a* would exert a pressure equal only to 0·085 pound per square inch. If the temperature were raised to 80°, more vapor would rise until its pressure became about 0·5 pound per square inch; at 102°, the pressure would be 1 pound; at 162°, 5 pounds; at 193°, 10 pounds; and so on, until at 212° F. the pressure would be 14·7 pounds, or exactly equal to that of the atmosphere. When this point has been reached, it is evident that the piston will be *in equilibrio*, the pressure beneath it being exactly equal to that above. At each intermediate point, the downward pressure on *pp* is equal to the pressure of the atmosphere, *minus* the pressure of the steam below the piston. So far as the piston is concerned, the conditions are therefore the same as if the vacuum had been impaired by the introduction of a certain quantity of *air* below *pp*; but there is this difference between the two cases: if the space *a* had been occupied by rarefied air, then, by forcing the piston down, and compressing it into less space, its density would increase until its pressure became equal to, or greater than that of the external air. With steam, however, if the piston were depressed, *and if the temperature of the steam were preserved the same*, instead of its pressure being increased, a portion of it would be liquefied, and the remainder would have the same pressure as before.

It is at 212° that water in an open vessel begins to boil; that is, the vapor rises rapidly and in volumes, being able to displace the atmosphere (see BOILING). In this state, it is usually called *steam;* but there is no essential difference between steam at 212° and steam at 60°. The steam rising from boiling water in an open vessel is of the same temperature as the water—viz., 212°; but notwithstanding this, it contains a great deal more *heat*. This heat is employed in (to use popular language) forcing asunder the molecules of the steam, and thus causing it to occupy so much greater a bulk as steam than as water. It does not make itself known by the thermometer (for which reason it is called *latent* heat), but its existence and amount are known by other means, for which see the article HEAT.

It is important to note, before going further, that, in speaking of the pressure of steam, we have given it in pounds per square inch above a perfect vacuum, or in what are called *absolute* pressures. These must be carefully distinguished from pressures (as often given) in pounds *above atmospheric pressure*. According to the method we adopt, which is the more scientific one, steam of 14·7 pounds, or one atmosphere, exactly balances the pressure of the air, and can therefore do no work against it; while, if the other nomenclature had been adopted, steam of 14·7 pounds *above* atmospheric pressure would have been really steam of *two* atmospheres pressure. In reading on this subject, the student should always make sure whether the pressures spoken of are measured above an absolute zero, or only above the atmospheric pressure, as much confusion is sure to result from any mistake on this point.

When a cubic inch of water is converted into steam at the ordinary pressure of the atmosphere, its volume is increased to 1645 cubic inches—i. e., a cubic inch of water becomes nearly a cubic foot of steam of one atmosphere. If the steam is produced at any greater pressure, its volume will be very nearly inversely as that pressure; at two atmospheres, it would occupy about 855 cubic inches; at four atmospheres, about 457 cubic inches.

When water is boiled in an open vessel, neither the temperature of the water, nor that of the steam rising from it, ever rises higher than 212°, however hot the fire; the heat as it enters is carried off in a latent state in the steam. But under pressure, the temperature of both can be raised to any degree. If, when the water and steam in *a*, fig. 1, came to 212°, the application of heat were still continued, more steam would continue to rise, and the pressure on the under side of the piston being now greater than that of the air above it, the piston would begin to ascend; but, suppose it held in the same position by force, the upward pressure of the steam would be found rapidly to increase, until it would soon require a weight of 14·7 pounds per square inch to keep it down, showing that the pressure of the steam was now equal to twice that of the atmosphere, or to 29·4 pounds per square inch. If at this point the temperature of the water and steam were examined, it would be found to be very nearly 250° F. When the absolute pressure of the steam reached 50 pounds, its temperature would be 281°; at 100 pounds, 328°; at 150 pounds, 360°, and so on.

From the numerous experiments made on this subject, some very important general conclusions may be drawn. Of these, one—which will be evident from the figures just given—is, that the pressure of steam increases at a far higher rate than the temperature (doubling the temperature increases the pressure *nearly* 23 *times*), which shows the extreme danger of continuing to apply heat to a vessel from which the steam is not allowed to escape. The bursting force would soon become such as no vessel could resist.

Another general conclusion of great importance is, that for every temperature there is a corresponding density of steam produced. This steam contains a fixed amount of latent heat, and exerts a certain uniform pressure on every side of any vessel in which it may be contained. The following table shows the rela-

tion between these values for steam of several different temperatures:

T.	*p.*	H.	V.	*v.*
32°	0·085	1091·8	3390·0	211.536
104°	1·06	1113·7	312·8	19.519
158°	4·51	1130·1	80 02	4,993
212°	14·7	1146 6	26·36	1,645
248°	28·83	1157·5	14·0	874
293°	60·4	1171·2	6·992	436
356°	145·8	1190·4	3·057	191
401°	250·3	1204 1	1·838	115

T, Temperature in degrees Fahrenheit. This corresponds to the *sensible heat* of the steam.
p, Pressure in pounds per square inch of the steam at that temperature.
H. Total heat of the vapor above 32° F. at that temperature (according to Regnault's hypothesis) in *thermal units*. A thermal unit (772 foot-pounds) is the quantity of heat which will raise 1 pound of water 1° F. at or near its temperature of greatest density, 39·1° F. The specific heat of water increases slowly as the temperature rises, so that 1 thermal unit will not raise 1 pound of water quite so much as 1° at high temperatures; but for the purposes of this article we need not take this into account.
V, Volume in cubic feet occupied by 1 pound of steam.
v, Number of times which volume of steam exceeds that of same weight of water.

The relations between temperature and pressure in the foregoing table apply only so long as the steam is in contact with the water from which it is generated. Once away from the water, its temperature may be raised without altering its pressure. Steam which has received additional heat in this way is called *superheated* steam. It approximates to the condition of a perfect gas, and therefore follows nearly what is known as Boyle's or Mariotte's Law (q. v.); its volume varying always inversely as its pressure. By this law, steam which occupied 1 cubic foot at 20 pounds absolute pressure, would occupy 4 cubic feet at 5 pounds, and half a cubic foot at 40 pounds absolute pressure.

Steam, however, as commonly used in the steam-engine, is not superheated, but used under the conditions given in the table. It is then called *saturated* steam, and differs sensibly from the condition of a perfect gas. If the pressure (p) be given in pounds per square inch, and the product (pv) of pressure and volume in foot-pounds, then the formula,

$$\log. (pv) = 4·675 + ·061 \log. p,*$$

gives results accurate enough at all ordinary pressures, and can be very easily applied. The volume, instead of increasing inversely as the pressure, increases less rapidly; the difference, though not very great, is large enough to be taken into account in all calculations as to the efficiency and behavior of steam in a steam-engine.

Another fact regarding the constitution of steam, requires attention, from its importance in point of economy. It would naturally be expected that it would take much more heat or fuel to convert a pound of water into steam at a higher than at a lower temperature and pressure. In reality, however, the difference is very slight. Referring back to the table, it will be seen that it requires 1146·6 units of heat to raise a pound of water from 32° to 212°, and evaporate it at that temperature; of these, 180 are expended in raising the temperature, while 1146·6 — 180, or 966·6 units, become latent in the steam. It only requires 1171·2 units however (261 sensible, and 910·2 latent), to raise the water to 293°, and evaporate it at that temperature; for the latent heat falls nearly as fast as the sensible heat rises. The additional heat required is thus only a little over 2 per cent., while the pressure—which is, *cæteris paribus*, a measure of the work the steam will do—is more than quadrupled. In this way, a large increase of power in any engine may be obtained by a small additional expenditure of fuel, and consequently steam of a high pressure is now being used for all purposes, its economy and advantages being fully recognized by engineers. It was thought for a long time that the *total* heat of steam—that is, the sum of the sensible and latent heats—was constant at all temperatures; but this is not strictly the case, although the table shows that the difference, for ordinary ranges of pressure, is but trifling. See HEAT and STEAM-ENGINE.

STEAM-CARRIAGE. Very early in the history of steam locomotion, projects were formed for running steam-carriages on common roads—not to draw a train of vehicles after them, but each carriage to have passenger-accommodation as well as steam-power. Robison suggested such a thing to Watt so far back as 1759. A French inventor, Cugnot, tried a steam-carriage at Paris in 1770, which went with so much force as to dash down a brick wall, and thereby deter other inventors. In 1782, Murdoch, exhibited a model of a steam-carriage; in 1784, Watt described his plans for another; and in 1786, Symington produced a model of a third. In the last-named year, too, Oliver Evans announced certain projects of the kind in the United States. In 1802, Messrs. Trevethick and Vivian patented a steam-carriage, planned on a much better principle than any that had preceded it; they adopted high-pressure steam, of which previous inventors had been afraid. The carriage was tried, but the ingenious patentees received very little encouragement, and soon turned their attention to railway matters. A long interval then passed without any new inventions in this kind of road-locomotion. When Telford and other engineers had improved the roads and highways, inventors were again induced to apply steam-power as a substitute for horse-power to road-vehicles. Bramah made a steam-carriage in 1821, on a plan patented by Julius Griffiths. Gordon invented one in 1822, which worked something like a squirrel in a cage, the engine being within a cylinder, which rolled along the ground; and another in 1824, which appeared to walk upon six iron legs.

Goldsworthy Gurney, Burstall, Hill, James, Hancock, Summers, Ogle, Heaton, Church, Dance, Field, Squire, Maceroni, Scott Russell, Hills, Sir James Anderson—all invented new forms of steam-carriage between 1824 and 1841. Some of these displayed great ingenuity, and attained a speed of 10 or 12 miles an hour on common turnpike roads. Sir Charles Dance ran such a carriage between Gloucester and Cheltenham in 1831, doing the 9 miles in 55 minutes; but the opposition of local interests put him down, after he had made 400 such trips without an accident, and carried a very large number of passengers. In the same year, Mr. Hancock began running his steam-carriage, called *The Infant*, regularly between London and Stratford; and some time afterwards, Mr. Scott Russell ran *his* invention between Glasgow and Paisley. All these three were passenger-vehicles which plied for traffic on the road. In the very numerous inventions from time to time brought forward, the passengers were in some cases seated in front of the engine and boiler; in others, they were seated behind; in others, the tank for water was placed beneath the passengers' feet; while in a fourth kind, there was a passenger-carriage, distinct from, but linked to, the steam-locomotive. None of the inventions, however, attained to commercial success, so many were the difficulties which beset them.

The last quarter of a century has exhibited inventions rather for heavy traction than for passenger steam-carriages. One of the most remarkable of the latter kind is that which the Earl of Caithness drove, in 1864, from Inverness to his seat near Thurso. It carried three or four persons, and ascended and descended very steep inclines without much variation of speed. As a question of profit or commercial advantage, the inventors of such engines now look to their employment on common roads, for dragging heavy loads. Numerous patents have been taken out, with this view, by Boydell, Bray, Clayton, Burrell, Fowler, Aveling, R. W. Thomson, and others. In Mr. Thomson's engines, or 'road steamers,' the wheels are encircled by a complete ring, or tire, of India-rubber, protected on the outside by a flexible sheath of steel plates. As engines for drawing very heavy weights, these have proved the most powerful yet invented, and several of them by 1874 were constantly at work in Glasgow, dragging enormously heavy castings and boilers from the workshops of the engineers to the railways or wharves. In ordinary work, however, the road steamers can hardly be said to have been a success. The expense connected with the renewal of the india-rubber tires, and the other parts worn by the constant jolting on common roads, has told very much against their adoption. Of traction engines with iron wheels, Fowler's and Aveling's are those most used. They are very simple in construction, and cheap in comparison to Thomson's, although not capable of doing the exceptionally heavy work we have just mentioned. Great endeavors are now being made to design an engine suitable for use upon tramway lines laid down on common roads, but as yet without complete success. Several acts of parliament have been passed to regulate the use of locomotives upon common roads. Their regulations at first were severely restrictive, framed apparently rather to discourage than to encourage enterprise. Now, however, that the engines are improved, and their use more understood by the public, the popular feeling against the engines, which caused this legislation, is rapidly disappearing.

It has been a favorite idea for many years with amateur and professional mechanicians to make a light carriage which could be used upon ordinary roads, and which should contain a steam-engine and boiler to propel itself. No doubt a self-propelling steam-carriage to carry only the weight of a passenger or two *can* be easily made, but its cost will be great in proportion to any service it can render.

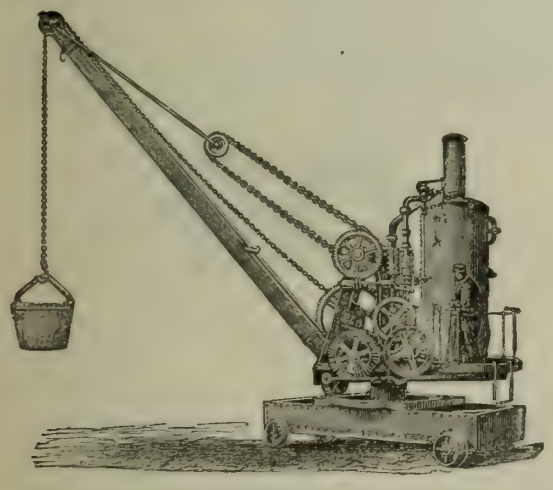
The true application of steam upon common roads is in the drawing of heavy loads which would otherwise require an inconveniently large number of horses. Engines for this purpose are called *traction engines*, and their use, notwithstanding determined, and too often ignorant, opposition, seems to be yearly on the increase. Traction-engines or road-locomotives are now made by all the chief makers of agricultural implements in England as well as in other countries. These are of different types, some being for drawing very heavy loads; some again for lighter work such as the drawing of a thrashing-machine from place to place over moderate gradients; these latter being also adapted for a variety of purposes for which a self-moving has been found to

* Cotterill, *Notes on the Theory of the Steam-engine*, page 9.

possess great advantages over an ordinary portable engine. Some recent forms of traction-engines have driving-wheels as large as 7 or 8 feet in diameter. An ingenious form of traction-engine, called by the inventor a *road-steamer*, was patented by the late Mr. R. W. Thomson, of Edinburgh, its most distinguishing feature being the use of thick india-rubber tires. These tires are simply rings of india-rubber, four or five inches thick, stretched over the rim of the wheel, and protected by a flexible circle of steel shoes from being damaged by stones, &c. The advantage of flexible tires is the greater adhesion (in proportion to weight) which they give to the engine, and the saving the machinery from shocks and jars. The great cost of these rubber tires is, however, a great hindrance to their being adopted.

Traction engines which are employed for such purposes as drawing heavy loads from quarries are found to entail great expense for the maintenance of the roads they traverse. But notwithstanding any drawbacks, road-engines are now used to a very considerable extent in Great Britain, chiefly for agricultural purposes. On the Continent and in America, however, the demand for them appears to be more limited.

STEAM-CRANE. Cranes worked either by steam or hydraulic power are now universal wherever much hoisting has to be done. It is often very convenient that a steam-crane should be movable, so that it may go to its work in cases where that arrangement is more convenient than the converse. For this purpose it is mounted on a plain railway truck, either of wood or iron, the truck being generally provided with clamps at the ends, by which it can be firmly secured to the rails when lifting weights. The balance construction, now universally adopted for portable cranes, was invented or suggested by the late Mr. R. W. Thomson, C.E., in 1856—its essential feature being the use of the boiler as a counterpoise to the weight to be lifted, as shown in the figure. The principal parts of a steam-crane are: 1. The boiler, which must be of some very simple construction, as it has so frequently to be worked with excessively dirty water; 2. The framing, which is generally made of cast-iron, and supports the boiler, the engine and gear, and the jib; 3. The engine (which has almost always two small cylinders, and is fitted with reversing gear), and the pinions, wheels, drums, &c., for the hoisting and other motions; 4. The 'jib' (either of wood or iron) over a pulley



in the top of which the chain passes, and the purpose of which is to enable the different objects to be lifted quite clear of the ground, and deposited, when necessary, on trucks, &c.; 5. The pillar, which is firmly attached to the truck, and which, passing upwards through the center of the frame, forms the pivot on which it turns round; 6. The truck itself, which supports the whole machine.

If the crane is stationary, the truck, of course, is not required, the bottom of the pillar being imbedded in masonry; and for large cranes the boiler is generally made separate from the machine itself, and sometimes the engines also. A portable balance steam-crane, like that in the engraving, is, when complete, fitted with the following motions: 1. Gear for hoisting, generally with two or more speeds, to be used according to the weight to be lifted; 2. Gear for raising or lowering the outer end of the jib; 3. Gear for slewing the jib (with boiler and frame attached to it); 4. Gear for propelling the truck along the rails. Our illustration shows a crane of this kind, made by Messrs. Chaplin and Co., of Glasgow. It will lift from 5 to 7 tons, according to the position of the jib. A number of very large steam-cranes with forked maleable-iron jibs have been erected in recent years by Messrs. J. Taylor and Co., of Birkenhead, at several of the great docks in England and Scotland. These will lift a weight of 50 or 60 tons, and are built on a strong and massive stone or brick foundation. They are constructed so as to sweep round an entire circle, but otherwise the jib is fixed.

STEAM-ENGINE. Steam-engines, in their infancy, were known as 'fire' (that is, *heat*) engines; and in point of fact the older term is the more correct, because the water or steam is only used as a convenient medium through which the form of energy which we call heat is made to perform the required mechanical operations. In modern engines, sufficient heat is added to the steam to raise it to a very high pressure and the excess of this pressure over the pressure opposed to it (either atmospheric pressure or the still lower pressure in a condenser) is both the cause and measure of the work done by the engine. In earlier machines, however, the steam was raised only to atmospheric pressure, and admitted into the engine only to be at once condensed by a jet of cold water. The excess of the atmospheric pressure above the pressure in the partial vacuum caused by the condensation was then the direct cause of work. Engines of this kind are not now used; they were called *atmospheric* engines. As a source of power, steam has many advantages over wind and water. It is independent of the weather, may be applied anywhere, affords a constant equable motion, and is capable of indefinite increase. Its invention, therefore, has caused a new era in the arts; and the revolution which it has brought about in industry of all kinds, as well as the influence it has had on civilization in general, and must yet have in a higher degree, are altogether incalculable.

The invention of steam as a moving power is claimed by various nations; but the first extensive employment of it, and most of the improvements made upon the steam-engine, the world indisputably owes to the English and the Americans. It would appear that as early as 1543, a Spanish captain named Blasco de Garay, showed in the harbor of Barcelona a steamboat of his own invention. It is most likely that Blasco's engine was on the principle of the Æolipile of Hero, invented 130 B.C., in which steam produces rotatory motion by issuing from orifices, as water does in Barker's Mill (q. v.). The preacher Mathesius, in his sermon to miners (Nurenberg, 1562), prays for a man who 'raises water by fire and air,' showing the early application of steam-power in Germany; and the German engineer, Sol. de Caus, in the service of the Elector Palatine in Heidelberg, describes, in his work, *Les Raisons des Forces Mouvantes avec Diverses Machines* (Frankf. 1615), a steam-machine, which was merely a contrivance for forcing the water contained in a copper ball through a tube by applying heat. An Italian engineer, G. Branca, invented, in 1629, a sort of steam windmill; the steam being generated in a boiler, was directed by a spout against the flat vanes of a wheel, which was thus set in motion.

In England, among the first notices we have of the idea of employing steam as a propelling force, is that contained in a small volume,* published in 1647, entitled *The Art of Gunnery*, by Nat. Nye, mathematician; in which he proposes to 'charge a piece of ordnance without gunpowder,' by putting water instead of powder, ramming down an air-tight plug of wood, and then the shot, and applying a fire to the breech 'till it burst out suddenly.' But the first successful effort was that of the Marquis of Worcester. In his *Century of Inventions*, the manuscript of which dates from 1655, he describes a steam-apparatus by which he raised a column of water to the height of 40 feet. This, under the name of 'Fire-waterwork,' appears actually to have been at work at Vauxhall in 1656.

Sir Samuel Morland, in 1683, submitted to Louis XIV. a project for raising water by means of steam, accompanying it with ingenious calculations and tables. The first patent for the application of steam-power to various kinds of machines was taken out in 1698 by Captain Savery. In 1699, he exhibited before the Royal Society a working model of his invention. His engines were the first used to any extent in industrial operations; they seem to have been employed for some years in the drainage of mines in Cornwall and Devonshire. The essential improvement in them over the older ones was the use of a boiler separate from the vessel in which the steam did its work. One vessel, in all former engines, had served both purposes. He made use of the condensation of steam in a close vessel to produce a vacuum, and thus raise the water to a certain height, after which the elasticity of steam pressing upon its surface was made to raise it still further in a second vessel.

In all the attempts at pumping-engines hitherto made, including Savery's, the steam acted directly upon the water to be moved without any intervening part. To Dr. Papin, a celebrated Frenchman, is due the idea of the *piston*. It was first used by him in a model constructed in 1690, where the cylinder was still made to do duty also as a boiler; but in an improved steam-pump invented

* The volume is in the possession of Mr. S. Holliday, to whom we are indebted for this fact.

about 1700 he used it as a diaphragm floating on the top of the water in a separate vessel, or cylinder, and the steam, by pressing on the top of it, forced the water out of the cylinder at the other end.

The next great step in advance was made about 1705 in the 'atmospheric' engine, conjointly invented by Newcomen, Cawley, and Savery. This machine held its own for nearly seventy years, and was very largely applied to mines, so that it will be worth while to give a somewhat more detailed description of it than of the others.

In this engine, which is shown in fig. 1, the previous inventions

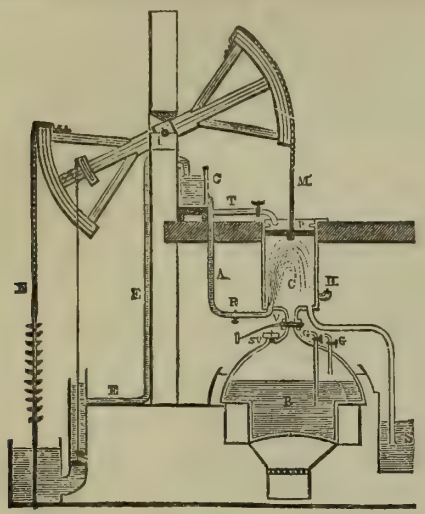


Fig. 1.

of the separate boiler, and of the cylinder with its movable steam-tight piston, are utilized, although in a new form. The 'beam,' which has ever since been used in pumping-engines, was used for the first time, and for the first time also the condensation of the steam was made an instantaneous process, instead of a slow and gradual one. Newcomen's engine was chiefly used, like all former sterm-engines, in raising water. To one end of a beam moving on an axis I, was attached the rod, N, of the pump to be worked; to the other, the rod, M, of a piston P, moving in a cylinder C, below. The cylinder was placed over a boiler B, and was connected with it by a pipe provided with a stop-cock V, to cut off or admit the steam. Suppose the pump-rod depressed, and the piston raised to the top of the cylinder—which was effected by weights suspended at the pump-end of the beam—the steam-cock was then turned to cut off the steam, and a dash of cold water was thrown into the cylinder by turning a cock R, on a water-pipe A, connected with a cistern C'. This condensed the steam in the cylinder, and caused a vacuum below the piston, which was then forced down by the pressure of the atmosphere, bringing with it the end of the beam to which it was attached, and raising the other along with the pump-rod. The cock was then turned to admit fresh steam below the piston, which was raised by the counterpoise; and thus the motion began anew.

The opening and shutting of the cocks was at first performed by an attendant, but subsequently a boy named Humphrey Potter (to save, it is said, the trouble of personal superintendence) devised a system of strings and levers by which the engine was made to work its own valves. In 1717, Henry Beighton, an F.R.S., invented a simpler and more scientific system of 'hand-gear,' which rendered the engine completely *self-acting*. During the latter part of the time that elapsed before Watt's discoveries changed everything, Smeaton brought Newcomen's engine to a very high degree of perfection. As the result of study and experiment, he made many improvements in it, in the form of the boiler, the proportions of the cylinder, &c. It was he, too, who invented the *cataract*, a very ingenious self-acting valve arrangement, which is still universally used in Cornish engines. It is worth mentioning that, in 1725, Leupold invented an engine in which steam of a higher pressure than that of the atmosphere was employed in the cylinder, but his engine possessed defects that prevented its practical use.

The next essential improvements on the steam-engine were those of Watt, which began a new era in the history of steam-power. The first and most important improvement made by Watt was the separate condenser, patented in 1769. He had observed that the jet of cold water thrown into the cylinder to condense the steam, necessarily reduced the temperature of the cylinder so much that a great deal of the steam flowing in at each upward stroke of the piston was condensed before the cylinder got back the heat abstracted from it by the spurt of cold water used for condensing the steam in the cylinder. The loss of steam arising from this was so great, that only about one-fourth of what was admitted into the cylinder was actually available as motive-power. Watt therefore provided a separate vessel in which to condense the steam, and which could be kept constantly in a state of vacuum, without the loss which arose when the cylinder itself was used as a condenser. This device, which now looks simple enough, was the greatest of Watt's inventions, and forms the foundation of his fame. His genius was such that in a few years he changed the steam-engine from a clumsy, wasteful, almost impracticable machine, into a machine practically the same as we now have.

The principal improvements since his time have been either in matters relating to the boiler; in details of construction consequent on our increased facilities, improved machinery, and greater knowledge of the strength of materials; in the enlarged application of his principle of expansive working; or in the application of the steam-engine to the propulsion of carriages and vessels. His principal inventions were: 1. The condensation of steam in a vessel separate from the cylinder, so as to avoid the cooling of the latter; 2. The use of a pump, called an 'air-pump,' to withdraw the condensed water, and mixed steam and air, from the condenser; 3. To surround the cylinder either with a steam-jacket, or with some non-conducting body, in order to prevent radiation of heat (these three, with others, were included in the specification of 1769); 4. To use the steam expansively in the way explained further on in this article (this was invented before 1769, but not published till 1782); and 5. The now universally used double-acting engine, and the conversion of the reciprocating motion of the beam into a rotary motion by means of a crank (both these were invented before 1778, the engine being patented in 1782, but the crank having before that date been pirated and patented by another). In 1784, Watt also patented and published his parallel motion, throttle-valve, governor, and indicator; all four of which are in substance still used.

It would be inconsistent with our limits to enter into any description of the constructive details of steam-engines; we can only afford to give a general notion of the way in which the motion is originated, and to explain the chief principles on which the motive-power and economy of engines depend. We shall consider the latter first, and may say that the article STEAM should be read as an introduction to what follows, as we must assume a familiarity with the statements there made.

The common mode of employing steam in an engine is by causing it to press alternately on the two surfaces of a movable diaphragm or piston enclosed in a fixed, steam-tight, cylindrical box. In fig. 2, A is the piston, and B a section of the box. The

Fig. 2.

piston, by means of a rod E, passing through the end of the box, is made to communicate motion to the rest of the machinery. The steam is first admitted to one end of the cylinder through an opening D, and forces the piston along to the other end. The current of steam from the boiler is then allowed to pass into the other end of the cylinder through the opening C, and forces the piston back again to its original position, and so on. But it is obvious that while this return-motion is going on, the steam previously admitted at D must be allowed some exit, or the piston could not be forced back. The manner of this exit constitutes the difference between the two principal classes of engines, according as the steam is allowed simply to rush out into the atmosphere, or is conducted into a separate vessel, and there 'condensed.'

The simplest way in which steam can be used in a cylinder is at the same time the most wasteful. It consists in filling each end of the cylinder alternately full of steam direct from the boiler, and having the full boiler pressure, and thus forcing the piston along in exactly the same way as that in which it would have to be forced were water the fluid used instead of steam. We have said this is wasteful; let us examine the reasons. If we imagine the cylinder to have a capacity of 7 cubic feet, then if it be filled entirely with steam from the boiler at 60 pounds pressure, it will contain just one pound-weight of steam.* The total heat in this pound of steam, as given in the table, is equivalent to 1171 thermal units.†

* These figures are near approximations only, as will be seen from the table in article STEAM.

† A 'thermal unit' is the quantity of heat necessary to raise, through 1° Fahr., the temperature of a pound of water at its temperature of max density—viz., 39·1 F., and may be considered, without much error, as the quantity of heat necessary to raise a pound of water 1° F., at any place on the thermometric scale.

When the piston A has reached the end of its stroke, the steam contained in the cylinder is thus in itself a great storehouse of work, for each of these thermal units is equivalent to 772 'foot-pounds' of mechanical energy. But instead of utilizing this force, at the moment when the cylinder is full of steam the opening C is put into communication with the boiler, the opening D with the atmosphere, and the steam immediately rushes out of the cylinder, and dissipates its contained energy through the air.

It must be remembered that although the steam, when allowed to go into the atmosphere, is immediately reduced to the pressure corresponding to the temperature of the air (which in ordinary cases would be only a fraction of a pound per square inch), still the full pressure of the atmosphere itself will always be acting on the back of the piston during its stroke; and that therefore, to find the force with which the piston is being pushed along, we must subtract that pressure from the steam pressure. On the one side of the piston will be the atmosphere with its uniform pressure of nearly 15 pounds per square inch, and on the other side the steam pressure of 60 pounds. The effective pressure thus will be 60—15, or 45 pounds per square inch only.

Let us now consider the somewhat more economical case of an engine in which the steam is first used as described above, but afterwards, instead of being allowed to pass into the atmosphere, is conducted through a pipe into a closed vessel, and there condensed. The process commonly called condensation, and associated with the idea of liquefaction, consists in essence merely of the subtraction from steam of a portion of its sensible heat. This reduction of temperature has a double effect on the steam—first, the liquefaction of a part of it; and then, the reduction of the rest to the pressure corresponding to the reduced temperature. (It will be remembered that steam exists at *all* temperatures.) It is not possible to do one of these things without the other, and this fact lies at the bottom of a correct conception of what is called by engineers a 'vacuum.'

What is commonly called 'vacuum' simply means pressure less than the atmospheric pressure; and, in the case of steam-engines, a vacuum generally implies a pressure of between two and four pounds per square inch—that is, from a seventh to a fourth of the ordinary pressure of the air. The most common way of condensing steam is by bringing it into contact either with a jet of cold water, or with surfaces kept continually cool by a current of water. In either case, directly the steam is brought into contact with the water, or cooling surfaces, it transfers to it the larger portion of its sensible heat. During this process, the greater part of the steam is liquefied, and the remainder retains only such a pressure as corresponds to its greatly reduced temperature.

The advantages possessed by a condensing over a non-condensing engine will now be obvious. When the piston is being forced from C to D by steam entering through C, the force on the back of the piston resisting its motion in that direction, instead of being equal to the pressure of the atmosphere, is only the pressure of the steam in the condenser, or about 1 pound per square inch. The net effective force is therefore 60—1, or 59 pounds, instead of 60—15, or 45 pounds. In actual practice, these figures would be modified, because, from various causes, such a low back-pressure as 1 or 15 pounds above zero (in condensing and non-condensing engines respectively) is never obtained, but the principle remains the same.

We have supposed that our cylinder, when full of steam, contained just 1 pound-weight at 60 pounds pressure. Let us now find out how much useful work this pound of steam has done for us, and we will then show how the same weight may be made to do a great deal more, by utilizing more of its great store of heat. Let us suppose that the area of the cylinder is 2 square feet, while its length (the stroke of the piston) is 3½ feet. It will thus have a capacity of 7 cubic feet, as before assumed. In the first case described, we should have a pressure of 45 pounds per square inch exerted on an area of 288 square inches through a distance of 3½ feet. This is equal to 45,360 foot-pounds of work. In the second case, we have a pressure of 59 pounds per square inch on the same area, and through the same distance. This is equal to 59,472 foot-pounds of work, or about $\frac{1}{13}$th of the total heat supplied by the fuel.* We may now proceed to examine the way in which the same weight of steam, generated by the consumption of an identical weight of fuel, may be made to perform many times more work by 'working expansively.'

One of the properties possessed by steam, in common with all other gases, is a tendency to expand indefinitely. In article STEAM we mentioned and illustrated the fact that its pressure varied nearly inversely as its volume. For simplicity's sake we shall here assume that steam is a perfect gas, and follows Boyle's law, the pressure varying *exactly* inversely as the volume. We shall now describe the way in which this expansibility of steam is taken advantage of by the engineer. If we have a cylinder of the same area as before, but of twice the length, but only intended to admit one pound of steam into it at a time, it will be necessary, when the piston has traveled 3½ feet of its stroke, to shut the entrance valve, so as to prevent more steam entering; this is called 'cutting off' the steam.

The piston, however, still continues its motion in the same direction as before, propelled by the internal separative energy among the particles of steam. But as it is pressed forward, the space occupied by the steam is always increasing, and its pressure always decreasing in proportion, until at length, when the piston has reached the end of its stroke, the steam occupies exactly double its original volume—namely, 14 cubic feet, and is reduced in pressure to half its original pressure—namely, to 30 pounds per square inch. We have thus during the first half of the stroke a constant pressure on the piston of 60 pounds per square inch, and during the second half a pressure gradually decreasing from 60 to 30 pounds. The *mean* pressure during this second half of the stroke will be found on calculation to be almost exactly 40 pounds. Let us now, in the same way as before, see what work we have been able to get out of our pound of steam by expanding it in this way. In the first half of the stroke we have 59,472 foot-pounds of work exactly as before, and then we have in addition a mean pressure of 40—1, or 39 pounds per square inch, exerted over 288 square inches for a distance of 3½ feet. This equals 39,312 foot-pounds, making a total of 98,784 foot-pounds of work obtained from the steam which only gave us 59,472 before. The economy of working expansively, however, goes much further than this. If the cylinder had been four times its original length, and the steam had been cut off at the same point as before (which would then be quarter instead of half stroke), we should have obtained from the 1 pound of steam 144,345 foot-pounds of work. If we had gone still further, and expanded the pound of steam into eight times its original volume, we should have obtained no less than 179,984 foot-pounds of work, which is more than three times as much as at first.* All modern engines are worked more or less on this principle of expansion, and the general tendency seems to be every year to adopt higher initial pressures, and larger ratios of expansion.

Having thus briefly sketched the history of the steam-engine, and the theory of its action, we may now proceed to some consideration of its mechanism. Fig. 3 represents Watt's 'double-

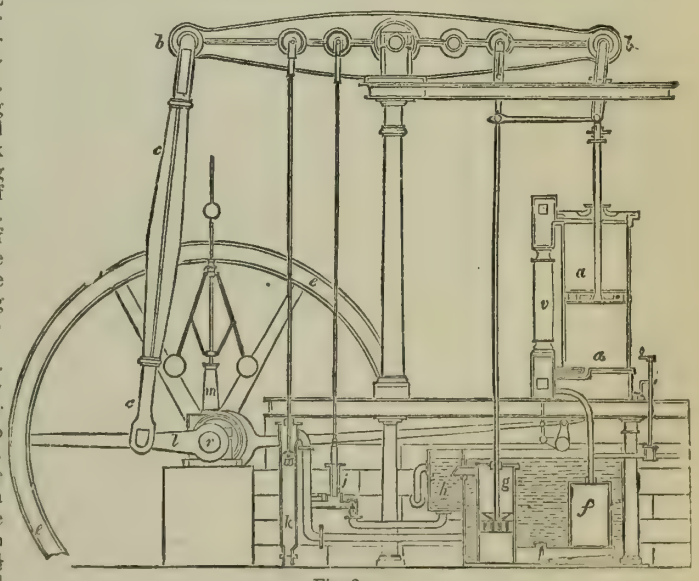


Fig. 3.

acting' condensing engine, which we have already mentioned. By 'double-acting engine' we mean an engine such as was sketched in fig. 2, in which the steam acts on both sides of the piston instead of only on one, as in Newcomen's engine. Watt's engine, though not of the form now generally used, contains all the parts now considered essential; and we may therefore describe it before saying anything about these parts in detail. The steam from the boiler passes direct to the valve-chest *v*, which is simply a long box attached to the cylinder *a*. In this chest are placed valves, which are so regulated as to open communication between the boiler, cylinder and condenser, in such a way that when the top of the cylinder is open to the boiler, the bottom communicates with the condenser, and *vice versâ*. When the steam has done its work, it passes out through the bent pipe into the condenser *f*, where it is met by a jet of water (not shown in the engraving), and

* For simplicity's sake, we have here assumed that the water in the boiler has to be raised from 32° to 292°, and evaporated at that temperature. If the water were supplied at 212°, then the work done would be about one-thirteenth instead of one-fifteenth of the total heat.

* In actual working, owing to various causes—such as imperfect action of the valves, radiation from the cylinder, bad vacuum &c.—the work obtained from the steam is not more than ·65 to ·75 of that given in this paragraph.

condensed as before explained. *g* is a pump called the air-pump, which continually draws away the contents of the condenser, and discharges them into a cistern *h*, called the hot-well. A small force-pump *j*, draws part of the water from this cistern, and sends it back again to the boiler, there to be reconverted into steam, while the rest of the water is allowed to run to waste. A suction-pump *k*, supplies water to the large tank round the condenser, and also for the condensing jet. Inside the cylinder are the piston and the rod (called the piston-rod) connecting it with the beam *bb*.

In Newcomen's engine, the rod had only to pull the beam down, and not to push it up; it could, therefore, be connected to it by a chain, as shown in fig. 1. In the double-acting engine, the piston-rod is required both to pull and to push the beam, so that the chain is no longer admissible. It is obvious that as the head of the rod must move in a straight line, while every point in the beam describes an arc of a circle, the two cannot be rigidly connected. Watt invented the arrangement of rods shown in fig. 3, by which the piston-rod head is always guided in a straight line, while the end of the beam is left free to pursue its own course. This is called a 'parallel motion.' The end of the beam furthest from the cylinder is connected by a rod *cc*, called a connecting-rod, to the crank *l*, which is firmly fixed on the shaft; and by this means the reciprocating motion of the beam is converted into the rotary motion of the 'crank-shaft' *r*. The governor *m*, and the fly-wheel *ee*, will be explained further on.

The *cylinder* and its *piston* are both made of cast-iron. The former is very accurately bored in a lathe, and ought always to be covered outside with non-conducting-material to prevent radiation of heat. It is frequently enclosed in another cylinder, and the annular space, or 'jacket' between them filled with steam from the boiler, principally with the object of preventing liquefaction in the cylinder, which is fatal to economical working. The openings for the entrance or discharge of the steam (*c* and *d* in fig 2) are called *ports*.

The *valve* or valves which regulate the admission of steam to the cylinder vary very much in construction and design. In ordinary engines one valve, called a *slide-valve*, does the whole work for each cylinder in a way which we shall explain by the aid of fig. 4. This figure shows the valve in two positions—namely, those corresponding to the times when the piston is at the middle of its stroke, going in the two different directions—*c* and *d* are the ports, the ends of which are denoted by the same letters in fig. 2; *b* is the 'exhaust port,' or opening through which the steam passes to the condenser; and *a* is the slide-valve working inside the steam chest (not shown). The sketch to the left shows the position of the valve when the piston is moving upwards. The steam enters the cylinder through *d*, as shown by the arrows, while the steam in the other end is free to rush out by *c*, under the valve, and through *b* into the condenser. By the time the piston has reached the same position, going in the opposite direction, the valve is in the position shown in the right-hand sketch, and the motion of the steam is exactly reversed. When it is desired to 'cut off' the steam earlier than half-stroke, a separate valve, called an *expansion valve* (of which there are innumerable varieties) is generally used. The rod to which the piston is attached is called the *piston-rod*, and the rod which actually drives the crank the *connecting-rod*. In Watt's engine, and similar machines, these are connected to opposite ends of a *beam*, but in the common type of engine shown in fig. 6 (below) the two rods are directly attached.

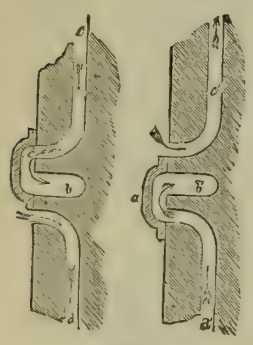


Fig. 4.

The *fly-wheel* is a large wheel fixed on the crank shaft, and having a very heavy rim. As it revolves, this contains, *stored up* in itself, a great quantity of energy, and so equalizes the motion of the shaft, and, by *restoring* some of the energy, enables the engine to pass the 'dead-points,' or points at which the connecting-rod and crank are in a line.

The *condenser* is simply a cast-iron box of any convenient shape. The water for condensing the steam is introduced into it in a jet in such a way that its particles mix with the steam at once on entering, and condense it almost instantaneously.

The *governor*, shown in fig. 5, is an ingenious application by Watt of mechanism long used in water-mills. Its object is to make the engine to a great extent regulate its own speed, so that it shall neither be pulled up altogether by a sudden increase of load, nor 'race' when any part of its load is suddenly removed. It consists essentially of a spindle or upright rod, with a pulley, by which it is caused to revolve, fixed on it. Two levers are pivoted on a pin near the top of the spindle, and at the lower end of each is fixed a heavy cast-iron ball. When the engine is running at its proper speed, the balls revolve with the spindle in the position shown; but if that speed be increased, the centrifugal force causes them to fly outward, and consequently upward; and conversely, if it be decreased, they fall downward towards the center. At the upper end of the spindle is a system of levers, by which it will be seen that the raising of the balls tends to close, and their lowering to open, the *throttle-valve* at the right of the engraving. This valve is simply a disc of metal placed in the steam-pipe near the cylinder. The further, therefore, it is opened, the greater the amount of steam admitted to the cylinder, and *vice versâ*, and so the tendency of the engine to alter its speed arising from causes extraneous to itself, is just balanced by the alteration made in the amount of steam admitted through the throttle-valve. In order that economy as well as regularity of working may be attained, the governor should, however, be so arranged as to control the 'cut-off' instead of throttling the steam as in the figure.

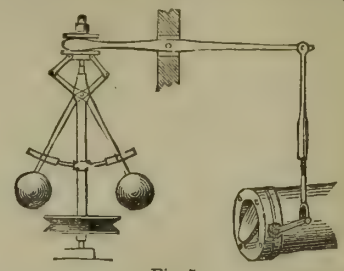


Fig. 5.

The 'Cornish' engine, so called from the fact that it is principally used in the Cornish mines, resembles Watt's engine in general appearance. Like Newcomen's engine, it is used exclusively for pumping, and has no rotary motion, and it is virtually single-acting; but unlike his, the steam pressure, and not that of the atmosphere, actually does the work. It is not easy to say why Cornish engines have remained so long in their original form. They are economical of fuel, owing to the great expansion used, but the same expansion could also be used with many other forms of engine. They are very costly, and extremely heavy and unwieldy, and it seems probable that it is only prejudice which stands in the way of their being superseded by small engines running at high speeds, which would do the same work as economically, and with a much smaller outlay in first cost.

Engines in which the piston-rod and connecting-rod are directly attached are called *direct-acting engines*, of which the horizontal engine, shown in fig. 6, is the most common type, and for all ordinary purposes is rapidly superseding every other form of stationary engine. It possesses the merits of having great simplicity and few working parts, and of all these parts being easily accessible to the engine-driver; and at the same time any required degree of economical working can be obtained in it as well as in any other form. It was for a long time only used as an non-condensing (or so-called 'high-pressure') engine, but is now frequently made with a condenser attached.

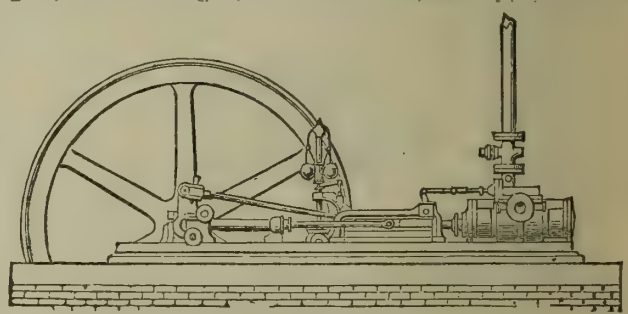


Fig. 6.

Two other forms of direct-acting engines have been much used in their day, but are now being rapidly abandoned except under special circumstances; these are called respectively the 'oscillating' and the 'trunk' engine. In the former (which has rarely been used except for marine engines) the crank-shaft is above the cylinder, the piston-rod head is attached to the crank-pin, and the connecting-rod is dispensed with by allowing the cylinder to oscillate on large hollow centers called *trunnions*, and so to adapt itself to the various positions of the crank-pin. In the 'trunk' engine, the piston-rod becomes a hollow cylinder or *trunk*, large enough to allow the connecting-rod to vibrate inside it. The latter is then attached at one end to the crank-pin as usual, and at the other to a pin fixed in the piston.

An immense amount of ingenuity has been expended in devising engines in which the rotary motion of the shaft is obtained *directly* from the piston without the intervention of reciprocating

parts. These machines are called *rotary* engines; they have never come into general use, and most of them have been defective in construction, as well as founded on a dynamical misconception.

In *locomotive engines*, it is necessary that the whole machinery should be compressed into the smallest possible bulk, and this necessity is the cause of their principal peculiarities. The engine itself is much the same as an ordinary horizontal engine, and has two cylinders placed side by side near the front of the locomotive. These cylinders are sometimes placed inside the main framing, which runs the whole length of the engine, and sometimes outside it, each plan having certain advantages. Fig. 7 is an

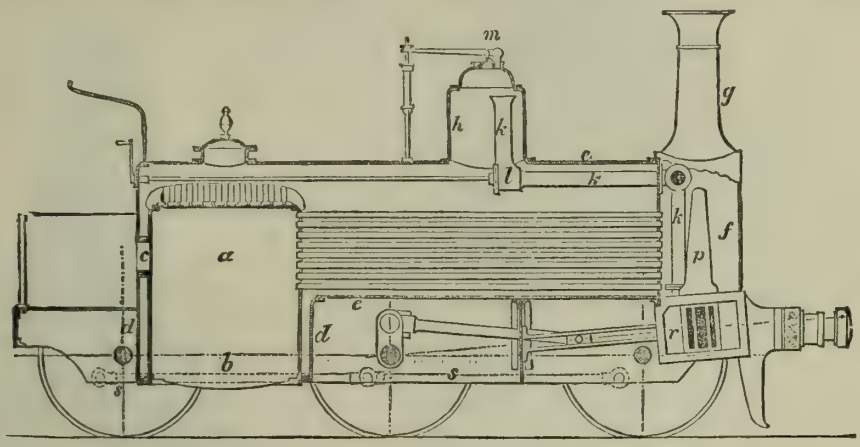


Fig. 7.

outline section of an 'inside cylinder' goods locomotive belonging to the Midland Railway Company. At the back of the locomotive is the fire-box *a*, the bottom of which is formed by the grate *b*. Fuel is introduced by the door *c*. The fire-box is enclosed in a casing *d*, and the space between is filled with water. This space communicates freely with the barrel *e e* of the boiler, a long wrought-iron cylinder. From the back of the fire-box numerous small tubes traverse the boiler (through the water) to the smoke-box *f*, and conduct the products of combustion to the chimney *g*. The steam-pipe *k* is led away from near the top of the dome *h*, and fitted with a regulator valve *l*. At *m* are a pair of spring safety-valves. Both cylinders discharge their steam through the vertical blast pipe *p*, and by this means a sufficient draught is caused, notwithstanding the small height of the chimney. The cylinders *r* are placed in the bottom of the smoke-box, and partly enclosed in it.

In all *marine engines*, except the very smallest, two cylinders are used, working cranks at right angles to each other, so as to equalize the motion as far as possible, it being almost impossible to use a fly-wheel of sufficient weight for that purpose on board ship. In vessels of war, where it is essential that all the machinery should be kept below the water-line, horizontal engines are used, often of the 'trunk' type. In merchant vessels, however, and in all cases where there is no necessity for the machinery being kept low down in the ship, the form known as the 'steam-hammer' engine, or some modification of it, is now almost universally adopted. These engines derive their name from their resemblance (in their earlier designs) to Mr. Nasmyth's steam-hammer, the form of which seems to have suggested their arrangement. They are direct acting, but the cylinders are inverted, and placed right above the propeller shaft.

The two greatest improvements in the modern steam-engine—the *surface condenser* and the *compound engine*—have been brought to perfection chiefly in connection with marine engines, and we may therefore mention them here. In the surface condenser, the steam is condensed by contact with the surface of a great number of small tubes, through which a current of cold sea water is kept constantly flowing. By this means the condensing water and the condensed are kept separate, the former being returned to the sea, and the latter only sent into the hot-well. The boiler, therefore, is continually fed with distilled water, and the wasteful process of 'blowing-off,' to get rid of the unvaporizable matter which would otherwise be deposited in the boiler, is rendered unnecessary.

In 'compound' engines, the two cylinders are of unequal size—the larger, called the low-pressure cylinder, having from three to four times the capacity of the smaller or high-pressure cylinder. The steam from the boiler is admitted into the latter in the usual way, and cut off generally at from ⅓ to ½ of the stroke; and after doing its work there, it is conducted to the large cylinder, where its reduced pressure, by acting on an increased area, does as much work as in the other cylinder, and thence to the condenser. This system of engine has several notable advantages—among which are that the internal stresses are more uniform than in ordinary engines; that leakage past the piston becomes of less importance; and that for any given *large* measure of expansion, the mechanism of the engine is much more simple and less liable to get out of order than for the same degree of expansion carried out independently in two cylinders.

The Work done by Steam-engines.—This is estimated in two ways—as *horse-power*, and as *duty*, and the first expression includes two things—nominal and indicated horse-power. Thirty-three thousand foot-pounds of work done per minute is called one horse-power, this being considered by Watt as the maximum force which a strong horse could exert. The *nominal* horse-power of an engine has long ceased to be any expression of the actual power it exerts; it is only used as a kind of commercial standard (a very deficient one) for the sale and purchase of engines, and is generally made to depend entirely on the diameter of the cylinder.

The indicated horse-power is the most useful measure we have of the work done by an engine. It expresses, however, the total work done by the steam on the piston, and does not show at all what proportion of that work has to be expended in overcoming the friction of the engine itself. It is ascertained by the use of a little machine called an 'indicator,' devised by Watt, and since his time greatly improved, especially by Mr. Richards.

By taking the *mean* pressure per square inch on the piston throughout the stroke (deduced from the indicator card), and multiplying it by the area of the piston, and by the number of feet passed through by it in a minute, we should find the number of foot-pounds of work done by the engine per minute; and this, divided by 33,000, would give the indicated horse-power.

'Duty' is a measure of power used only for pumping-engines, and differs from horse-power in being entirely independent of time. It is the number of foot-pounds of nett work resulting from the consumption of a given quantity of coal, usually either a bushel of 94 lbs. or a hundredweight. At the beginning of this century, the maximum duty that had been attained by any Cornish engine was 20 millions of foot-pounds per cwt. of coal, but six times that duty has since been occasionally obtained. In these engines, it is the actual nett work done which is taken into account; the duty would be 20 or 25 per cent. greater if the total load on the steam-piston had been considered instead.

For engines whose power can only be measured by the indicator, the standard of economy is the number of pounds of fuel used per hour per indicated horse-power. In factories where 'dross' is used as fuel, with horizontal engines and Cornish boilers, and where no means are taken to insure economy, we have known 15 to 20 pounds of fuel burned per indicated horse-power per hour. In marine engines and other cases where the best coal only is used, and where high pressures, surface condensation, and compound cylinders are employed, the consumption of fuel is often as low as 2 pounds.

The theory of a 'perfect heat-engine,' which should return in mechanical work (see FORCE) the greatest possible amount of the heat supplied to it, is considered under THERMODYNAMICS. For other points, see articles BOILER, SAFETY VALVE, and SCREW PROPELLER, as well as STEAM; and STEAM-ENGINE and MARITIME CONVEYANCE in *Information for the People*. See also, for theory, Rankine's *Steam-Engine* and Cotterill's *Notes on the Theory of the Steam-Engine;* for history, Galloway's *The Steam-Engine and its Inventors* (1881).

STEAM-HAMMER, THE, has doubtlessly contributed more than any other mechanical invention of modern times in developing the

wonderful resources of the iron trade. The first idea of a steam-hammer appears to belong to James Watt, the great father of engineers, and was patented by him in 1784. In 1806, a William Deverell, described as 'an engineer of Surrey,' also took out a patent for a steam-hammer; but in neither case does it appear that steam-hammers were actually constructed, though in both specifications a direct acting steam-hammer is, so to speak, sketched in words. From this time till 1839, the idea seems to have been entirely lost sight of, when it was again taken up by Mr. James Nasmyth, of the Bridgewater Foundry, near Manchester, as the result of an application made to him by Mr. Humphreys, engineer to the Great Western Steamship Co., who had been unable to induce any forge-master to undertake the forgings required for the paddle-shafts of the *Great Britain* steam-ship, then in course of construction. Mr. Nasmyth sent a sketch of his hammer plan to Mr. Humphreys, who, along with Mr. Brunel and others, heartily approved of the scheme, but in consequence of an alteration in the arrangements, the paddle-shaft was not required, and the hammer was not then constructed. The scheme was offered to many of the large forge-masters and engineers; but they failed to duly appreciate its value and importance, and the hammer remained a mere sketch in Mr. Nasmyth's 'scheme-book' till 1842. In the spring of that year Mr. Nasmyth, much to his surprise, saw at Creuzot in France a steam-hammer which had been made from a copy of his own rough sketch, and in the following June he secured a patent for it in England.

The first English steam-hammer, in accordance with his plan, was made at the Bridgewater Foundry early in 1843; but although considered as an improvement upon the old 'helves' hitherto used for forging purposes, it was far from being a perfect tool. See fig. 1. The hammer was worked by means of an

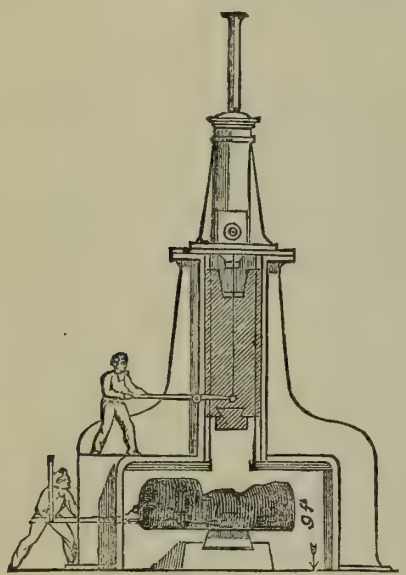


Fig. 1.

ordinary slide-valve and a long lever, requiring great labor and constant attention in order to give the blow required; thus some other contrivance was necessary, to secure complete command over the power of the blow, and in order that, the instant the blow was struck, the block should immediately rise again, so that the heat in the mass of iron on the anvil might not be reduced by the cold face of the block. The peculiar difficulty of securing a true automatic arrangement will be seen when it is considered that the instant of percussion must vary with almost every blow that is struck; for the piece on the anvil becomes thinner and thinner by each succeeding blow, and in flat bars, a blow is first given on the flat side, and then on the edge, the difference in the fall of the hammer in the two cases being oftentimes several inches; and further, that the hammer must be under perfect control at all times.

Mr. Nasmyth, after many and protracted trials, failed to produce the motion required, and, as a consequence, the whole hammer scheme was on the point of being abandoned. In this dilemma, and during Mr. Nasmyth's absence from the works, his partner, Mr. Gaskell, applied to their engineering manager, Mr. Robert Wilson, who afterwards became managing partner and successor to Mr. Nasmyth, to endeavor to solve the problem which had hitherto baffled the skill of Mr. Nasmyth. Mr. Wilson took the matter in hand, and in little more than a week, a motion was invented and attached to a hammer upon which former experiments had been made, and was at once found to answer most admirably every condition required. Under the influence of this very beautiful mechanical motion every variety of blow could be given, from the gentlest tap to the heaviest blow within the compass of the hammer, and that, too, perfectly self-acting in every respect, the long lever and the hard work before referred to being now entirely banished. By simply altering the position of the tappet lever by means of two screws, a blow of the exact force required could be produced and continued so long as steam was supplied. So completely was the hammer now under control, that it became a favorite amusement to place a wine-glass containing an egg upon the anvil, and let the block descend upon it with its quick motion; and so nice was its adjustment, and so delicate its mechanism, that the great block, weighing perhaps several tons, could be heard playing tap, tap, upon the egg without even cracking the shell, when, at a signal to the man in charge, down would come the great mass, and the egg and glass would be apparently, as Walter Savage Landor has it, 'blasted into space.'

On the 18th August 1843, the first hammer made like fig. 2 was

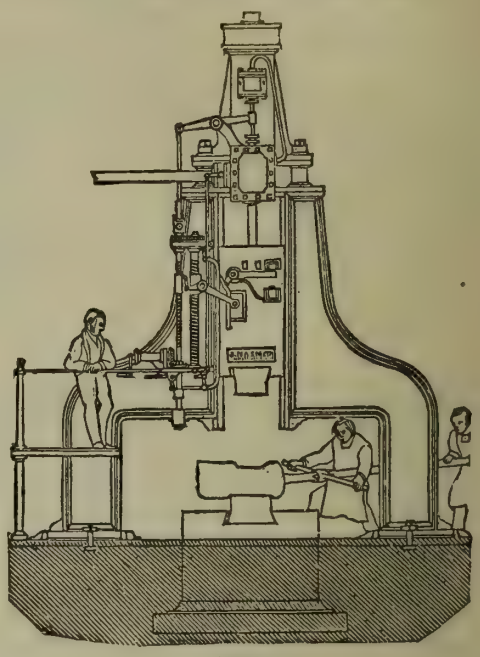


Fig. 2.

delivered to Messrs. Hird, Dawson, and Hardy of the Low Moor Iron-works, near Bradford, Yorkshire, and gave such satisfaction, that orders for this remarkable tool began to flow in from all parts of the country. The hammer remained in this condition, with the exception of a few minor details, from 1843 to 1853, when Mr. Wilson (who in the interim had removed to the Low Moor Iron-works) invented, patented, and applied to the hammers at Low Moor and elsewhere what is called the 'circular balanced valve.' The *Practical Mechanic's Journal* for 1855, vol. viii., p. 174, in an article on this invention, says: 'The wonders of Mr. Nasmyth's invention, the steam-hammer, have just received new lustre at the hands of Mr. Wilson, to whom belongs a large portion of the credit attaching to the early practical development of the beautiful automatic action of this invaluable tool. The special feature which Mr. Wilson has introduced is his balanced-pressure cylindrical valve, several modifications of which we noticed in our pages of June and July last year. Hammers divested of all self-acting apparatus whatever, and fitted merely with a hand-geared valve of this kind, exhibit an immensely improved action, enabling the workman to obtain the exact kind of blow he wants under all circumstances.

In July 1856, Mr. Wilson returned to the Bridgewater Foundry as managing partner in the firm of James Nasmyth and Company, and in September following obtained a patent for a *balanced slide-valve*, and at once arranged to apply his invention, which arrangement continues in operation to the present time. His balanced side-valve, by a most ingenious arrangement, allows the valve, as it were, to float in an atmosphere of steam pressing equally upon it on every side, entirely doing away with all superincumbent pressure upon the *valve*, no matter what the pressure in the *boiler* may be. Hammers are now made of such a size, that, if the valve were not balanced, a small steam-engine would be required to move it.

In June 1861, Mr. Wilson patented and introduced another very important improvement, popularly known as the *double-acting hand-gear motion*. By this arrangement, the steam is admitted as before to *raise* the piston, and when it has attained the required elevation, and at the very moment when about to descend, by

slightly increasing the travel of the hand-lever (more than when working single-acting), the steam is admitted into the cylinder *above* the piston, which accelerates and increases the intensity of the falling blow and the consequent capacity of the hammer; so much so, that that which had hitherto been described as a 5-*ton* hammer is by this double-action arrangement increased to at least a 12½ or 15 ton one.

In 1862, Mr. Wilson designed and constructed a small hammer suitable for tilting steel, fitted with the balance-valve, double acting, and with an entirely new self-acting motion (much less complicated than the original one), capable of striking *five hundred* blows per minute.

Fig. 3 shows the form of the more modern and simplified steam-

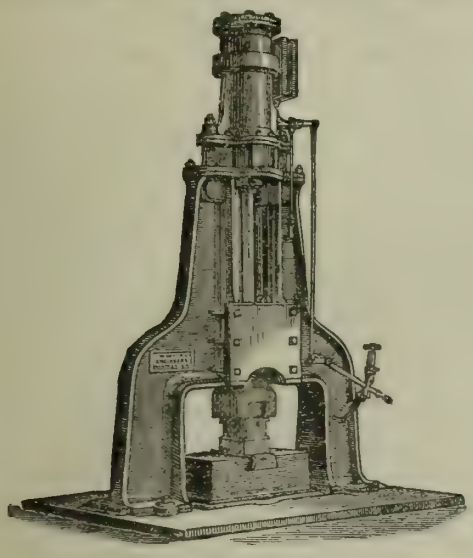


Fig. 3.

hammer. Several 50-ton hammers, made double-acting in the way above-mentioned, so as to be equal to a 100-ton single-acting one, are in operation in large iron-works.

In the Nasmyth hammer, the steam cylinder is fixed, and the large hammer head is attached to a comparatively small piston-rod. But in another type of hammer (Rigby's patent), which has been made in large numbers, the piston-rod itself, with only a slight enlargement at the striking end, forms the actual hammer. This form requires no 'guides' below a short casing under the steam cylinder and as it is chiefly used for small hammers, supported by a single standard, it gives plenty of room for workmen to forge with it. Condie's steam-hammer—perhaps the earliest modification of Nasmyth's—is so planned that the steam cylinder itself moves, and with the simple addition of a face piece, forms the hammer. This form seems to have fallen greatly out of use. Of late years, duplex steam-hammers have been used. In these there is no anvil, but two opposing horizontal hammer heads deliver blows of equal force on opposite sides of the forging.

STEAM-NAVIGATION. When once steam was known as a moving power, its application to navigation was obvious enough; it was even to this purpose that the first attempt was made to apply it at all—that of Blasco de Garay—namely, in the harbor of Barcelona in 1543. See STEAM-ENGINE. The only surprising thing is, that thirty years should have elapsed—between 1777, when the steam-engine had become in Watt's hands an efficient power for other purposes, and 1807, the date of Fulton's first voyage—before a really serviceable steam-vessel was produced. The connecting link seems to be the use of revolving-paddles instead of oars. Wheel-boats propelled by oxen, horses, or men were known to the Romans, and were used for ferry-boats in modern times. Some experiments with this mode of propulsion made by Mr. Miller of Edinburgh, suggested to his friend Mr. Taylor the application of steam as the moving power, and led to the most decided step in the discovery of steam-navigation previous to the final success of Fulton.

As early as 1736, Jonathan Hulls had taken out a patent for a tow-boat to be propelled by a paddle-wheel set in motion by a sort of steam-engine. The project appears never to have been executed. Besides some experiments on the Seine by Comte d'Auxiron in 1774, and Perier in 1775, the Marquis de Jouffroy constructed a steamboat of considerable size in 1782, which navigated the Saône for some time; it was deficient, however, in power. In America experiments began to be made about 1783, by Fitch and Rumsey. Fitch launched a paddle steamboat in 1788, which moved at the rate of four miles an hour; but before proceeding far the boiler burst. Rumsey proposed to propel the vessel by making a stream of water issue with force from the stern; his attempt failed.

The next important experiment was the one above alluded to, by Messrs. Miller and Taylor. It took place on a small lake on Mr. Miller's estate of Dalswinton in Dumfriesshire. A small engine having four-inch cylinders of brass was prepared, under the superintendence of Mr. Taylor, tutor in Mr. Miller's family, and Mr. Symington, an ingenious mechanic, and fitted on board a double-boat, with a paddle-wheel in the interspace. The trial took place amid a concourse of hundreds on October 14, 1788, and with perfect success. Next year Mr. Miller had larger engines fitted into a vessel, and tried on the Forth and Clyde Canal, when the vessel moved at the rate of seven miles an hour. Partly from caprice, partly from derangement of his affairs, Mr. Miller was diverted from pursuing the matter farther. But in 1801, Mr. Symington took out a patent for the construction of steamboats, and in 1803 built the *Charlotte Dundas*, to tow vessels on the Forth and Clyde Canal. The success seems to have been complete, excepting in one respect, that the agitation of the water by the paddles was found to wash down the banks in an alarming manner. The use of the vessel was therefore given up, and it lay at *Lock Sixteen* for many years.

In the meantime, attempts had been making at steam-navigation in America by Stevens, Livingston, and others. Robert Fulton, another American, had thought of steam as a motive-power for vessels, as early as 1793. Traveling into Scotland he visited the unfortunate *Charlotte Dundas*, and obtained drawings of the machinery. Returning to America with one of Boulton and Watt's engines of 20 horse-power, he, in conjunction with Livingston, built a vessel called the *Clermont*, at New York, and in 1807 made the first really successful voyage by steam from New York to Albany, up the Hudson. The vessel sailed 110 miles in 24 hours, against stream and wind. Fulton has thus indisputably the honor of having first proved the practical utility of steam-navigation. Yet nothing but perseverance seems to have been wanting to crown the experiments of Miller, Taylor, and Symington with equal success. Four years later, 1811, Henry Bell of Glasgow, who had witnessed the experiments on the Canal in 1789, and had accompanied Fulton on his visit to the *Charlotte Dundas*, started a steamboat, the *Comet*, on the Clyde, and was thus the father of steam-navigation in Britain.

In 1815, a steamboat made a passage from Glasgow to London, and in 1818, one plied from New York to New Orleans; it was not till 1820 that steam-packets were established between Holyhead and Dublin. 1838 was a memorable year in the history of steam-navigation. The steamer *Sirius* sailed from Cork on the 4th of April, the *Great Western* from Bristol on the 8th of the same month; both arrived at New York on the 23d, the *Sirius* being only twelve or fifteen hours before the other. The passage is now often made from Queenstown to New York in six or seven days. The opening of the Suez Canal greatly promoted swift steam-communication with India, China, and the East, and Australia. Since 1880, some of the Orient line of steamers do the passage from Plymouth to Australia in from 30 to 35 steaming days. Steam-vessels are now to be found on all seas and lakes and navigable streams. War-steamers have taken the place of the old ships of the line; and except for the transport of heavy goods to long distances, steam bids fair to supersede the use of sails. The maximum speed yet attained by steam-vessels is 20 miles an hour; the ordinary rate 8—15 miles.

The steam-engine employed to propel a vessel does not differ essentially from any other; but some modifications are necessary to suit the special circumstances under which they work. In ships of war, the cylinders are generally placed horizontally, and the whole machinery kept below the level of the water-line; in merchant-vessels, vertical engines are more commonly used, with the cylinders inverted, placed right above the propeller-shaft. For working paddle-wheels, oscillating engines were, on the whole, the most common. See STEAM-ENGINE; PADDLE-WHEEL; SCREW-PROPELLER.*

* The application of the screw to the propulsion of vessels is well known to have been tried at least before the middle of the 18th century. In the *Traité de Navire* by Bouguer (Paris, 1746), it is stated that 'revolving arms like the vanes of a windmill were tried for the propulsion of vessels.' In 1751, Daniel Bernouilli, the famous mathematician, in his *Recueil d'Ouvrages Curieux*, describes and gives drawings of the screw-propeller. In 1770, James Watt mentions a screw propeller in a letter to Dr. Small, who replies that he had tried it. In 1776, D. Bushnell, an American, in an account of a submarine vessel, describes a screw-propeller for moving it. In 1804, J. Stevens tried at New York a vessel fitted with a screw propeller driven by a steam-engine made by Boulton and Watt. This appears to be the first attempt at propulsion by the screw with steam as a moving power. Colonel Beaufoy has described a spiral oar or screw-propeller, with two spiral rims fixed on arms, which he had seen used in China about the year 1780. In the present century, hundreds of patents have been taken out for screw-propellers; but costly experience has contributed more to the present perfection of the screw than any recent 'inventions.' The name most widely known in connection with the introduction of the screw-propeller is that of Mr. (afterwards Sir) Francis Pettit Smith, a farmer near London, who took out a patent in May, 1836, for a screw-propeller. This gentleman who was by no means the first who tried to get the screw into use, was fortunate enough to obtain the assistance of influential capitalists, and after various trials on a small scale, he fitted up the *Archimedes*, a regular sea going vessel. The complete success of this the first real trial on a large scale, gave to Mr. Smith a position

STEA'RIC ACID AND STE'ARIN. The composition of stearic acid is represented by the formula $C_{36}H_{36}O_3.HO$; this acid being one of the solid fatty acids represented by the general formula $C_nH_{n-1}O_3.HO$. It exists as a glyceride (stearin) in most fats, and is especially abundant in the more solid kinds, such as mutton-suet. It is readily obtained by saponifying suet, and decomposing the hot solution of the soap by tartaric acid. The oily acids which are thus liberated are compressed between hot plates, by which means most of the Oleic Acid (q. v.) which is present is expelled. The solid residue is then to be repeatedly crystallized from alcohol, and afterwards from ether till the fusing-point becomes constant at 159°. If the final solution is allowed to cool slowly, the acid is deposited in beautiful, colorless transparent rhombic plates. After fusion, it cools into a wax-like, glistening, crystalline mass, devoid of taste or smell. It is insoluble in water, on which it floats, but dissolves in alcohol and ether, its solution reddening litmus powerfully. When heated above its fusing-point, it becomes decomposed into palmitic acid ($C_{32}H_{31}O_3$,-HO), palmiton ($C_{62}H_{62}O_2$), and an oily hydro-carbon. Stearic acid forms both normal and acid salts. The only normal stearates which are soluble in water are the stearates of the alkalies, whose solutions are frothy and form a lather, but on the addition of an excess of water, separate into an acid salt which is deposited in silky crystalline plates, and the free alkali which remains in solution. The stearates of the alkalies are also soluble in alcohol.

Chloride of sodium (common salt) has the property of separating the alkaline stearates from their solution. The stearates of the alkalies are the principal constituents of the different kinds of soap. The other stearates are insoluble. Stearate of lead, which is one of the constituents of lead-plaster, is readily formed by mixing solutions of stearate of soda and acetate of lead, when the stearate of lead falls as a heavy amorphous precipitate, sparingly soluble in alcohol or ether, but dissolving freely in oil of turpentine.

The *Bassic Acid* extracted from the oil of the seeds of *Bassia latifolia*, a tree growing in the Himalaya, and the *Stearophanic Acid* obtained from the berries of *Monospermum Cocculus*, are identical with stearic acid.

The use of stearic acid in the manufacture of candles is described under the head CANDLE. See also OILS.

STEARO'PTEN. See OILS.

STE'ATITE, or SOAP-STONE, a mineral principally composed of silica and magnesia, with more or less alumina and water. It is found massive, or sometimes assuming the forms of the crystals of other minerals which it has replaced. It is plentiful in many parts of the world, and is found in various parts of Britain. It is generally white, reddish white, or yellow. It is soft and greasy to the touch, easily cut, but broken with difficulty. It is used in the manufacture of porcelain. It writes readily on glass, and is used by glaziers for marking plates of glass before they are cut with the diamond. Tailors use it for marking cloth before they cut it. It is also used by shoemakers, to give unctuosity to the heels of stockings, that new boots may more easily be tried on. It is sold for such purposes under the names of Briançon Chalk, French Chalk, and Venice Talc. It readily absorbs oil or grease, and is used in powder for extracting spots of them from silken and woolen stuffs. It is the basis of Rouge (q. v.). It is used for imitating engraved stones, being easily cut, and afterwards hardened by heat; after which, it may be colored by metallic solutions.

The *Agalmatolite* or *Figure-stone* of China is a kind of S., containing a little potash. Exquisite specimens of Chinese workmanship in this material are now familiar to every one. The earth eaten by the savages of the banks of the Orinoco and of New Caledonia is a kind of soft steatite.

STEELL, SIR JOHN, R. S. A., an eminent Scottish sculptor, the son of a carver and gilder in Edinburgh, was born at Aberdeen in 1804. He received his education as an artist at the Edinburgh Academy, and afterwards at Rome. On returning thence in 1830, he executed a colossal group of 'Alexander and Bucephalus,' which was instantly recognized as a work of great merit. The promise of this early work he has since amply fulfilled; and is now admitted to stand in the front rank of his profession. His chief works are in Edinburgh: the colossal figure of the Queen crowning the front of the Royal Institution, which procured him the honorary appointment of Sculptor to Her Majesty in Scotland; the statue of Scott in the Scott monument, a commission which was won in competition; the equestrian statue of the Duke of Wellington (1852); statues of Professor Wilson and Allan Ramsay (1865); and the equestrian statue of Prince Albert, at the inauguration of which in 1876 S. was knighted.

STEEL. See IRON.

STEELBOW, in Scotch Law, means goods, such as corn, cattle, straw, and implements of husbandry, delivered by the landlord to his tenant, by means of which the latter is enabled to stock and labor the farm, and in consideration of which he becomes bound to return articles equal in quantity and quality at the expiration of the lease.

STEELE, SIR RICHARD, was born in Dublin in the year 1671. His father, who held the office of secretary to the Duke of Ormond, was of an English family, but his mother was Irish; and the son appears to have inherited from her the impulsive ardor, tenderness, bright fancy, and reckless profusion immemorially ascribed to the Irish national character. He was educated at the Charter-house School, along with his illustrious friend Addison, and from thence was removed to Merton College, Oxford. Leaving college without taking a degree, he enlisted in the Horse Guards, for which imprudence he was disinherited by a rich relation of his mother, who had named him as heir to an estate in Wexford. In the army, he rose to the rank of captain, but was gay, thoughtless, and dissipated—always sinning and repenting, as he himself confesses. To impose a check on his irregularities, he wrote a religious treatise, *The Christian Hero*, published in 1701, the design of which was to show that no principles but those of religion are sufficient to make a great man. This public profession of seriousness had little effect on the volatile captain, and he next took to writing comedies.

In 1702, he produced *The Funeral, or Grief à la Mode;* in 1703, *The Tender Husband;* and in 1704, *The Lying Lover*—the last a decided failure. About the same time, he obtained some fortune by marrying a West Indian lady, who survived the marriage only a few months; and in 1706, he got the appointment of Gazetteer, with a salary of £300 per annum, and also the post of Gentleman Usher to Prince George, which added another £100 to his income. In the following year (September 9, 1707), he married a Welsh lady, Mary Scurlock, who figures conspicuously in his correspondence as the 'Dearest Being on Earth,' 'Dear Prue,' and 'Dear Wife,' to whom he addressed some 400 letters—admiring, apologetic, and passionate. A course of extravagance—town and country houses, horses and chariots—soon involved the pair in difficulties. Mrs. Steele had a fortune of £400 a year, and was thrifty; but the lady's mother had a life-interest in the estate, and was hard and uncongenial. Addison gave a loan of £1000 which was repaid within a twelvemonth; but he made other advances, secured by a bond on house and furniture. He put the bond in execution, sold the house and furniture, and remitted the surplus to his imprudent friend. For this seeming harshness, Addison has been blamed; but it rests on good authority that the sufferer himself entertained no such feeling: he regarded the incident as a warning meant to do him service, and he met his friend again with his wonted composure and gaiety.

In 1709, S. commenced *The Tatler*, a periodical published thrice a week, containing short essays on life and manners, town gossip or *tattle*, and articles of foreign and domestic news, for which S.'s appointment of Gazetteer furnished him with peculiar facilities. Addison joined cordially in this publication, and still more effectively in its successor, *The Spectator*, a daily literary journal of a higher tone and character, which was continued with unexampled success through 635 numbers. A third miscellany of the same kind, *The Guardian*, was extended to 175 numbers. S. afterwards attempted other periodicals, as *The Lover*, *The Reader*, &c., but these were short-lived. His fame rests on his essays in the *Tatler*, *Spectator*, and *Guardian*, to which he contributed respectively 188, 240, and 82 papers. In the keen political strife of that venal age, S. fought courageously and honestly for the Hanover succession and Whig principles. He lost his office of Gazetteer, and was expelled the House of Commons, for writing a pamphlet called *The Crisis*, in which he warned the nation that the Protestant cause was in danger. But when Queen Anne died, and the Whigs were again triumphant, S. participated in the royal favor. He obtained an appointment in the king's household, was elected M.P. for Boroughbridge, and received the honor of knighthood.

In 1717, S. was nominated one of the commissioners for the forfeited estates in Scotland, and he seems to have made four annual visits to Edinburgh on the business of this commission. He was led into a controversy with Addison, a few weeks before the death of the latter, on the once-famous Peerage Bill—a proposal by

which he had well earned, not by his invention or improvement of the screw-propeller, but by demonstrating to the world on a large scale its capabilities. Other inventors were before him in point of time, but most of them confined their operations to trials of models, or, at most, to small boats fitted with screws which were driven by hand. Mr. Robert Wilson made and exhibited working models of a vessel propelled by a screw in the years 1821—1825, and for several years afterwards his schemes were before a number of public bodies in Scotland. The successful introduction of a propeller with several separate blades, each forming a small portion of a complete helix (the form now universally used), is claimed for Mr. Lowe, Mr. Henry Wimshurst, and others. Sir Francis Pettit Smith's propeller in the *Archimedes* had one blade forming a complete spiral, a form which was speedily abandoned. In addition to the gentlemen mentioned, Mr. Bennett Woodcroft, Mr. Robert Griffiths, and others, have contributed greatly to the introduction and improvement of the screw-propeller; but as Sir F. P. Smith, aided by his moneyed associates, was the first to put the screw into a big ship, and boldly go to sea in her, the world will continue to give him credit for introducing the screw-propeller into actual use, and sometimes, but with less justice, he will get credit for having invented it.

ministers for restraining the king from any new creation of peers, except upon the extinction of an old family. On this question S. took the side of the crown, and fairly beat his opponent in argument and in temper, besides enjoying the triumph of seeing the bill thrown out. The friends, alas! met no more. The survivor struggled on among controversies, embarrassments, and lawsuits; he was patentee of Drury Lane Theater; and in 1722, he produced his admirable and successful comedy of *The Conscious Lovers*. His health now rapidly failed. His wife had died in 1718, but he had children to solace his decline. The last three years of his life were spent in retirement in Wales, and there his chequered existence came to a close: he died at Llangunnor, near Carmarthen, on the 21st of September 1729.

The essays of S. have eclipsed his dramas. His Bickerstaff, the Spectator Club, allegories, and short tales have the true, ever-living, dramatic spirit. In taste and delicate humor, he was greatly inferior to Addison; but in invention and insight into human character and motives, he was fully his equal. He knew the world better, and he sympathized with almost every phase of life and character except meanness and cruelty. He seems to have considered it to be his special mission to reform the minor vices and absurdities of English society. If his satire had been more keen and trenchant, or his moral lessons more formal and didactic, he could not have succeeded as he did: his essays were just adapted to the times—they insinuated morality and benevolence, and supplied innocent enjoyment mingled with instruction. The lively, natural writer and companion is never lost in the teacher, nor the gay captain of horse wholly absorbed in the author.

STEEL TOYS. This is a manufacturing term much used in Birmingham, London, and elsewhere. It has a somewhat different meaning to that which would at first sight be given to it. Steel toys are small articles, such as cork-screws, buckles, boot-hooks, and a great variety of similar objects, when made of polished steel. Birmingham and Sheffield are the chief seats of this industry, which employs a large number of operatives and considerable capital.

STEE'LYARD. See BALANCE.

STEEN, JAN, a celebrated Dutch painter, was born in 1626, or according to others in 1636, at Leyden, where his father was a brewer. He showed an early predilection for art, which led to his being apprenticed to a German painter, Nicholas Knupfer of Utrecht. Subsequently he became a pupil of Van Goyen, whose daughter Margaret he married. Very soon his repute became established. As he worked, however, in a slow and elaborate manner, his gains were insufficient, and he started a brewery at Delft. This enterprise promised fairly; but, according to tradition, he was by no means of steady business habits, and so bemused himself with his own beer that very soon he brewed no more of it. Little that is certain appears to be known regarding the subsequent life of S., but numerous unauthenticated anecdotes are in vogue, which, if it could be shown that they were true, would prove him to be a wretched drunkard; but a late biographer, Van Westerheene, throws considerable doubt on the accuracy of the popular impression. S. died in 1679 or 1689, leaving his family in very destitute case.

As an artist of the Dutch school he ranks high; and his works are now much valued. In humor and spirit they are scarcely surpassed, and their coloring is clear, fresh, and delicate. At times he attempted historical subjects, but his success in these was not great. It was in homely and domestic scenes that his genius truly exhibited itself; and in this field he has scarcely since been quite equalled.

STEEPLE, the tower and spire, lantern, or other superstructure attached to a church. These are usually of stone, but in some cases are carried up from the floor in massive wooden framing.

STEEPLE-CHASE. This singular term is used to designate a kind of horse-race, run not on a prepared course, but across fields, hedges, ditches, and obstacles of every kind that may happen to be in the way. The name and practice are said to have both originated in a party of unsuccessful fox-hunters, on their return home, agreeing to try a race towards the steeple of a village church, the first who could touch the church with his whip to be the winner. This kind of sport soon became popular; and matches were made and sweepstakes entered into—the requirements of the course being simply two flagstaffs placed about two miles apart, from one of which the competitors started, made their way to the other, and returned to the starting-point. Each rider was allowed to go and come as he chose, but the country was often selected on account of its difficulty; high and strong fences, deep and broad ditches, and sometimes even swollen rivers having to be crossed and recrossed. Then came the more regular steeple-chase of modern times over a course marked out by flags, between which the rider must pass in order to win the race. This improvement was introduced about the end of last century, and no further change took place till 1841, when *handicapping* began. This consists in the weighting of horses according to their supposed merits, without reference to age, size, or sex.

The first handicap steeple-chase was run at Newport-Pagnell on April 20, 1841, and the sport has since become more and more popular in England, most of the spring and autumn meetings having their steeple-chases, for valuable stakes. Great crowds of people always attend, the very danger of the sport seeming to increase its attractiveness. Serious accidents are not unfrequent; and great courage, coolness, resolution, and judgment are requisite on the part of the rider in a steeple-chase.—The name is also applied to similar races for men.

STEE'RAGE, in a vessel, is the lowest class or accommodation for passengers.

STEERING is the act of directing the ship's course by means of the Helm (q. v.). It is bad steering when the ship's head is allowed to oscillate first on one side and then on the other of the course she has to pursue. By such steering the distance to be traversed is increased, and a greater resistance is encountered, the sea being struck more obliquely.

STEIN, HEINRICH FRIEDRICH KARL, BARON VON, one of the greatest statesmen that ever conducted Prussian affairs, belonged to an old Rhenish-Franconian family, and was born at Nassau, October 26, 1757. He studied at Göttingen from 1773 to 1777, entered the service of Prussia in 1778, and in 1784, had risen to be at the head of the department of mines for Westphalia. In 1786, he visited England in company with his friends, the Counts von Redern and Schlahberndorf, and carefully studied the institutions of that country, for which he conceived a high admiration, and sought to introduce them at a later period into Prussia.

After several minor preferments, he was appointed, in 1797, president of the Westphalian chambers, where he displayed rare administrative talent. In October 1804, he entered the Prussian ministry as chief of the department of indirect imposts, taxes, manufactures, and commerce. In this capacity he effected important ameliorations, particularly by abolishing various restrictions on the internal trade of the nation; yet to his great grief and vexation he found himself incapable of modifying the policy that resulted in the French invasion and conquest. Of a thoroughly conservative and religious disposition, full of pious reverence for the past, so far as it possessed vital energy, but strongly opposed to bureaucracy and military despotism; recognizing in the self-governing powers of communities and provinces the only practical guarantee of national liberty, yet, as a baron of the empire, hostile to the anarchic sovereignty of little states, he occupied a political standpoint which procured for him many adversaries and few friends. In 1807, he was dismissed from office by the king, and withdrew to his estate in Nassau; But the peace of Tilsit opened the eyes of his sovereign to the wisdom of S.'s policy, and in less than seven months he was recalled, with the approbation of Napoleon, who had as yet no idea of the deep and earnest patriotism of the minister.

S.'s industry was untiring. Seeing clearly that, in a military point of view, Prussia was powerless for the moment, he set about developing her internal resources by attempting a series of administrative and political reforms, known as *Stein's System*—the principal of which were the abolition of serfage, with indemnification to the territorial lords; the subjection of the nobles to manorial imposts; equality of orders in the sight of the law; the universal obligation of military service; promotion in the state by merit alone, without distinction of caste; and the establishment of a municipal system analogous to that of England. Some of these reforms were carried out by S., and others by his successor, Hardenberg (q. v.). Meanwhile, he had become suspected by Napoleon. Among other things, an intercepted letter was brought to the French emperor, in which his policy was sharply criticised. S. was obliged to resign (November, 1808), and retired to Austria, where he became the center of a secret national society—the *Tugendbund*. Napoleon, who bitterly hated patriots that stood in his way, confiscated his property. In 1812, S. was summoned to Russia by the Emperor Alexander, and contributed by his counsels to prepare the coalition against Napoleon.

After the march of the allies into Saxony, he was appointed president of the council of all the German States; was a leader in all the military diplomacy of that stirring time up to the Congresses of Vienna and Aix-la-Chapelle, in which, however, he took no part, owing to the intrigues of the Bavarian minister, acting for the lesser states of Germany, who knew well that he did not look with a favorable eye on their anarchic autonomy. The absolutists were also against him. S.'s active political career was now finished; henceforth he enjoyed some honorable functions, but no power, and died at Frücht, July 29, 1831.—See Pertz's *Leben des Freiherrn von Stein* (1855); Professor Seeley's *Life and Times of S.* (1879). His correspondence with Humboldt,

Gneisenau, Eichhorn, Niebuhr, &c., is extremely valuable for the political history of the period.

STEI'NBOK. See BOUQUETIN.

STELLA'RIA. See STITCHWORT.

STE'LLERINE (*Rytina*), a genus of *Sirenia*, of the family *Manatidæ* (q. v.), of which only one species is known (*R. gigas*), about 25 feet in length, a native of Behring's Strait, and never observed since the middle of last century, so that it is supposed to be extinct.

STE'LVIO, PASS OF THE (Ger. *Stilfserjoch*), the highest carriage-road in Europe (9176 feet above the sea-level), leads from Bormio, on the Italian side of the Tyrolese Alps, near the head of the Valteline, to Glurns on the Austrian side. It forms part of the great road between Milan and Innsbruck, and was completed by the Austrian Government in 1828, at an expense of 3,000,000 florins. The praise bestowed on it in Murray's *Handbook for Southern Germany* is well deserved: 'Whether we consider the boldness of the design, the difficulties of its execution, from the great height and exposure to storms and avalanches, or the grandeur of the scenery through which it passes, the route of the Stelvio is the most remarkable in Europe.'

STEM, in Botany, that part of the plant which, arising from the surface of the ground, and shooting upwards as the root shoots downwards, bears the leaves and flowers. Stems are either simple or branched. They are herbaceous or woody, solid or hollow, jointed or unjointed. Sometimes they are weak so as to be procumbent, although more generally firm and erect; sometimes weak stems are twining, or they are upheld in various other ways by the climbing habit of the plant. Stems are generally round, but sometimes compressed or angular. The arrangement of the leaves and branches, in reference to the stem, is symmetrical, but plants differ from each other in the nature of this arrangement. In the branching of trees, the symmetrical arrangement is often lost, as to the principal branches, in consequence of the death of some of them. In many plants the stem is obsolete, or so abbreviated as to be inconspicuous, forming a mere neck—the *crown of the root*—where the leaves and flower-stalks spring as at once from the root. Very important differences in the structure of stems distinguish the three great classes of plants—Acrogenous (q. v.), Endogenous (q. v.), and Exogenous (q. v.). Stems sometimes creep along the ground, or even under the ground, when they receive the name *rhizome* or *root-stock*.

STEM, of a ship, is that very powerful piece, or combination, of timber, which, being scarfed to the fore-end of the keel, rises nearly perpendicularly to form the bow and cutwater. To it are rabbeted the fore-ends of the planks. It is backed by an equally powerful timber called the Stemson, bearing the same relation to it as the Keelson (q. v.) does to the keel. See also SHIP-BUILDING.

STE'NCILLING, a method of printing letters or designs. The process consists in cutting out the pattern in a thin plate, usually of metal; this is then laid on the surface intended to receive it, and the color is rubbed into the cut space with a brush, the plate preventing the contact of the color, except on the space cut out. It is much used for wall and other surface-decoration, as it is a rapid and cheap process.

STE'NDAL, a town of Prussian Saxony, 38 miles north-north-east of Magdeburg. Pop. (1880) 12,870. It has manufactures of woolens, cottons, tapestries, tobacco, gloves, &c.

STENO, NICHOLAS, a distinguished anatomist and geologist, was born at Copenhagen in 1638. He had long been famed for his anatomical discoveries, when, in 1667, he devoted himself to geology, acquiring the right to be regarded as the father of palæontological science. He lived much in Italy, and became a Catholic. Latterly he wrote several religious and controversial works, and was made a bishop *in partibus* by the Pope. He died at Schwerin, November 25, 1687. See *Nature*, Vol. xxv.

STENO'GRAPHY. See SHORTHAND.

STEPHEN, ST., THE DEACON, called also the Proto-martyr, or earliest of the Christian martyrs, was one of the seven deacons named in Acts, chap. vi., where his martyrdom is also given. His festival is fixed during the festivals which accompany that of Christmas. His relics were believed to have been discovered in the beginning of the 5th c., the 'discovery' being commemorated by a festival held on the 3d of August.—In the calendar of the Roman Catholic Church are several other saints of the same name, of whom perhaps the most remarkable is Stephen, king of Hungary in the early part of the 11th c. He died in 1038.

STEPHEN, the name of ten popes of the Roman Catholic Church. It is only necessary to refer in detail to the following. STEPHEN I. was the successor of Lucius III., in 253, and his pontificate (253—257) is memorable as affording a topic for the historians who discuss the question as to the early evidences of a Roman *primacy*. The history of Stephen I. is urged as an argument by each party in support of its own view. The advocates of the primacy infer, from several examples of the deposition of bishops by S. in various places, that a power equivalent to the modern primacy of Rome was even then acknowledged. The adversaries of the primacy contend that the resistance offered to S. by Cyprian (q. v.), on the rebaptizing of heretics, is altogether irreconcilable with the general recognition in the 3d c. of any supremacy on the part of the bishop of Rome.—STEPHEN III. plays a most important part in the history of the temporal sovereignty of the Roman see. He was a native of Rome, and was in possession of the see during the occupation (which practically dates from the year 752) of Ravenna, the Exarchate, and the Pentapolis, by Astolphus, king of the Lombards.

That king having invaded Rome, and the Byzantine emperor, Constantine Copronymos, having left unheeded the appeals of S. and the Romans for succor, S. had recourse to Pepin, king of the Franks. The latter in vain sent legates to Astolphus, and the pope returned to France with the legates to solicit in person the aid of the Frank monarch, whom he solemnly crowned. Pepin agreed to compel the Lombards to withdraw from these provinces (which form the portion of the states lately in occupation of the Roman see known as the 'Legations'), and to bestow them on the see of Peter. The Lombard king made a promise to that effect; but on Pepin's withdrawal, again renewed his pretensions, and marched upon Rome. S. therefore again recalled Pepin in a most curious letter written in the name and person of St. Peter, an invitation with which Pepin at once complied; and having again forced Astolphus to withdraw, he again (notwithstanding a demand from the Byzantine emperor for their restoration to the empire) reinstated the Roman see in its sovereign rights. S. died in 757.—STEPHEN VII., elected in 896, has supplied to historians much matter of discussion, from his strange proceedings in disinterring the corpse of his penultimate predecessor, Formosus, stripping it of its pontifical garments, and condemning it, after a juridical procedure, to lay burial. The circumstances of this curious conflict are not fully understood.—STEPHEN X. was one of the remarkable series of reforming popes in the 11th c., who are believed to have been elected under the influence of the celebrated Hildebrand, and who, by their energetic rule, prepared the way for that great scheme of ecclesiastical organization of which the pontificate of that eminent man, under the name of Gregory VII. (q. v.), was the final development.

It ought to be observed that, although in the series of the POPES (q. v.) printed in this *Encyclopædia* ten pontiffs named Stephen are recited, other catalogues reckon but nine; the discrepancy arising from the omission by some of Stephen II., who was elected in 753. This pontiff died before consecration, and is therefore by some excluded from the series of popes; but, as his election was complete and canonical, we have included his name in our general catalogue.

STEPHEN, king of England, was the third son of Stephen, Count of Blois, by Adèle, or Alise, daughter of William the Conqueror, and was consequently nephew of Henry I., and cousin of Matilda, daughter of Henry. He was born in 1105, brought over to England at an early age, and became a favorite with his uncle, who bestowed on him large estates, both in that country and in Normandy, and procured for him a marriage with Mahout, or Matilda, daughter of Eustace, third Count of Boulogne, and younger brother of the famous Godfrey of Bouillon. By this marriage S. not only inherited the earldom of Boulogne on the death of his father-in-law (1125), but also became related to the royal family of Scotland, for his wife's mother, Maria, was a daughter of Malcolm Canmore. When his uncle Henry resolved to settle the crown on his daughter Matilda, whose first husband was Henry V., emperor of Germany (whence she is often spoken of as the 'Empress Maud'), he naturally relied on his project receiving the support of his nephew; and at a council held in London, January 1127, S. along with all the other dignitaries of the land, lay and ecclesiastical, took the oath of fealty to Maud.

A few months later, the widowed empress married Geoffrey Plantagenet (q. v.). On the death of Henry I. (December 1, 1135), S., knowing well the temper and wish of the English people, hurried over to England from Normandy, where he had been in attendance on his dying uncle, and before the year was out had got himself surrounded by a powerful body of the nobles and clergy and crowned at Westminster. His usurpation of the throne was confirmed by a bull of Pope Innocent. But S. was doomed to find his crown a crown of thorns. Although a gallant, generous, handsome prince, immeasurably superior in personal and royal virtues to Maud (who was suspected of having murdered her first husband, who quarelled with her second, and was altogether a fiery, insolent, unwise, and exasperating female); yet it must not be forgotten that on S. rests the responsibility of causing a civil war as sanguinary, if not as protracted, as the famous *Wars of the Roses*. Listen to the *Saxon Chronicle*: 'In this king's time, all was dissension and evil and rapine. . . . . Thou mightest go

a whole day's journey, and not find a man sitting in a town, nor an acre of land tilled. The poor died of hunger, and those who had been men well-to-do begged for bread. Never was more mischief done by heathen invaders. . . . . To till the ground was to plough the sands of the sea. This lasted the nineteen years that Stephen was king, and it grew continually worse.'

We have not space to narrate in detail the struggle of these nineteen years. It is enough to say, that in February 1141, after five years of the hardest fighting imaginable—against David of Scotland, uncle of Maud, who had taken up arms for his niece (see STANDARD, BATTLE OF THE); against Robert, Earl of Gloucester, natural son of the late King Henry, who had also raised the standard of his half-sister; against individual nobles who simply wished to live in anarchic and barbarous independence; and finally, against the power of the church, which he vainly sought to diminish—he was taken prisoner by the Earl of Gloucester, and placed in chains in the Castle of Bristol. Maud was now elected queen by her own party, but her rapacity and other bad qualities soon made her rule intolerable, and the wife of the imprisoned S. (also called Maud or Matilda) found it possible to continue the war, by the help of the Londoners, who were staunch adherents of her husband. S. obtained his liberty in exchange for the Earl of Gloucester, who had fallen into the hands of S.'s friends at Winchester, and the war was resumed with greater violence than ever. The death of the Earl of Gloucester, in 1146, forced Maud to take refuge in Normandy; but a conspiracy of nobles, headed by Ranulph, Earl of Chester, and another quarrel with the church, kept S.'s hands as full of work as before, and no sooner were these matters settled, than Maud's son, young prince Henry, appeared in England (1153), at the head of an army to support his claim to the throne. Fortunately for the nation, so sadly wasted and desolated, a compromise was effected between the two rivals, which saved the necessity of further bloodshed—S. agreeing to acknowledge Henry as his successor. S. died at Dover the year after (25th October 1154).

SPEPHENS (Fr. *Estienne*). The family of the celebrated printers and publishers of this name (descended from a noble Provençal family) is found settled at Paris towards 1500 in the person of Henry Stephens, supposed to have been born about 1470, and died in 1520. In Paris, Henry carried on the business of printer and bookseller for upwards of twenty years. In 1526, Robert, his second son, born in 1503, is found in possession of the business. Every year of Robert's life is marked by the issue from his printing-press of several volumes, many of them masterpieces of art, and all of them surpassing anything of the kind previously seen in France. He was at once printer, publisher, commentator, and author. Though prosperous, he showed unmistakably that truth—or that which to him was truth—was of more value in his eyes than worldly gain. Having secretly become a convert to the doctrines of the Reformation, he endeavored for some time to reconcile his convictions with the outward demeanor required by his position. But the convictions were too strong, or the nature of the man too truth-loving. His Bible of 1545, and his Greek Testament of 1549, each drew down upon him a public prosecution; and though the prosecutions failed legally, they were disastrous to his private fortune. Having first sent his family to Geneva, he followed them there in 1549. Robert, his second son, shortly afterwards returned to Paris where he resumed his father's business, returning to the Roman Catholic church.

In flying from Paris to Geneva, the S. family found that they had but exchanged Roman Catholic for Protestant persecution.

Henry the second, born at Paris in 1528, and succeeding his father Robert on his death in 1559, was repeatedly called before the council, reprimanded, ordered to print cancels, and excommunicated. Though Henry possessed the same literary industry and ability as his father, he was unfortunately deficient in his father's practical turn of mind. Devoted to his art and to his calling, he seems to have been utterly wanting in worldly prudence. In two years we find that he had revised and published more than 4000 pages of Greek text; while at the same time he was writing his *Apologia pro Herodoto*, a work of formidable length and learning. Rendered nervous and irritable by an overworked brain, and by pecuniary difficulties, which were gathering fast around him, the petty surveillance and censorship of the pious pastors of Geneva became intolerable to him. Traveling, originally undertaken from literary curiosity, grew into a necessity of life. In 1578, he visited Paris, where for several years he became a hanger-on of the court of Henry III., who bestowed upon him a pension, which the state of the royal exchequer rendered merely a nominal one. Quitting Paris, he wandered in poverty over Europe, his own family often ignorant of where he was to be found. He died at Lyon in 1598. Great as a publisher and commentator, Henry S. does not seem to have possessed much power as an original thinker. His mastery of Greek seems to have been almost complete, and as a critic of the French language he is still esteemed in France.—See Feugère *Caractères et Portraits* (1864); *Quarterly Review* (1865); article in the *Biographie Générale*); Bernard, *Les Estiennes* (1856); Renouard, *L'Imprimerie des Etiennes*.

STEPHENSON, GEORGE, was born at Wylam, eight miles from Newcastle, on the 9th of June 1781, in circumstances of great poverty, his father having to maintain a family of six children on 12*s*. per week, earned by tending a colliery-engine at Wylam, near Newcastle. George's first employment was herding cows at 2*d*. per day, from which he was promoted to hoeing turnips at 4*d*.; subsequently, he was appointed fireman at Midmill Colliery, and at 15 we find him rejoicing on his salary being raised to 12*s*. a week. As fireman, he applied himself to diligent study of the steam-engine, taking his machine to pieces during his leisure-hours, and thus gaining a thorough practical knowledge of it. At Black Callerton Colliery, in 1801, by dint of mending shoes and cleaning watches, in addition to his regular employment, S. contrived to save his first guinea. At 21, he had saved as much as enabled him to furnish a cottage in a humble way, and on 28th November 1802, he was married to a young woman named Fanny Henderson. She died in 1804, while her husband was brakesman at Killingworth Colliery. The early life of S. presents a record, whose interest cannot be surpassed, of a contest between determined purpose, industry, and sagacity on the one hand, against poverty on the other. Slowly, inch by inch, we find the inward forces gaining ground upon the outward. Out of his humble gains he contrived to pay 4*d*. a week for lessons in reading, writing, and arithmetic, which were conned over at night, and mastered by the light of his engine-fire. On one occasion, indeed, so hard had the tide gone against him, that even he had nearly given way to despair. 'I wept bitterly,' he says, in allusion to an intention he had formed of emigrating, —'for I knew not where my lot in life might be cast.'

In 1815, the invention of a colliery safety-lamp, the 'Geordie,' brought his name before the public. The fact of his invention being almost simultaneous with that of Sir H. Davy, gave rise to a long controversy between their respective friends and supporters. In 1819, S. married his second wife, Elizabeth Hindmarsh, the daughter of a farmer at Black Callerton. It was at Killingworth Colliery that he constructed his first locomotive. At first, it was not very efficient; but, subsequently, the grand improvement of the 'steam-blast' carried his experiment to a triumphant issue. Further improvements followed, and in 1821 S. was appointed engineer for the construction of the Stockton and Darlington Railway; the line, on its completion, being partially worked by means of his great invention. The rapid growth of the trade of South Lancashire, together with the unpopular management of the Bridgewater Canal, gave rise, in 1821, to the project of a railway between Liverpool and Manchester. S. was chosen engineer. That he proposed to work the line with an engine which was to go at the rate of 12 miles an hour, was a fact held up as of itself sufficient to stamp the project as a bubble. 'Twelve miles an hour!' exclaimed the *Quarterly Review*—'as well trust one's self to be fired off on a Congreve rocket.'

When the bill ultimately passed, on 16th March 1826, S. was appointed principal engineer, with a salary of £1000 a year. After inconceivable difficulties, the line was completed in 1829. There then ensued the memorable competition of engines, resulting in the complete triumph of Mr. S.'s 'Rocket,' which, to the astonishment of every one except himself, was found capable of travelling at the till then undreamt-of rate of 35 miles an hour. 'Now,' exclaimed one of the directors, 'George Stephenson has at last delivered himself.' While occupied in carrying out the vast system of railway which soon overspread the country, S.'s home was at Alton Grange, near Leicester. He saw but little of it, however, as he was often traveling on business for weeks at a time. During the three years ending 1837, he was principal engineer on the North Midland, York and North Midland, Manchester and Leeds, Birmingham and Derby, and Sheffield and Rotherham Railways. In 1836 alone, 214 miles of railway were put under his direction, involving a capital of five millions. He has been known to dictate reports and letters for twelve continuous hours. But in the midst of his immense business, his heart remained as youthful as ever. In spring, he would snatch a day for bird-nesting or gardening; in autumn, nutting was still a favorite recreation. We find him even at this time writing a touching account to his son of a pair of robins. Strong as he had shown himself when the world was all against him, he was not less so in the midst of his success.

During the railway mania, his offices in London were crowded every day with men of every rank and condition, eager to strengthen their prospectuses by the weight of his name. Where he disapproved—and at this time he almost always did disapprove—he invariably declined, though by acceding he might have made enormous gain; but to make money without labor or honor had no charm for Stephenson. In the autumn of 1845, he visited Belgium and Spain for professional purposes. On his way home he

was seized with pleurisy, from which attack he does not seem ever to have thoroughly recovered. He occupied his declining years with the quiet pursuits of a country gentleman, indulging his love of nature, which, through all his busy life, had never left him. He died at his country-seat of Tapton on 12th August 1848. The leading feature of his mind was honesty of purpose, and determination in carrying it out. 'I have fought for the locomotive single-handed for nearly twenty years,' he says; 'I put up with every rebuff, determined not to be put down.' Towards trickery and affectation he never concealed his contempt, while honest merit never appealed to his liberality in vain.—See *Lives of Engineers*, by Samuel Smiles, vol. iii. (Lond. 1862).

STEPHENSON, ROBERT, only son of George Stephenson, was born on the 16th October 1803. When a boy, he attended a school in Newcastle. In 1820, his father's improving circumstances enabled him to send Robert to the university of Edinburgh, where he seems to have made excellent use of his time. In 1823, we find him assisting his father in the survey for the Stockton and Darlington Railway. Subsequently, he took an active part in the locomotive engine-works started by his father at Newcastle. In June 1824, he went to Mariquita, in South America, on an engineering appointment; but this not suiting him, at the end of three years he returned home by the United States and Canada. He then assumed the management of the Newcastle business. During the discussion as to the power to be employed on the Liverpool and Manchester line, he was in constant communication with his father, to whom his quick perception and rapid judgment were of great assistance. Shortly after the completion of this line, he was appointed engineer of the Leicester and Swanington Railway. Subsequently, he was appointed joint managing engineer, along with his father, of the London and Birmingham line, the execution of which immense work was ultimately almost wholly intrusted to him. In 1829, he married Frances, daughter of John Sanderson, merchant in London. She died in 1842 without issue; and he did not marry again. The London and Birmingham line was completed in such a manner as to raise S. to the very highest rank in his profession. Business now flowed in upon him. In one parliamentary session we find him engaged in 33 new schemes. Projectors thought themselves fortunate if they could procure his services on any terms. The work which he got through was enormous, and his gains large beyond what had then been known in his profession.

The Britannia Tubular Bridge, of which undertaking Robert S. was the master spirit, is one of the most remarkable monuments of the enterprise and engineering skill of the present century. It was completed on 5th March 1850, at a cost of £234,450. S. lived to repeat his splendid achievement in the bridge across the St. Lawrence at Montreal, and in the two bridges across the Nile at Damietta. In 1847, he was returned to the House of Commons as member for Whitby. On 15th August 1849, he completed the high-level bridge at Newcastle, and in the following year the great viaduct across the Tweed at Berwick. In 1855, the emperor of the French decorated him with the Legion of Honor. At home, the university of Oxford made him D.C.L. In the same year he was elected President of the Institute of Civil Engineers. The immense amount of work which he went through both at home and abroad proved too much for his constitution, originally delicate; while in Norway, in 1859, he was seized by the illness which soon afterwards ended his illustrious career. He died on 12th October 1859. He was buried in Westminster Abbey. It was as a workman that Robert S. was great, his political views being at times rather narrow. Contrasting him with his great rival Brunel, it has been said that the ambition of the latter was to make a great work, that of the former to make a work which would *pay*. Robert S. inherited the kindly spirit and benevolent disposition of his father. He almost worshiped his father's memory, and was ever ready to attribute to him the chief merit of his own achievements.—See *Lives of the Engineers*, by S. Smiles, vol. iii. (Lond. 1862).

STEPPES, the distinctive name applied to those extensive plains which, with the occasional interpolation of low ranges of hills, stretch from the Dnieper across the south-east of European Russia, round the shores of the Caspian and Aral Seas, between the Altai and Ural chains, and occupy the low lands of Siberia. The word, which is of Russian origin, denotes primarily an uncultivated plain of great extent, and has been applied by geographers to the above-mentioned regions as expressive of their flat, semi-barren, treeless character. In spring and early summer, the steppes are clad with a thin covering of green herbage, become parched and barren under the scorching heat and drought of June, and in winter are hid beneath a thick covering of snow, which, raised in huge white thin clouds, and driven hither and thither by furious storms, brings destruction to every living creature within its sweep. The monotony of the steppe is as fatiguing to the traveler as is that of the sandy, arid desert: for hundreds of leagues his eye is compelled to endure the same unvarying level of scanty herbage, unbroken by tree or bush, and bounded by the utmost limits of the horizon; only in spring, while the vegetation is succulent and fitted for pasture, is the solitude broken here and there by herds of horses and cattle, and their mounted guardians. In autumn, when the tall herbage, withered by the heats of summer, has been rooted up and broken by violent winds, it becomes gathered and rolled together into enormous balls, sometimes of from nine to eleven yards in diameter. Here and there are tracts which offer some inducement to the agriculturist; such are the steppe east of the Dnieper, that between the Don and Volga—of inferior fertility, but rich in coal—and the steppes of South-western Siberia, especially those in the government of Tomsk, all of which have been partially colonized; but a very wide extent is hopelessly barren.

STERCULIA'CEÆ, a natural order of exogenous plants, closely allied to *Malvaceæ* and *Byttneriaceæ*, and consisting of large trees and shrubs, natives of warm climates. About 130 species are known. The flowers of some are irregular; and in some they are hermaphrodite, in others unisexual. Many species, particularly of the sub-order *Bombaceæ*, are trees of gigantic size, amongst which is the Baobab or *Adansonia* (q. v.) *digitata*. The bark of some species is very fibrous, so that it is made into ropes and coarse cloth. The light wood of *Ochroma lagopus* is used in the West Indies instead of cork. *Sterculia fœtida*, an Indian tree, with excessively fetid flowers, has pale wood, which is very durable, and susceptible of a high polish. Spars of this wood are called *Poon Spars*. The seeds of some species, as of the Silk-cotton (q. v.) trees, are surrounded with silky hairs. The seeds of all the species are oleaginous; those of some are eatable, as those of the CHICHA (*Sterculia chicha* and *S. lasiantha*) of Brazil, which

Chicha (*Sterculia chicha*):
a, branch with leaves and flowers; *b*, parts of fructification; *c*, pistil; *d*, transverse section of ovary.

are about the size of a pigeon's egg, and have a pleasant flavor. They are roasted before being eaten. The Cola (q. v.) Nut of Africa is the seed of a *Sterculia*. The whole order agrees with *Malvaceæ* in possessing mucilaginous and demulcent properties. The Gum Tragacanth (q. v.) of Senegal and Sierra Leone is produced by a *Sterculia*. The Durian (q. v.) is the fruit of a tree of this order.

STERE (Gr. *stereos*, solid), the name given to the unit of cubic measure in the French metrical system. It is a cubic *mètre* (q. v.), and equivalent to 35·3165818168 English cubic feet, or 1·3080215487 English cubic yards. The *decastère* is equal to 10 steres, and the *decistère* to the tenth part of a stere. This measure is much used for wood, especially firewood.

STERELMI'NTHA (Gr. *stereos*, solid, and *helmins*, an intestinal worm), a term suggested by Professor Owen, and generally adopted to signify those intestinal worms which have no true abdominal cavity, and which were called 'parenchymatous' by Cuvier. See CŒLELMINTHA.

STE'REOCHROMY, a process of wall-painting, invented by Professor J. N. von Fuchs, of Munich, professed to be superior to fresco-painting, inasmuch as it will admit of any part of the picture being retouched, as in the case of oil-paintings. It is also more durable being protected by a varnish from the effects of the atmosphere.

STE'REOSCOPE (Gr. *stereos*, solid, and *skopein*, to see), an optical instrument of modern invention, by means of which pictures of objects possessing three dimensions, are seen not as plane representations, but with an appearance of solidity or relief, as in ordinary vision of the objects themselves. The more recondite principles of the stereoscope, which are of high interest and importance in their bearing on the philosophy of perception, will be fully considered under VISION, BINOCULAR. The present article

will be limited to an historical sketch of its invention and subsequent developments, coupled with an exposition of the optical and mechanical details of its construction.

The essential principle of the stereoscope, the first conception of which by Professor Wheatstone, justly ranks as one of the most brilliant optical discoveries of the age, may be thus explained. It is an obvious fact that the eyes being separated by a certain interval of space, all solid objects so near to the observer as to be seen with a sensible convergence of the optic axes, necessarily form retinal pictures, differing as to their perspective projections for each eye. Singular to say, the true import of this plain fact was wholly unsuspected prior to the investigations of Professor Wheatstone, who, in his first paper on this subject, published in the *Philosophical Transactions* for 1838, clearly established the important conclusion, that this dissimilarity of the retinal images is made to subserve an important end in the use of our visual organs—that it is, in fact, the principal originating cause of our immediate perception of the solidity (or relief) of objects adjacent to the sight. The problem he set himself to investigate was: 'What would be the visual effect of simultaneously presenting to each eye, instead of the object itself, its projection on a plane surface as it appears to that eye?' and in order to bring this question to the test of experiment, he devised an instrument which he named the stereoscope, and which with certain additions more recently proposed by the same author, is shown in fig. 1.

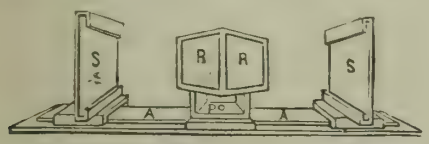


Fig. 1.

RR, two square mirrors about three inches in diameter, fixed vertically with their backs at a right angle with each other; SS, slides for the reception of the pictures, the *left*-hand picture being placed in the *right*-hand slide, and *vice versâ*, on account of the lateral inversion of their reflected images. SS are made to slide along the arms AA, so that their distance from RR may be varied at pleasure. SS also revolve each on a vertical axis, to admit of the variation of their angular position with reference to the arms AA. AA may also be moved in a horizontal plane, on the common pivot P.

The pictures being attached to the slides, the observer places himself with his nose close to, and immediately in front of, the vertical angle made by the reflectors, so that the view by each eye is limited to the rays reflected by its appropriate mirror; the pictures are then seen, as it were, behind the mirrors, and the eyes being made slightly to converge, either by an effort of the will, or by drawing the slides, SS, a little forward, the effect of either of which is to refer the reflected images to the same part of space, the observer sees no longer mere pictorial resemblances, but, to all appearance, the objects themselves, exquisitely modelled, occupying a certain extent of space, and standing forth with a substantiality of aspect truly wonderful. At the outset, the only stereoscopic pictures obtainable were the outlines of geometrical solid figures, which it was possible for a skilful artist to depict with perspective projections adapted for the right and left eye respectively; and the pictures so prepared excited the greatest interest and admiration. They, moreover, abundantly exemplified the truth and importance of the binocular principle, though the universality of its application to purposes of pictorial illustration only became apparent on the introduction and gradual improvement of the photographic arts. In 1849, Sir David Brewster originated that convenient, portable, and in all respects admirable form of the stereoscope which is now in general use over the whole civilized world. For this—the lenticular stereoscope—the pictures (taken, be it remembered, from two different points of view) are mounted side by side, on a piece of cardboard, and, being placed in the instrument, are viewed through semi-lenses, fixed at the distance apart of the two eyes.

To effect the displacement of the pictures, so that they shall be referred to the same part of space, which we have above defined to be an essential condition, Sir David Brewster most ingeniously availed himself of an opticle principle, which enabled him at the same time to fulfil several collateral ends of considerabfe importance. This principle may be described as follows: If an object be viewed through the center, or, more properly, along the axis, of a convex lens, it will be seen exactly in front of the eye; i. e., in a line with the eye, the center of the lens, and the actual place of the object. If now the lens be moved slightly to the left, the object will appear towards advance to the right; and, conversely, as the lens is moved towards the right, the object is displaced in the opposite direction. Let the lens be cut in half, transversely, and the two semi-circular pieces reversed as to their former position, i. e., placed side by side, and so that their thin edges shall be adjacent, while the two plane edges, formed by the section of the lens, are kept in mutual parallelism, and have their faces turned outwards, towards the left and right respectively: the right eye will now look through the left half of the lens, and *vice versâ*; and the two pictures, each placed opposite its appropriate eye, and in the principal focus of the eye-piece, will be seen not in their actual places, but in a position midway between the two.

The subsidiary purposes served by this arrangement are, that the pictures are magnified as well as caused to coalesce; and that the equality of the magnifying power of the eye-pieces (a result by no other means certainly attainable) is secured by the fact of their being cut from the same lens, the whole of which is thus advantageously and economically utilized. In too many of the instruments offered for sale, the conditions stated above are very imperfectly fulfilled; the parallelism of the two sectional planes of the semi-lenses, and their rectangularity with two imaginary planes joining their opposite ends respectively, are not maintained, and as a consequence, the coalescence of the pictures is effected, if at all, by a forced and more or less painful displacement of the eye-balls, entirely destructive of all pleasure in the use of the instrument. And it is important to recollect that this parallelism of the sides of the semi-lenses may be either actual or virtual; for to whatever shape they may be cut (and the circular form is the one most often adopted), the foregoing conditions are in no wise altered. The best lenticular form of the instrument with which we are acquainted, is the achromatic stereoscope devised by Messrs. Smith, Beck, and Beck, the well-known London opticians, which combines excellencies of a very varied character. Its construction is shown in fig. 2.

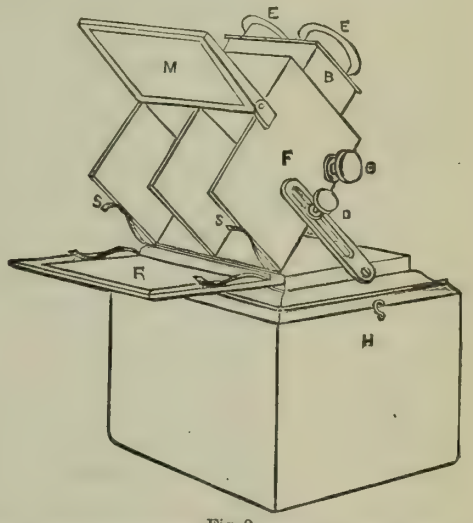


Fig. 2.

EE, the eye-pieces fitted to the sliding-box, B, which, by means of the milled head, C, attached to a rack-and-pinion movement, can be moved out or in for adjusting the focus. D, a slot and screw for fixing the body of the stereoscope, F, at any desired inclination; M, a mirror for reflecting light upon the picture, which is inserted between the springs, SS, and the woodwork of the stereoscope, and is thus firmly held. For viewing transparencies, the flap containing M is closed, and the picture illuminated by light reflected through it by the mirror R, the inclination of which is adjustible at pleasure; H is a box forming a convenient receptacle for the whole of the instrument.

It remains to speak of the pictures in their relation the one to the other as a stereoscopic pair. Evidently, exactly to reproduce the conditions of normal vision, they should be taken from points of view separated laterally by a space equal to the distance between the eyes, viz., about 2½ inches; and for all objects within narrow limits of distance this rule is observed. But taking a wider range, such as would include, for instance, an extensive architectural pile, photographers usually take their pictures from spots separated by a considerable interval; and the stereoscopic slides thus obtained, when viewed in the stereoscope, exhibit effects of solidity or relief of a very striking character. Inasmuch, however, as these effects are due to a gross exaggeration of the ordinary difference of perspective relatively to the two eyes, they to a like extent misrepresent the actual appearance of the scene; and it were to be wished that for all stereoscopic pairs alike, whether representative of near or of remote objects photographers would be content to adopt that exact relation of the two retinal pictures which subsists in ordinary binocular vision.

As to the mounting of the pictures it is of course highly important that they be placed exactly in the same line; it has further been pointed out by Mr. Claudet that, as the apparent solidity of the objects viewed in the stereoscope conflicts with the evident flatness of the cardboard mount, it is advantageous to adopt the following expedient. The pictures must be of the same size, but instead of having them identically the same as regards

the objects represented on each, let the left-hand picture include on its left-hand margin somewhat less than is found on the same margin of the right-hand picture; similarly, let its right-hand margin contain somewhat more than is found on the same margin of the right-hand picture: then will the view appear to extend well out of and beyond the cardboard, which forms, as it were, a framework around it. A moment's consideration will show that this ingenious arrangement does but reproduce the conditions which obtain whenever we look out upon a scene through a casement distant from us by a few feet. Availing himself of the libration of the moon, Mr. Warren De La Rue has obtained lunar stereoscopic photographs, which exhibit that body with a general appearance of rotundity, while the objects on her surface are seen in conspicuous relief. These effects are, however, evidently due to an exaggeration of the 'binocular parallax;' for by no human eyes, how near soever they might be placed to the lunar surface, could such a view be obtained. It is, as Sir John Herschel has remarked, as though the moon were seen with the eyes of a giant, placed thousands of miles apart.

Among the minor applications of the stereoscope, may be mentioned the STEREOMONOSCOPE and the STEREOTROPE, the former devised by Mr. Claudet, the latter by Mr. William Thomas Shaw; and severally described by them in the *Proceedings of the Royal Society* of June 1857, April 1858, and January 1861. In the stereomonoscope, the two pictures of a stereoscopic pair are projected, by means of lenses, on to the posterior surface of a piece of ground glass, one upon the other, or so that they occupy the same place; when the observer, looking from the opposite side of the glass, sees them not as a confused mixture of two pictures, but as a single stereoscopic representation, possessing the usual attributes of solidity or relief. The stereotrope consists in an application of the principle of the stereoscope to that class of instruments variously termed thaumatropes, phenakistoscopes, &c., which depend for their results on 'persistence of vision.' In these instruments, as is well known, an object represented on a revolving disc in the successive positions it assumes in performing a given evolution, is seen to execute the movement so delineated; in the stereotrope, the effect of solidity is superadded, so that the object is seen as if in motion, and with an appearance of relief as in nature. A highly ingenious application of the principle of the stereoscope to portraiture has been described by Mr. Henry Swann in the *Report of the British Association* for 1863. In this arrangement, the portrait is seen as a solid bust embedded in a cube of crystal. A form of the reflecting stereoscope, in which the planes of reflection are vertical, has been proposed by Mr. Walter Hardie.

But by far the most important application of the stereoscopic principle, is its realization in the binocular microscope of Mr. Wenham, the advantages of which over the monocular form of that instrument are increasingly appreciated by microscopists. In this, the right and left eye pictures, respectively, are thus obtained. Immediately behind the object-glass, a small and peculiarly shaped prism is placed in such a position, that it shall receive the whole of the rays coming through the right half of the lens. These rays, after being twice reflected within the body of the prism, finally emerge at such an angle to their original direction, that they cross the undiverted pencil of rays transmitted by the other half of the lens, and are then received into a second tube, which, being inclined to the first or main tube at an appropriate angle, conveys them to the left eye; while the other complement of rays pursues an undeviating course to the right eye. Each of the two tubes is fitted with the usual eye-pieces; and object-glasses of all but the highest powers may be used with pleasure and advantage. For a fuller explanation, see the original paper by Mr. Wenham in the *Transactions of the Microscopic Society*, new series, vol. ix., page 15.

STE'REOTYPING (Gr. *stereos*, fixed, solid), the art of fabricating metal plates resembling pages of type, from which impressions may be taken as in ordinary letterpress-printing. The plates, which are composed of type-metal, are about three-sixteenths of an inch thick, perfectly smooth on the back, and having a face exactly resembling a page of movable type. To yield an impression, the plates are fastened by a temporary arrangement to blocks of wood—plate and block together being the height of a type, or one inch. Stereotyping is not employed where only a definite and moderate number of impressions of any work are required. Its chief value consists in its availableness for future impressions contingent on the renewed demand for copies; but it is also of importance in duplicating the means of taking large impressions quickly. Considering the small quantity of metal employed in fabricating a stereotype plate, printers are enabled to secure and store up forms of type, so to speak, at a comparatively small outlay, and have at all times the means ready at hand to produce fresh editions without the trouble or cost of setting a single letter.

As in the case of many valuable inventions, there has been not a little discussion as to who was the discoverer of the art of stereotyping. By some it has been ascribed to Van der Mey, a Dutch printer, who early in the 18th c. executed editions of the Bible from forms of fixed type. Van der Mey's process, however, was not stereotyping in the proper sense of the word; for it consisted in nothing more than soldering together all the types in a page in order to fix them permanently. There can be no doubt that the inventor of stereotyping was William Ged, a goldsmith in Edinburgh, who made the discovery about 1725. In 1727, he entered into a contract with a person to prosecute the business of stereotyping; but this person, who had little means, becoming intimidated, the contract was relinquished. In 1729, Ged entered into a partnership for the same object with William Fenner, a London stationer. Afterwards, John James, an architect, Thomas James, a typefounder, and James Ged, son of the inventor, joined the partnership. By this association, certain Bibles and Prayer-books were stereotyped for the university of Cambridge about 1731. Ged's success was so far complete, but his prospects were blighted by ill-treatment from his partners, as well as by the misconduct of the pressmen employed to print from his plates, which they maliciously damaged and rendered imperfect. The university appears to have at length abandoned the use of the plates, which were sent to Caslon's letter-foundry in London to be melted. A few of these plates escaped the crucible, and from two of them, being pages of the Book of Common Prayer, impressions are given in Hansard's *Typographia*, Part II. (1825).

Ged's partnership was broken up in 1738, and full of disappointment he returned to Edinburgh. There, he prosecuted his art, and was able to execute several editions of Sallust, of a small size, for the use of schools. Copies of these editions still exist. The earliest which we have seen purports to be printed in 1739, and bears an imprint in Latin which may be translated as follows: 'Not executed by movable types, but by tablets of fused metal.' The printing is as neatly executed as that of any volume at the period. This Sallust of 1739, as we apprehend, was the first book correctly printed from stereotype plates. To add to the cares of William Ged, his son James engaged in the Jacobite insurrection of 1745, and was taken prisoner, and condemned; his life, however, was spared on account of his father's useful invention, and he proceeded to Jamaica, where William, his brother, was already settled. William Ged, the inventor of stereotyping, died at Edinburgh, October 19, 1749, in very indifferent circumstances.

The art of stereotyping has undergone little change since its discovery by Ged. The process of fabricating plates is very simple. The page of type being set, corrected, cleaned, and fixed in a frame, is laid on a smooth iron table, face upward; a little fine oil is brushed over it, to prevent the liquid stucco from adhering; the stucco to the consistency of cream is now poured over the face of the page, and straightened over it in the process of hardening; when hardened, the cake of stucco is lifted off, and is seen to be a perfect mould of the types. The cake is now baked in an oven, and then placed in an iron pan; the pan, which has inlets at the upper side, is plunged into molten metal, which soon runs into the mould; being lifted out and cooled, the pan is opened and found to contain a plate resembling the page of type; the mould is broken and of no further use. When removed from the pan, the plate is rough, and needs to be trimmed for working; for this purpose, it passes through the hands of artisans, who prepare it for the press. Should any particular letter be defective, it is dug out, and a corresponding type inserted; the end of which type is cut off at the back of the plate by a soldering bolt. In preparing plates for press, nothing is more important than giving a high degree of level smoothness to the back, and to effect this certain planing and smoothing operations are adopted. Such is the old and well-known *stucco* process of stereotyping.

Latterly, there have been divers improvements as regards the shape of the pans, in order to facilitate the fabrication of several plates at once, but the principle is in all cases the same. After the stereotyping is finished, the types are distributed. In some printing-offices, all work whatsoever is executed from plates, and types are employed only to produce moulds. This however, does not save types from deterioration; in cleaning them with brushes and oiling them for the stucco, their finer parts become in no long time rounded off. As regards impressions from stereotype plates, the work is seldom so sharp and fine as from pages of movable letter; but it answers every required purpose in a large variety of cases. Plates properly manufactured, stored, and mended when necessary, will last for repeated impressions to the extent of hundreds of thousands over a long series of years. The stock of plates in some establishments is accordingly large, and represents a considerable sunk capital. When no longer required, the plates are melted down as material for fresh castings.

The *paper* process of sterotyping was invented some years ago on the continent, but has been since perfected in the *Times* office, where it was adopted for duplicating newspaper forms. See TIMES. A uniform sheet of soft and damp matter is formed by gumming together, first a sheet of thin yet very tough tissue paper; second, a sheet of loose and bibulous white paper; and

third, a sheet of fine-grained and tough brown paper. The smooth and white side of the sheet, still soft and moist, is placed on the types. Both are then put in a press. A roller passes under the form, and presses it up against the paper, so as to receive the impression of the types and convert it into a mould. The dents made by the types rise on the outside of the paper, so that any spot where the paper has not sunk into the spaces between the types is at once detected. Such spots generally occur, and are removed by the paper being driven in between the types by blows of a hard brush. The dents made by the types, we have said, are represented by elevations on the outside of the sheet, and the interstices are represented by corresponding hollows. The latter are filled up at this stage by a thin coating of stucco laid on by a brush. The mould is then carefully removed dried, and placed in a shallow box of metal placed upright. The smooth or stucco side of the mould is pushed against the back of the box. The lid is then closed very tightly, leaving only an opening at the top. Through this opening molten metal is poured, and a plate is thus formed, one side of which, of course, is a cast from the mould. It contains elevations at places where there are wide spaces between the types, and these it is necessary to remove with the chisel. In other respects the plate is an exact copy of the form. The great advantage of this mode of stereotyping is its rapidity.

Plates from stucco could scarcely be produced and ready for press in less than six hours; plates from paper can be produced and laid on the machine in less than one hour. Indeed, in the *Times* office, where the process has been carried to great perfection, the plates are now produced in seven minutes. By the paper process, plates are produced every morning for the London newspapers and others of which vast impressions are required. The forms of types themselves are no longer used, a number of plates being produced corresponding to the number of machines employed (see TIMES), and all the copies of the paper are printed from them. A very great saving in the cost of types is thus effected. It was necessary to renew the fount every few months in the *Times* office, when that paper was printed in the usual way. Since the introduction of the new process, the expense of the production of that great newspaper has been to a considerable degree kept in check. The types last as many years as they did months when printed from.

To accommodate printing machines on which the forms need to be fixed in a cylinder, the paper moulds are placed in pans or boxes which are of the required shape. The moulds are then bent with their backs outwards, and the molten metal is poured between the concave mould and convex lid. The plates are generally cast in four segments, which screwed together form a cylinder. They are adjusted to the printing press by a planing machine, which cuts their inner surface to the exact convexity of the cylinder. To this duplication there is of course no limit; sets of plates can be produced to any required number. As copies of old newspapers are not wanted, the plates are melted down as soon as the operations of the day are over. Even when books are printed from movable types, it may serve a good purpose to take paper moulds from them before distribution; for the moulds, on being dried, can be laid aside and be afterwards employed for fabricating plates should a new impression be wanted. The author of a book, for example, could at a most insignificant addition to the expense of typography, possess himself of a set of paper moulds of his work, to be used if necessary at some future period, in order to save the composition for a new edition. W. G.

STE'RLET. See STURGEON.

STE'RLING, an epithet generally applied to the money of the United Kingdom. The original standard of money was weight, and among the Anglo-Saxon and Teutonic nations the basis of weight was in early times supplied by the wheat-corn. Charlemagne superseded the earlier systems by a new coinage, in which a pound of 12 ounces became the money-weight, each pound being divided into 20 solidi, and each solidus into 12 denarii of the weight of 32 wheat-corns. The older *silfer* or scruple of 24 wheat-corns being superseded by the penny of 32 wheat-corns, the term sterling seems to have been applied to the latter, in consequence of its being in use among the Ripuarian or Austrasian Franks, sometimes called the *Esterlings*, while the old scruple continued to be used by the Northmen. In England, where the change was early introduced, the word sterling came in the course of time to indicate the fineness or standard of the silver; and nearly the same standard, consisting of 11 oz. 2 dwt. of pure silver, and 18 dwt. of alloy to the pound troy, or $\frac{1}{22}$dwt., seems to have subsisted from the 12th c. downwards. The superiority of the English standard silver to all other currency has been generally acknowledged over Europe; and hence the adjective sterling has become a synonym for pure and genuine.

STE'RNBERG, a town of Austria, in Moravia, 12 miles N.-N.-E. of Olmütz. Pop. (1880) 14,243. It is the chief seat of the Moravian cotton manufactures, and has also not unimportant manufactures of linen, hosiery, and liqueurs. The cotton and linen goods made at S., and in the vicinity, are known as *S. wares*.

STERNE LAURENCE, though of English descent and parentage, was born at Clonmel, in Ireland, on 24th November 1713. In that country also, in some intermittent way, a good deal of his boyhood was passed, with possibly some effect in developing that oddity and whimsical exuberance long after to find vent in his writings. His father was of a good Yorkshire family, and as lieutenant in a marching regiment led a wandering and unsettled life. When about ten years old, the boy was consigned to the care of his kinsman, Mr. Sterne of Elvington, in Yorkshire, by him put to school near Halifax, and thence, on his proving himself a lad of parts, transferred in 1733, to Jesus College, Cambridge, where, in 1736 and 1740 respectively, he took the degrees of Bachelor and Master of Arts. He was educated for the church, and on his leaving the university, his uncle, the Rev. Jaques Sterne, an ecclesiastical dignitary of some magnitude, procured for him the living of Sutton in Yorkshire. With this relative he afterwards quarrelled, but not before another appointment had been secured him as Prebendary of York cathedral. In 1741, he was married to a lady whom he met in York, and soon after, through the influence of a friend of his wife, he was presented to the additional living of Stillington. For nearly 20 years he lived at Sutton unheard of.

That his devotion to his clerical duties was great, is more than can be supposed from what we know of his character; and we can readily believe the 'books, painting, fiddling, and shooting,' which he tells us were his choice recreations, formed pretty much the business of his life. Up to the year 1759, in which the first two volumes of his *Tristram Shandy* appeared, he had published only two sermons, which, according to his own statement, 'found neither purchasers nor readers.' *Tristram Shandy*, which, though published without his name, was from the first known to be his, had instant and immense success, and S., on going up to London, found himself the literary lion of the day. In 1761, two more volumes of it appeared, followed by vols. 5 and 6 in 1762, vols. 7 and 8 in 1765, and in 1767 by the 9th and last. During this period he also issued 4 vols. of sermons, and the *Sentimental Journey*, published in the beginning of 1768, completes the list of his works. He died on 18th March of that year, his health having been much impaired for some considerable time.

From the time of his becoming famous his parishioners saw of S. but little. He lived mostly either on the continent or in London, where his literary celebrity made him welcome in the best circles. Always an easy, mercurial kind of mortal, he now led somewhat a gay and dissipated life, rather modelled on the Epicurean maxim of enjoying the present hour, than on those more serious precepts he had been wont to enforce from the pulpit. But except that he does not seem to have been excessively devoted to his own wife—she and her daughter being in these pleasant years but little with him—and was a little of a sentimental Lothario in respect of the wives of other people, no very great harm is known of him. He is said, despite of the exquisite sentiment which abounds in his writings, to have been really heartless and unfeeling; and the sneer of Walpole, that he could snivel over a dead ass, to the neglect of his live mother, is familiar to almost every one. It is in fairness, however, to be said that the implied slander rests on no distinct basis of evidence.

Whatever question may be made of the worth of S. as a man, there can be none of his genius as a writer. *Tristram Shandy*, his chief work, must live as long as the language, were it only in virtue of the three characters of Old Shandy, Uncle Toby, and Trim, the most perfect and exquisite, perhaps, in the whole range of British fiction. These are genuine creations, at once fantastic and real, in which the subtlest reconcilement is effected between the sportive exuberance of fancy and the sober outlines of truth. Otherwise there is a good deal in the work which needs excuse; in particular, a most wilful and gratuitous indecency almost without a parallel, and a constant trick of lawless and whimsical digression, to the endless incalculable frivolities of which even the inimitable grace, ease, and tricksy flexibility of the style can with difficulty reconcile the reader. The humor of S. is notwithstanding the most subtle, airy, delicate, and tender to be found in our literature; and in many passages he shows himself master of a pathos equally exquisite and refined. See also Traill's *Sterne* (1882). Though against the charge of unclerical levity, at once in his writings and his life, it is impossible to defend S., except as the laxer *morale* of his time may afford some slight palliation of it, candid investigation suggests a considerably more kindly view of his character than that which used to be current. Traill's short life of S. (1882) stands midway between Fitzgerald's apology (*Life*, 2 vols., 1864) and Thackeray's unsparing attack.

STERNHOLD, THOMAS, one of the authors of the English version of psalms formerly attached to the Book of Common Prayer, was a native of Hampshire, and born towards the close of the 15th century. He held the office of Groom of the Robes to Henry VIII. and Edward VI., and died in 1549. At the Refor-

mation period, when the practice of singing metrical psalms—first introduced by Clement Marot among the gay courtiers of Francis I.—came to be taken up by the Reformers, S. undertook to render the whole book of Psalms into English verse. He only lived to complete twenty-one psalms; and his version was published after his death under the title of *All such Psalm of David as Thomas Sternhold did in his Lyfe drawe into English metre* (Lond. 1549). S.'s labors were completed by John Hopkins and William Whittinghame, and first annexed to the Book of Common Prayer with the music attached, as *The Whole Booke of Psalmes collected into English metre by Thomas Sternhold, John Hopkins, and others; compared with the Ebrue, with notes to sing withal.* S. and Hopkins's psalms are very literal, but somewhat coarse and homely in phraseology. They were used in the church service of England till superseded by the version of Tate and Brady, which appeared in 1698. They were also in use in Scotland down to the middle of the 17th century.

STE'RNIDÆ. See TERN.

STE'RNUTATORIES, are agents which cause sneezing. The most common are the different kinds of snuffs, but other substances are known which produce a more powerful and prolonged action on the nasal mucous membrane. They have been employed in medicine with various objects; as, for example, to restore suspended respiration in case of fainting, to dislodge foreign bodies from the nasal passages or even the windpipe, to avert or check histerical attacks, and to terminate prolonged fits of hiccup. They are scarcely ever used at the present day.

Stethoscope.

STE'THOSCOPE, THE (Gr. *stethos*, the chest, and *skopeo*, I look into), is an instrument invented by Laennec for examining the sounds of the chest. Its form will be best understood by the figure, which represents the section reduced to half the natural diameter, or one eighth of the actual size. The upper part is the chest end, the lower the ear-piece. The most convenient measurements are—length, 7 inches; diameter of the ear-piece, 3 inches; circumference of shaft, 1¼ inch, and diameter of chest end, 1¼ inch. The main object of the stethoscope being to circumscribe and localize the sounds which it transmits, the chest end should be small, in order to determine the exact seat of the greatest intensity of sound. To ascertain this, the instrument should be moved right and left, up and down, till its end is on the exact spot from which the abnormal sound for which we are searching—or, it may be, the absence of sound—proceeds.

In the construction of the stethoscope, the following points should be attended to: 1. It should be composed of a material which allows the least amount of sound to be lost, and which least of all modifies or prevents the sound. A porous wood, such as cedar or deal, answers these conditions best, a dense wood, like ebony, having a tendency to modify the sound; 2. It should be of one piece of wood, and not, for example, part ivory and part cedar; 3. The ear-piece should be large and flat to secure perfect apposition and occlusion, and the chest end should be narrow and smoothly rounded over the edge. The various sounds heard through the stethoscope are described in the articles RESPIRATORY SOUNDS, PNEUMONIA, &c.

STETTI'N, an ancient town of Prussia, capital of the province of Pomerania (*Pommern*), and, after Danzig, the most important sea-port in the kingdom, is situated on the left bank of the Oder, where it flows into the Stettiner-Haff 83 miles north-east of Berlin, with which it is connected by railway. The entire population of this town in 1880 was 91,756. Across the river, which is here from 12 to 16 feet deep, lies the suburb of Lastadie, connected with S. proper by means of two bridges. Outside the fortifications lie the suburbs of Upper and Lower Wieck and Tornei. The site of the town is hilly, and in consequence the streets are uneven, but the houses are good and the environs very pleasant. The principal buildings are the castle or fortress, the government house, the 'county buildings' with a valuable library, the exchange, and theater. The chief manufactures are silks, leather, sail-cloth, cottons, &c. There is also a large anchor foundry, where all the anchors for Prussian ships are forged.

Ship-building and the manufacture of machinery give employment to great numbers; and the commerce of the city is extensive and increasing. S. is the port whence the products of Silesia, both natural and artificial, are mainly shipped to other countries. Corn, wood, and brandy are the principal articles of export. The value of the annual imports into S. is about £10,000; of the exports about half that amount. In the course of a year about 1700 ships enter the port from foreign countries, of near 200,000 tons burden. S. was formerly a fortress of the first rank.—The *Stettiner-Haff* is formed by an expansion of the river Oder, north of the town of S., and is nearly quite shut in from the Baltic, having communication with the sea only by three narrow straits, the most important of which is the Swine. See SWINEMUNDE. It has an area of 200 sq. m., and a depth of from 12 to 18 feet.

S., the ancient *Sedinum*, later *Stettinum*, is of Slavic origin, became a flourishing commercial town in the middle ages, joined the Hansa, and was repeatedly the residence of the Dukes of Pomerania.

STEUBEN, FREDERIC WILLIAM AUGUSTUS, BARON, a general of the American revolutionary army, was born at Magdeburg, Prussia, November 15, 1730, educated at the Jesuits' College of Niesse and Breslau; and at the age of 14 served as a volunteer under his father at the siege of Prague. In 1747 he was appointed cadet of infantry, and in 1758 had risen to the rank of adjutant-general. He was wounded in the battle of Kunersdorf, and in 1761 was conducted as a prisoner of war to St. Petersburg, but was shortly after released. The following year he was appointed adjutant-general on the staff of the Prussian king, effected important reforms in the quartermaster's department, and superintended an academy of young officers selected for special military instruction. At the close of the Seven Years' War, he traveled in Europe, and was appointed Grand Marshal and General of the Guard of the Prince of Hohenzollern-Hechingen. Being on a visit to Paris in 1777, where the cause of the American rebellion was favored by the government, he was invited by Count St. Germain to go to America. He arrived at Portsmouth, Virginia, December 1, 1777, and offered his services to General Washington, which were joyfully accepted; and he joined the army, then in the most deplorable condition, at Valley Forge.

He was appointed inspector-general, prepared a manual of tactics for the army, remodelled its organization, and improved its discipline. He was one of the officers who composed the court-martial at the trial of Major André. In the campaign of 1780 he had a command in Virginia, and was on the staff of General Lafayette at the siege of Yorktown. As generous in character as he was capable as an officer, he spent his whole fortune in clothing his men, and gave his last dollar to his soldiers. Congress made tardy reparation, and in 1790 voted him an annuity of 2500 dollars, and a township of land in the state of New York, both of which he divided with his fellow-officers. He died on his estate near Utica, New York, November 28, 1794. See Sparks's *American Biography*, and a Life by Fredrich Kapp (New York, 1860).

STEVENSON, ROBERT, a Scotch engineer, was born at Glasgow, 8th June, 1772. His father, who was a merchant connected with the West India trade, died during his infancy; and his mother having (1786) married Mr. Thomas Smith, the first engineer of the Light house Board, young S. was led to devote himself to the study of engineering, in which his progress was so rapid that in 1791 he was intrusted by Mr. Smith with the erection of a light-house on little Cumbrae. In 1796, he succeeded his father-in-law as engineer and inspector of light houses; and during his 47 years' tenure of that office, he planned and constructed no fewer than 23 light-houses round the Scottish coast; employing the catoptric system of illumination, and his valuable invention of 'intermittent' and 'flashing' lights.

The most remarkable of these erections was that on the Bell Rock (q. v.), for which he had been sketching plans for some time, when the wreck of the *York*, a 74-gun ship, on this reef drew general attention to the same subject. The enterprise was quite unprecedented in light-house engineering, for in the only instance at all analogous—the Eddystone Light-house—the rock was barely submerged at flood, while the Bell Rock was never uncovered except at very low ebb tides. In 1814, S., was accompanied in his tour of inspection by Sir Walter Scott, and while the former was projecting another light-house on the Skerryvore (q. v.), near Tiree, the latter was doubtless laying up ample materials for those minute descriptions of the west coast of Scotland and its islands which were afterwards embodied in the *Lord of the Isles*. S. was also in great request as a consulting engineer in the matter of roads, bridges, harbors, canals, and railways, introduced many improvements in their construction, and occasionally co-operated with Rennie, Telford, and others. He died in Edinburgh, July 12, 1850. Like most eminent practical men, S. has left few literary remains; these being merely four volumes of professional printed reports, a large work on the Bell Rock Light-house, some articles in the *Encyclopædia Britannica* and in the *Edinburgh Encyclopædia*, and a series of letters on the engineering works of the Netherlands in the *Scots Magazine* (1817). See his *Life* by his son, David Stevenson, C.E. (1878).

STE'VENSTON, a town of Scotland, county of Ayr, is a station on the Ardrossan and Saltcoats branch of the Glasgow and Ayr Railway, and is situated about three miles east of Ardrossan. Pop. (1881) 3556. S. consists mainly of one low, straggling, uneven, and narrow street, about half a mile in length; but the parish church is finely placed on a slight eminence, which commands a splendid view of the Arran Hills and the lower scenery

of the Firth of Clyde. Cotton-weaving used to be the chief industry of the place, but its prosperity now depends almost exclusively on the collieries and ironworks in its vicinity.

STEWARD OF ENGLAND, LORD HIGH, one of the great officers of state, and anciently the first officer of the crown in England. The dignity was in early times hereditary. From Hugh Grentmesnell, Lord Steward in the time of Henry II., it passed by the marriage of his daughter and co-heir to the family of De Bellomont, Earls of Leicester, and thence also by marriage to the Montforts, Earls of Leicester. On the death and attainder of Simon de Montfort, Earl of Leicester, in 1265, the office, reverting to the crown, was granted with the earldom of Leicester to Edmund, younger son of Henry III., and continued annexed to the earldoms of Lancaster and Leicester, till absorbed into the royal dignity on the accession of Henry IV. Since that time, there has been no permanent Lord Steward, but the office is temporarily revived when occasion requires, a Lord Steward being appointed under the Great Seal *pro hac vice* at a coronation, or the trial of a peer (see PARLIAMENT). When the proceedings are at an end, the Lord Steward terminates his commission by breaking his wand of office.

STEWARD OF THE HOUSEHOLD, LORD, an officer of the royal household in England, of great antiquity, originally designated the Lord Great Master of the Household. He is the head of the ancient court called the *Board of Green Cloth*, and as such has the control of all the officers and servants of the household, except those belonging to the Chapel, the Chamber, and the Stable. The other members of the Board of Green Cloth are the treasurer and the comptroller, over whom, as well as the Master of the Household, the Lord Steward's authority extends. That court, had, by 3 Hen. VII. c. 14, and 33 Hen. VIII. c. 12, authority to try and punish all treasons, misprisions, murders, manslaughters, bloodsheds, &c. in the royal palace, and within the verge of the court. But this jurisdiction, which had long fallen into disuse, was in part repealed by 9 Geo. IV. c. 31, and altogether abolished by 12 and 13 Vict. c. 101; and the functions of the Board of Green Cloth are now confined to the supervision of the household expenses and accounts, the purveyance of the provisions and their payment, and the good government of the servants of the household. The Lord Steward selects all the subordinate officers and servants, except those connected with the royal stables; he also appoints the Queen's tradesmen. He is always sworn a member of the Privy Council, and has precedence of all peers of his own degree. He has no formal grant of office, but receives his charge from the sovereign in person, who, delivering to him a white wand as his staff of office, says: '*Seneschal, tenez le bâton de notre maison.*' He holds his appointment during pleasure, and his tenure depends upon the political party to which he belongs. The salary of the office is £2000.

STEWARD or HIGH STEWARD OF SCOTLAND, an office of high dignity and power under the Scottish crown during the 12th, 13th, and 14th centuries (called in Latin *dapifer* or *seneschallus*). The High Steward not only was chief of the household, but collected and managed the crown revenues, and possessed the privilege of holding the first place in the army next to the king in battle. The office was early in the 12th c. conferred by David I. on Walter, second son of Alan, Lord of Oswestry, along with extensive territorial possessions, comprehending among others the barony of Renfrew; and the dignity of steward became hereditary in his family, who in virtue of their office assumed the surname of Stewart. The accession of Robert, the seventh High Steward, to the throne, as Robert II., merged the seneschalship in the crown; but the estates of the stewards afterwards became the appanage of the king's eldest son, and by act of the Scottish Parliament of 1469, the titles of Prince and High Steward of Scotland, Duke of Rothesay, Earl of Carrick, Baron of Renfrew, and Lord of the Isles, were vested in the eldest son and heir apparent of the crown of Scotland for ever. 'Great Steward of Scotland' has thus become one of the titles of the Prince of Wales. See STEWART, FAMILY OF.

STEWART, THE FAMILY OF. The origin of the Stewarts, long obscured by myth, was rediscovered in the beginning of the present century by the indefatigable antiquary, George Chalmers. Alan, son of Flahald, a Norman, accompanied the Conqueror into England, and obtained by his gift the lands and castle of Oswestry in Shropshire. His eldest son, William, remaining in England, became the ancestor of the Fitzalans, Earls of Arundel, from whom the Duke of Norfolk inherits that earldom through an heiress. The second son, Walter, passing into Scotland in the service of David I., had large territorial possessions conferred on him by that monarch, along with the dignity of Steward of Scotland, which became hereditary in his family, and was assumed by his descendants as a surname; some branches of the House, when spelling began to be considered, modifying the orthography to Steuart, or the French form Stuart. The fess chequy adopted as the arms of the family is emblematical of the chequer of the Steward's board. The connection between the Stewarts and Fitzalans was shown by Mr. Chalmers to have been well known and acknowledged as late as 1336, when Richard Fitzalan, Earl of Arundel, sold the Stewardship of Scotland to his sovereign, Ed. III., and Edward Baliol, as king of Scotland, ratified the transaction; the sale being a political fiction, founded on a supposed forfeiture of the Scottish branch of the family, by which the hereditary office reverted to the English branch.

The lands conferred on Walter the Steward by David I. included the barony, or what is now the county, of Renfrew, which became the chief patrimony of the family, as well as Innerwick, Hassendean, and other large estates in Teviotdale and Lauderdale. For seven generations the stewardship continued to descend without a break from father to son. Walter, the third, and grandson of the first Steward, held, in addition, the office of Justiciary of Scotland, and was one of the two ambassadors sent to conduct Marie de Couci, second wife of King Alexander II., to her adopted country. His third son, Walter, called Balloch, by his marriage with the younger daughter of Maurice, Earl of Menteith—the lady's elder sister having been banished and her rights forfeited—got the earldom of Menteith, and was ancestor of a line of earls and countesses of Menteith, of whom the Countess Margaret carried the earldom to her husband, Robert, Duke of Albany, son of King Robert II. Alexander, fourth Steward, was regent of Scotland in Alexander III.'s minority; he commanded at the battle of Largs in 1263, when the Scotch army obtained a signal victory over Haco of Norway; and invading the Isle of Man, annexed it to the Scottish crown. From his second son, Sir John Stewart, who married the heiress of Bonkyl, sprung various important branches of the family, including the Stewarts of Darnley, Lennox, and Aubigné. James, the fifth Steward, was one of the six regents of Scotland after the death of Alexander III.

Walter, the sixth Steward, occupies a conspicuous place among Bruce's companions-in-arms. When but a youth, he did considerable service as one of the principal leaders at Bannockburn, and, four years later, increased the promise of his fame by his successfull defence of Berwick against Edward II. in person. His marriage with Marjory, daughter of Robert Bruce, eventually brought the crown of Scotland to his family. He died at the age of 33, much lamented throughout Scotland. His son by Marjory Bruce, Robert, seventh High Steward, was regent from 1338 to 1341, and afterwards during the captivity of his uncle, David II., from 1346 to 1357; and in the midst of events which threatened a total overthrow to the liberties of Scotland, he exerted himself with zeal and energy in their defence, and was the main instrument in defeating the intrigues of David II. and Edward III. to place an English prince on the throne. On the death of David II. in 1371, he ascended the throne as Robert II., and died in 1390. He was twice married; first to Elizabeth, daughter of Sir William Mure of Rowallan, and afterwards to Euphemia, Countess of Moray, daughter of Hugh, Earl of Ross, and had issue by both unions. In consequence of Elizabeth Mure being related to him within the prohibited degrees, he obtained a dispensation for the marriage from Pope Clement VI. in 1347, in which those children who had already been born, as well as those to be born of that connection, were legitimated; and the succession to the crown was further regulated by parliament.

In later times, when the true history of these proceedings was lost or mystified, the descendants of Robert II.'s first marriage came to be branded with the suspicion of illegitimacy, while those of the second marriage were in the habit of boasting of their preferable claim to the throne; and the dispensation setting the question at rest was only discovered in the Vatican in 1789 by Andrew Stuart of Castlemilk. Of the children by the first marriage, the third son, Robert, Duke of Albany, and his issue are separately noticed below. The fourth son, Sir Alexander Stewart, who got the earldom of Buchan on the forfeiture of the Comyns, ruled over the northern part of Scotland with little less than regal authority, and his savage and ferocious character obtained for him the appellation of the 'Wolf of Badenoch.' He had no lawful issue, but several natural sons, one of whom stormed the castle of Kildrummy, the residence of the Countess of Mar, forcibly wedded that lady, and possessed himself of the earldom; and others were progenitors of the branches of the family known as the Athole Stewarts, of whom the principal were the Stewarts of Garth. For the subsequent history of the royal family, see articles ROBERT II. and III.; JAMES I., II., III., IV., V.; MARY, QUEEN OF SCOTS; JAMES I. (of England); CHARLES I. and II.; JAMES II.; WILLIAM AND MARY; and ANNE.

James II. (of England) was twice married, first to Lady Anne Hyde, daughter of Lord Chancellor Hyde; and secondly, to Mary Beatrice, daughter of the Duke of Modena. By the first marriage he had Mary, queen of William III., and Anne, who succeeded to the throne, neither of whom left issue; and by the second, James, Prince of Wales, born in 1688, known as the Chevalier St. George, or the elder Pretender. Prince James, who was born but a few months before his father's abdication, was commonly but ground-

lessly supposed to be a supposititious child, and was involved in his father's exclusion from the crown. In 1715, the party who supported him, known in history as the Jacobites, endeavored to procure him the throne by force of arms. In Scotland, the Earl of Mar, with about 5000 men, engaged the royal forces under the Duke of Argyll at Sheriffmuir: it was a drawn battle, but the result was a delay as fatal as a defeat. In England, the rising was headed by the Earl of Derwentwater, and ended by the unconditional surrender of the insurgents at Preston, when Lords Derwentwater and Kenmure were beheaded, and other persons of note executed and attainted. James escaped to France; and for the rest of his life resided in obscurity principally at Rome, where he died in 1766. In 1719, he married one of the wealthiest heiresses in Europe, Maria Clementina Sobieski, grand-daughter of John Sobieski, king of Poland, and by her had two sons, Charles Edward Lewis Casimir, born 1720, known as the young pretender (see STUART CHARLES EDWARD), and Henry Benedict Maria Clement, Cardinal York, born 1725.

Henry Benedict, second son of the Chevalier St. George, went to France in 1745 to head an army assembled at Dunkirk for the invasion of England, but the news of the defeat of Culloden put an end to his plan. He then returned to Rome, took orders, and was advanced to the purple by Benedict XIV. in 1747. During his brother's life, he was known as Cardinal York; but after his death he assumed the regal style as Henry IX., king of England. His various bishoprics and rich church livings enabled him for long to live in great splendor; but the expulsion of Pius VI. from Rome, and other events of the Revolution, drove him to Venice, aged and infirm, stripped of his means, and reduced to absolute poverty. His deplorable situation becoming known to the British court, George III. settled on him an annuity of £4000, which the cardinal accepted with gratitude, and enjoyed during the remainder of his life. He died in 1807, at the age of 82, the last surviving descendant of James II.

Next to the exiled Stewarts in representation of the royal house as heir-of-line came the descendants of Henrietta Maria, daughter of Charles I., who was married to Philippe, Duke of Orleans, brother of Louis XIV. of France. This princess had two daughters, of whom the elder, Mary, was queen to Charles II. of Spain, but died childless; the younger, Anna Maria, married Victor-Amadeus, Duke of Savoy and king of Sardinia, and was mother to Charles-Emmanuel III., king of Sardinia, and grandmother to Victor-Amadeus III., king of Sardinia. Victor-Amadeus had three sons who successively occupied the Sardinian throne as Charles-Emmanuel IV., Victor-Emmanuel I., and Charles-Felix, and a daughter who married Charles X. of France, and was mother of Henri, Duc de Bordeaux, present representative of the French Bourbons. Victor-Emmanuel and Charles-Felix left daughters only; and the present senior co-representative as heir-of-line of the House of Stewart, as well as that of Tudor, is Maria Teresa, wife of Prince Louis of Bavaria and only child of the younger brother of the last Duke of Modena, grandson of Victor-Emmanuel IV. The house of Savoy-Carignan, from which the king of Italy springs, does not participate in the Stewart descent.

The branch of the family which the parliamentary settlement called to the throne on the death of Anne were the descendants of the Electress Sophia of Hanover, grand-daughter of James VI. by her mother the Princess Elizabeth Stewart, Electress Palatine and queen of Bohemia. By this destination, not only were the already-mentioned descendants of Charles I.'s daughter, the Duchess of Orleans, excluded, but also the sons of the king of Bohemia and their descendants. The eldest son, Charles Lewis, Duke of Bavaria, is represented through his daughter, the Duchess of Orleans, by the Comte de Paris, grandson of Louis Philippe, late king of the French. Her Majesty Queen Victoria is sixth in descent from and representative of the Electress Sophia, the line of descent being through George I.; George II.; Frederick, Prince of Wales; George III.; and Edward, Duke of Kent.

We have now briefly to notice the most important cadets of the House of Stewart.

DUKES OF ALBANY, EARLS OF MARCH, LORDS OF ANNANDALE AND MAN.—The dukedom of Albany, forfeited on the attainder of Duke Murdoch, nephew of Robert III. (see *infra*), was conferred on Alexander, second son of King James II. of Scotland, who also obtained the earldom of March, and lordship of Anandale and Man. Albany, falling under suspicion of James III., was arrested, and escaping from custody in Edinburgh Castle to France, was attainted. He afterwards took part in a plot with the discontented barons and Edward IV. of England to place himself on the throne, and joining the English army, captured Berwick.

After making his peace with James, and being restored to his dukedom, he again rebelled, and invading Scotland with the Earl of Douglas, was routed at Lochmaben, and once more attainted. He was first married to Lady Catherine Sinclair, daughter of the Earl of Orkney and Caithness, from whom he obtained a divorce on the ground of propinquity of blood, by which his son Alexander was bastardized. By his second wife, the daughter of Bertrand, Count de la Tour d'Auvergne, he had a son John, who was restored to the dukedom, assumed the regency of Scotland in James V.'s minority, and was declared heir to the throne. By the settlement of the crown under Robert II., John, Duke of Albany, would, had he survived James V., have had a preferable claim to Mary. After a regency of eight years, during which he gave offence by his hauteur and French predilections, he returned to France, became governor of Bourbonnais, attended Francis I. in his unfortunate expedition into Italy in 1525, and died in 1536. By his wife, Anne de la Tour d'Auvergne, he left no issue.

DUKES OF ALBANY, EARLS OF FIFE AND MENTEITH.—Robert, second surviving son of Robert II. and Elizabeth Mure, obtained the earldom of Menteith by marriage with its heiress, and the earldom of Fife by indenture with his sister-in-law, the countess, and was appointed Great Chamberlain of Scotland in 1383. He practically exercised the regency during his father's declining years, and continued to wield the supreme authority after the succession of his timid and irresolute brother, Robert III., who bestowed on him the title of Duke of Albany—i. e., of all Scotland north of Forth and Clyde. His unscrupulous ambition led him to get rid of his nephew, the Duke of Rothesay, by starving him, in order to pave his way to the throne; and Prince James was sent abroad by his father, lest he should meet a similar fate. On Robert III.'s death, Albany at once became regent of Scotland, and wielded the chief power of the state during the minority and captivity of James I. By his first marriage to Margaret, Countess of Menteith, he had a son, Murdoch, who, on his father's decease in 1419, succeeded, unchallenged, to the regency. By his second wife, Muriella, daughter of Sir William Keith, the Marischal, he had, besides two younger sons of whom there was no succession, a son, John, created Earl of Buchan, on whom Charles VII. bestowed the office of Constable of France after the battle of Baugé, and who fell at Verneuil, leaving only a daughter, who married the second Lord Seton, and is represented by the Earl of Eglinton. Duke Murdoch married the eldest co-heiress of the Earl of Lennox, and had four sons.

On James I.'s restoration, his vengeance fell on Duke Murdoch, his sons Walter and Alexander, and his father-in-law, Lennox, who were all put to death, and the dukedom of Albany forfeited to the crown. Murdoch's youngest son, James, generally known as 'James the Gross,' escaped to Ireland, where he had a numerous issue by a lady of the family of the Lords of the Isles, some of whom were brought to Scotland, and raised to high honors by James II., and received letters of legitimation, which in the 15th c., conferred far more nearly than at a later date the full rights of legitimacy. The eldest, who was created Lord Avandale, enjoyed for life the estates of the earldom of Lennox, which had belonged to his grandmother, to the exclusion of the descendants of that lady's sisters; and we afterwards find the Earl of Arran, a descendant of the sixth son of James the Gross, entering a protest in the parliament of 1585 regarding the perfect legitimacy of the house of Ochiltree. From the youngest son James (not legitimated), sprung the Stuarts of Ardvorlich, Glenbuckie, and others in Balquidder.

LORDS AVANDALE, OCHILTREE, and CASTLESTUART; EARLS OF CASTLESTUART.—Andrew Stewart, eldest legitimated son of James the Gross, and grandson of Murdoch, Duke of Albany, was created Lord Avandale in 1455, and held the office of Chancellor to James III. On his death without issue in 1488, he was succeeded by his nephew, Andrew, eldest son of his also legitimated brother, Walter, who had three sons.

The eldest of these, Andrew, third Lord Avandale, exchanged his title for that of Ochiltree, and was father of Andrew second Lord Ochiltree, sometimes called the 'Good Lord Ochiltree,' an active promoter of the reformed faith, one of the Lord's of the Congregation, and an accomplice in the assassination of Riccio. One of his daughters became the second wife of John Knox; and his younger son, James, has an unenviable notoriety in history. He was the unprincipled and arrogant favorite of James VI.'s early years; held along with other offices that of Chancellor of Scotland; was created Earl of Arran on the forfeiture of the Hamilton family; and enriched himself with the spoils of the estates of Angus, Mar, Glammis, and other forfeited lords. But his downfall was as sudden as his elevation. At the Raid of Stirling, in 1585, he was stripped of his honors, offices, and spoils, the earldom of Arran being restored to the Hamiltons; and in 1596, he was assassinated by Sir James Douglas. The second Lord Ochiltree was succeeded by his grandson, Andrew, third Lord Ochiltree, who resigned the lordship of Ochiltree to his cousin, Sir James Stewart of Killeith, son of the Earl of Arran, settled in Ireland, where extensive lands were bestowed on him by James VI., and was in 1619 created Lord Stuart of Castlestuart in the peerage of Ireland.

After the death of the fifth Lord Castlestuart in 1684, the title remained dormant till claimed by Andrew, ninth lord, as heir-

male of the body of the first lord, which claim was proved to the satisfaction of the Irish House of Lords in 1774. The younger branch of the house, to whom the title of Ochiltree was transferred, had come to an end in 1673, and Lord Castlestuart claimed also the Ochiltree title; but the evidence adduced by him was held insufficient by the British House of Lords. He was, in 1793, created Viscount Castlestuart, and in 1800, Earl of Castlestuart; and the present and fifth earl is his great-grandson.

LORDS METHVEN.—Henry Stewart, second son of Andrew, second Lord Avandale, became, in 1526, third husband of the Princess Margaret of England, widow of James IV., and divorced wife of Archibald, Earl of Angus. In 1528, he was created Lord Methven He left no children by the queen-dowager, but by a second marriage had a son, who became second Lord Methven, and in the person of whose son, the third lord, the succession terminated.

LORDS DOUNE, EARLS OF MORAY, LORDS ST. COLME.—Sir James Stewart of Beath, third son of Andrew, second Lord Avandale, obtained from James V. the hereditary command of the castle of Doune, with the stewartry of Menteith. He had two sons, from the younger of whom sprang the Stewarts of Burray, in Orkney. The elder son, James, on the dissolution of the monasteries, obtained the lands of St. Colme, and was created Lord Doune in 1581. His son, the second Lord Doune, married Elizabeth, the only child of James Stuart, Earl of Moray, Regent of Scotland, natural son of James V. by Margaret, daughter of John, Lord Erskine (see MURRAY, JAMES, EARL OF), and thereupon became Earl of Moray. This nobleman is known in history as the 'Bonny Earl of Moray,' and fell a victim to his hereditary enemy, the Earl of Huntly, in 1592. His son, the third earl, is believed to have got a new investiture to heirs-male, and from him descends the present and fourteenth Earl of Moray. The ninth Earl became, in 1796, a peer of Great Britain, as Baron Stuart of Castlestuart. Henry Stuart, younger brother of the 'Bonny Earl of Moray,' was made a lord of parliament as Lord St. Colme in 1611, a title which, however, became extinct on his son's death without issue, and the estates reverted to the Earl of Moray. The family of Stuart of Duncarn sprang from a younger brother of the fifth earl.

EARLS AND MARQUISES OF BUTE, LORDS WHARNCLIFFE, LORDS STUART DE ROTHESAY.—Sir John Stuart, a natural son of Robert II., was made hereditary sheriff of Bute and Arran; and his descendant and representative, Sir James Stuart, had a baronetcy conferred on him in 1627. Sir James Stuart, grandson of the above Sir James, a privy councillor to Queen Anne, and a strenuous opponent of the Union, was raised to the peerage as Earl of Bute. The fourth earl was advanced to the Marquisate of Bute. The present peer is the third Marquis. Two grandsons of the third earl were raised to the peerage as Lord Wharncliffe, and a grandson of the same earl, Lord Stuart de Rothesay (the latter title is now extinct); and a grandson of the first marquis as Lord Stuart de Decies.

EARLS OF ANGUS.—Sir John Stewart (commonly called of Bonkyl), brother of James, fifth Steward of Scotland, was progenitor of some of the most considerable branches of the family, and direct ancestor in the male line of James VI. and the Stuart kings who followed him. He married Margaret, daughter and heiress of Sir John Bonkyl of Bonkyl, in virtue of which alliance most of his descendants added the bend or buckle of the Bonkyl coat to the fess of the Stuart escutcheon. The issue of this marriage was five sons—1. Sir Alexander Stewart of Bonkyl; 2. Sir Alan Stewart of Dreghorn; 3. Sir Walter Stewart of Dalswinton; 4. Sir John Stewart of Jedworth; 5. Sir James Stewart of Pierston; and a daughter, Isabel, who married the celebrated Thomas Randolph, Earl of Moray, nephew of Robert Bruce.

The eldest son, Sir Alexander, succeeded to Bonkyl on his maternal grandfather's death, and was father of Sir John Stewart, created Earl of Angus in 1329. The third earl, grandson of this Sir John, was the last male descendant of Sir Alexander of Bonkyl; and on his death, the earldom devolved on his sister, Margaret Stewart, Countess of Angus in her own right. This lady was married to Thomas, Earl of Mar, by whom she had no issue; but she had a natural son, George, by William, first Earl of Douglas (a connection then deemed incestuous, the earl being brother-in-law to her husband), upon whom, on her resignation, the earldom of Angus was conferred by Robert II. in 1389, and who was ancestor of the Douglases, Earls of Angus.

EARLS OF DARNLEY, EARLS AND DUKES OF LENNOX, LORDS OF AUBIGNÉ.—Sir Alan Stewart of Dreghorn, second son of Sir John of Bonkyl, who with his brothers, John and James, fell at Halidon Hill in 1333, was ancestor of this distinguished line. His domains included the extensive lands of Cruickston and Darnley, in Renfrewshire, to which his grandson, Sir Alexander Stewart, added Galston by his marriage with Janeta, daughter and heiress of Sir William Keith of Galston, and widow of Sir David Hamilton of Cadyow.

Sir John Stewart of Darnley, eldest son of this marriage, distinguished himself much in the French wars, when succors were sent from Scotland to the aid of the Dauphin, afterwards Charles VII. He was Constable of the Scots army in France, and contributed greatly to the victory of the Baugé, in recompense for which the lands and lordship of Aubigné and Concressault, in France, were conferred on him, as well as the county of Evreux, with permission for himself and his descendants to quarter the royal arms of France. In 1428, he was one of the ambassadors sent by Charles to negotiate a marriage between the Dauphin and the Princess Margaret of Scotland; and in the following year, along with a younger brother, William, fell at the siege of Orleans. His marriage with Elizabeth, one of the daughters and co-heirs of Duncan, Earl of Lennox, afterwards added the Lennox estates to the family possessions. According to arrangements made by permission of the king of France, the lordship of Aubigné was generally enjoyed by a younger member of the family; it went in succession to the third son of Sir John Stuart, and to his son, Bernard Stuart. The latter, alike distinguished for military and statesmanlike qualities, had a share in the victory of Bosworth, and supported by arms Charles VIII.'s claim to the throne of Naples. He held, among other dignities, those of Viceroy of Naples, Constable of Sicily and Jerusalem, and Duke of Terra Nova.

His grandson, Sir John Stuart, was advanced to the dignity of a lord of parliament under the title of Lord Darnley; he was also served heir to half the Lennox domains, and claimed the earldom of Lennox. His elder son, Matthew, second earl of Lennox, fell at Flodden; his younger son, Robert, got the lordship of Aubigné in 1508, on the death, without issue, of Bernard Stuart, whose daughter was his first wife. John, the third Earl of Lennox, was son of the second earl by Elizabeth, daughter of James, Lord Hamilton, and niece of James III.; he was one of the lords of the regency in James's V.'s minority, and in endeavoring to rescue the youthful king from the thraldom of the Douglases, he was taken prisoner at Linlithgow, and murdered by Sir James Hamilton of Finnart, Arran's natural son. This earl was married to Lady Anne Stewart, daughter of John, Earl of Athole, and had three sons, Matthew—who succeeded him as fourth earl—Robert, and John. The termination of the male line of Robert III. by the death of James V., along with the imperfect legitimacy of the descendants of the house of Albany, placed Matthew Earl of Lennox, in the position of heir-male of the Stewards of Scotland. He married Lady Margaret Douglas, only child of Archibald, Earl of Angus, by the queen-dowager Margaret, sister of Henry VIII., an alliance which brought his children into the position of being nearest heirs after Mary, Queen of Scots, to the crown of England. The issue were two sons, the elder of them the unhappy husband of the unhappy Queen Mary, and father of James VI.

Lennox, after spending his youth in France and in the wars in Italy, returned home in 1543, and took an active part in the negotiations for the proposed marriage of Queen Mary with Edward VI. His subsequent intrigues with England led to his banishment and attainder, but he was recalled and restored to his honors by Mary. After that queen's forced resignation, he was appointed to the regency, and when on his way to hold a parliament at Stirling in 1571, he was attacked by a party of the queen's friends and mortally wounded.

The earldom and estates of Lennox, which, on the death of the fourth earl, had devolved on James VI. by right of blood, were conveyed by him to his uncle, Charles, fifth Earl of Lennox, brother of Lord Darnley. The marriage of this earl in 1574, with a sister of the first Earl of Devonshire, gave great displeasure to Elizabeth, whose own doubtful legitimacy made her very sensitive to possible pretensions to the throne. The sole issue of that union was a daughter, Arabella, and the earldom went in succession to the fifth earl's uncle, Robert, Bishop of Caithness, and his cousin, Esme, son of John Stewart, Lord of Aubigné, youngest son of the third Earl of Lennox, who was created Duke of Lennox. The near relationship to the crown, both of England and Scotland, in which the fifth earl's daughter, the unfortunate Lady Arabella Stewart, stood, made her an object of jealousy equally to James and Elizabeth.

Elizabeth first interfered to prevent her contemplated marriage with her cousin, Esme, Duke of Lennox, and afterwards imprisoned her for listening to overtures from a son of the Earl of Northumberland. The result was, that this lady formed an illicit connection with William Seymour, afterwards Marquis of Hertford; on the discovery of which, both were summoned by James before the Privy Council, and severely reprimanded. The consequence was the reverse of what was intended. Lady Arabella privately married Seymour; which becoming known, she and her husband were committed into custody. Both effected their escape: Lady Arabella was overtaken in Calais Roads, and imprisoned in the Tower, where these undeserved oppressions drove her to a condition of lunacy, in which she died, 27th September 1615. Esme, first Duke of Lennox, had two sons, Ludovic and

Esme, successively second and third Dukes of Lennox. The former held the offices of Great Chamberlain and High Admiral of Scotland, and was created Earl of Richmond, Earl of Newcastle, and Duke of Richmond in the peerage of England. The latter, who was also Lord of Aubigné, was created Earl of March in England, and was father of James, fourth Duke of Lennox, who fell under the guardianship of James VI. as his nearest heir-male, and had the title of Duke of Richmond, which had expired at his uncle's death, revived in his favor in 1641. On the death of the sixth and last duke without issue in 1672, King Charles II., as nearest heir-male, was served heir to him in special.

LORD PITTENWEEM.—Alexander Stewart of Galston, younger brother of the first Lord Darnley, got from his brother the lands of Dreghorn and Galston. His great-grandson, Thomas Stewart of Galston, had two sons, Thomas and William. The younger son, William, became commentator of the Priory of Pittenweem, and his son was made a Lord of Parliament as Lord Pittenweem. The line of the elder son, Thomas, failed in 1650 in the person of Ludovic Stuart of Galston.

STUARTS OF CASTLEMILK.—The earliest proved ancestor of this important and well-allied branch of the Stewarts, was Sir William Stewart of Castlemilk, who in 1398 was appointed umpire for the preservation of the Western Marches, probably descended from the Stewarts of Darnley. Archibald Stewart of Castlemilk was created a baronet of Nova Scotia by Charles II. His line failed on the death of Sir John Stuart, fifth baronet, in 1797, when the succession devolved on Andrew Stuart of Torrance and Castlemilk, M.P., the author of *The Genealogical History of the Stewarts*, descended from an uncle of the first baronet, who died without issue.

STEUARTS OF ALLANTON, COLTNESS, &c.—This family, which first came into notice in the 16th c., and includes various men of eminence who would do honor to any line of ancestry, is of unascertained descent, but some traditional accounts make it a branch of Castlemilk. Sir James Steuart of Coltness and Kirkfield, younger brother of Sir Walter of Allanton, and his son, Sir Thomas, were active Covenanters; and the latter, an energetic member of King William's first parliament, and the framer of the Act of 1690 for the regulation of the Church of Scotland, was in 1698 made a baronet. His son, Sir David Steuart of Coltness, accompanied Archibald, Earl of Argyll, in his descent on Scotland, for which he was sentenced to death, but escaped, and was afterwards pardoned. His brother, Sir Robert Steuart, fourth baronet, was among the more distinguished scientific men of the beginning of the 18th c., and filled the Natural Philosophy chair in the university of Edinburgh, in which he was succeeded by his son. Sir James Steuart of Goodtrees, Lord Advocate under King William and Queen Anne, author of the Answers to *Dirleton's Doubts*, and one of the most eminent jurists of his time, was younger brother to the first baronet of Coltness. His son, Sir James Steuart of Goodtrees and Coltness, also a distinguished lawyer, and created a baronet in 1705, was father of another Sir James, who was Prince Charles's confidential agent at the Court of France, and at the same time the author of various works of merit on political economy and kindred subjects.

EARLS OF GALLOWAY.—Sir Walter Stewart of Dalswinton, third son of Sir John of Bonkyl, obtained the lands of Dalswinton from King Robert Bruce, and Garlies from his nephew, John Randolph, Earl of Moray. His grandson, Sir Walter of Dalswinton, left an only daughter, Marion, who married Sir John Stewart, son of Sir William Stewart of Jedworth, and probably a descendant of John, fourth son of Sir John of Bonkyl. Sir Alexander Stewart of Garlies, eighth in descent from Sir John and Marion Stewart, was created Lord Garlies in 1607, and Earl of Galloway in 1623. In 1796, John, seventh Earl of Galloway, was created a British peer as Baron Stewart of Garlies. Alan Plantagenet Stewart, tenth Earl of Galloway, is present representative.

LORD BLANTYRE.—This branch of the House of S. is descended from Sir Thomas Stewart of Minto, third son of Sir William of Dalswinton and Garlies, the eldest son of the heiress, Marion Stewart. Sir John Stewart of Minto, great-grandson of that Sir Thomas, had two sons. The line of the elder, Sir Matthew, became extinct in the person of Sir John Stuart, who died in the Darien expedition of 1697. The second son, Walter, was educated along with James VI. under George Buchanan, and had the priory of Blantyre bestowed on him by that monarch: he was Privy Councillor, Keeper of the Privy Seal, one of the four Commissioners of the Treasury and Exchequer, called Octavians, and afterwards High Treasurer. In 1606 he was raised to the peerage as Lord Blantyre. The present representative of this branch is Charles Stuart, twelfth Lord Blantyre.

VISCOUNTS MOUNTJOY. EARL OF BLESSINGTON.—Sir William Stewart, descended from Walter Stewart of Tonderghie, fourth son of Sir William of Dalswinton and Garlies, who was in great favor with James VI., and undertaker for the plantation of escheated lands in Ulster, was made a baronet of Ireland in 1623. His grandson, Sir William Stewart, second baronet, was in 1682 created Baron Stewart of Ramalton, and Viscount Mountjoy in the peerage of Ireland. He served in Hungary at the siege of Buda, and in 1688 undertook a mission from Lord-deputy Tyrconnel to James II., then at Paris, when he was thrown into the Bastille, and was a prisoner there for four years. He afterwards joined King William at Flanders, and was killed at the battle of Steinkirk. The second viscount, his son, married the daughter and eventually heiress of Viscount Blessington. Their son, the third Viscount Mountjoy, was advanced to the Earldom of Blessington, which title, as well as that of Mountjoy, became extinct on his decease in 1769, though the baronetcy exists.

EARLS OF ATHOLE, LORDS OF LORN AND INNERMEATH.—Sir James Stewart, fifth son of Sir John of Bonkyl, killed with his brothers Alexander and John at Halidon Hill, had a grant from Robert Bruce of the lands of Pierston and others in Ayrshire, and was father of Sir Robert Stewart of Shanbothy and Innermeath. This Sir Robert had two sons, John and Robert, who married the two co-heiresses of the princely house of De Ergadia, Lord of Lorn, who were also co-heirs of the line of Robert Bruce. The younger son, Robert of Durrisdeer, was ancestor of a line of Stewarts of Rossyth and Craigiehall, to whom Oliver Cromwell's mother is said, on no very certain grounds, to have belonged, and which probably came to an end about 1830. The elder son, Sir John, whose wife was the elder and principal co-heiress, had five sons. The eldest, Robert, became Lord of Lorn; the third, Sir James, known as the Black Knight of Lorn, was husband of James I.'s widow; and his eldest son, brother uterine of James II., was created Earl of Athole, with remainder to the heirs-male of his body. His great-grandson, John Stewart, fourth Earl of Athole, was much involved in the political events of Mary's and James VI.'s time. An adherent of the old faith, and at first a staunch supporter of the queen, he nevertheless assisted in her seizure, and took a lead in the association formed in 1567 for the defence of James VI. He headed the confederacy which took up arms against the Regent Morton, and induced James to call a parliament. In 1577, he became Chancellor of Scotland, and died suddenly under suspicion of poison from Morton. His son, the fifth Earl of Athole, had no male issue, but daughters, of whom the eldest was married to the Earl of Tullibardine; and at his death, the earldom fell to the crown, and was conferred on the elder branch of the House of Innermeath, to which we now revert.

Robert, Lord of Lorn, eldest brother of the Black Knight, had two sons. The elder of these, John, second Lord of Lorn, had three daughters, co-heiresses, who respectively married the Earl of Argyll, Campbell of Glenorchy, and Campbell of Ottar, the lordship of Lorn passing to the Argyll family; he had also a natural son, ancestor of the Stewarts of Appin. The second son of Robert, Lord of Lorn, was Walter, Lord Innermeath, whose descendant and representative, John, sixth Lord Innermeath, obtained the earldom of Athole on the death of the above-mentioned fifth earl; with a remainder to the heirs-male of his body, which came to an end on the death, in 1625, of his only son, who had succeeded him in the earldom. The earldom of Athole was then conferred by Charles I. on the Earl of Tullibardine, grandson through his mother of the fifth Earl of Athole, from whom the existing ducal House of Athole is descended. From Alexander, fourth son of Sir John Stuart of Innermeath, descend the family of Stewart of Grandtully, on whom a baronetcy was conferred in 1683.

EARLS OF BUCHAN.—The earldom of Buchan was, in 1469, bestowed on James Stewart, second son of the Black Knight of Lorn, and brother uterine of James II. By his marriage with the heiress of Auchterhouse, his family became heritable sheriffs of the county of Forfar. His legitimate line ended in the fourth generation in an heiress, Christian, Countess of Buchan, who, marrying a son of Sir Robert Douglas of Lochleven, carried the earldom of Buchan into his family.

EARLS OF TRAQUAIR.—This James Stewart, first Earl of Buchan, had, besides his lawful issue, a natural son, James, legitimated in 1489, on whom his father conferred the lands of Traquair. His descendant, Sir John Stuart, was created by Charles I. Lord Stuart of Traquair in 1628, and in 1633, Earl of Traquair. The title became extinct or dormant on the death of the eighth earl in 1861.

Various works have been written to elucidate the history of the S. family, or particular branches of it, including Symson's *General and Historical Account of the Stewarts* (Edin. 1712); Hay of Drumboote's *Essay on the Origin of the Royal Family of the Stewarts* (1722); Duncan Stewart's *Historical and Genealogical Account of the Royal Family of Scotland, and of the Surname of Stewart* (Edin. 1739); Noble's *Historical Genealogy of the Royal House of Stewart* (Lond. 1795); and Andrew Stuart of Castlemilk's *Genealogical History of the Stewarts* (Lond. 1798), a work full of laborious research, but nearly confined to the Houses of Darnley, Lennox, and Castlemilk. See also *The Genealogy of the Stewarts refuted* (Edin. 1799), and the rejoinder to it in Andrew Stuart's *Supple-*

ment to the Genealogical History of the Stewarts (1799); Chalmer's *Caledonia* (1807—1824); Crawford's *Description of the Shire of Renfrew, with Supplement* by George Robertson (Paisley, 1818); Fraser's *Red Book of Grandtully* (Edinburgh, 1868).

STEWART, DUGALD. This philosopher was born in Edinburgh, on the 22d November 1753. His father was Matthew Stewart, Professor of Mathematics in the university of Edinburgh. He entered the High School in his eighth year, and remained till his thirteenth. During the last two years of his attendance, when in the rector's classes, he was principally under Alexander Adam, afterwards well known for his classical scholarship, who then began to teach as the rector's substitute. His subsequent course at the university extended from 1765 to 1769. In the departments of study where his own career afterwards lay, he was fortunate to find professors of ability and distinction; the logic chair was filled by John Stevenson, who lectured on logic, metaphysics, rhetoric, and the history of philosophy; the Moral Philosophy chair was occupied by Adam Ferguson. While S. gave his highest promise in these subjects, he also made great attendance in mathematics and natural philosophy, and likewise in classics. In 1771, he went to study at Glasgow, partly with a view to one of the Snell scholarships at Baliol College, Oxford, and partly to attend the lectures of Dr. Reid. It was while there that he wrote an essay on Dreaming, which was his first effort in mental philosophy, and contained the germs of many of his subsequent speculations. He lived in the same house with Archibald Alison, the author of the *Essay on Taste*, and the two became intimate friends through life. He was at Glasgow only one session.

In 1772, in his 19th year, he was called upon by his father, whose health was failing, to teach the mathematical classes in the university of Edinburgh; in 1775, he was elected joint professor, and acted in that capacity till 1785. In 1778, Adam Ferguson was absent from his post on a political mission to America, and S. taught the moral philosophy class in addition to his mathematical classes. The lectures that he gave on this occasion were wholly his own, and were delivered from notes, as was his practice in after years. On the resignation of Ferguson in 1785, he was appointed Professor of Moral Philosophy, and continued in the active duties of the class for 25 years. His lectures were greatly admired and numerously attended. He went over a wide compass of subjects: Psychology, or the Science of Mind proper, Metaphysics, Logic, Ethics, Natural Theology, the Principles of Taste, Politics, and last of all, Political Economy, which, from the year 1800, he treated in a separate course. In 1792, appeared his first volume of the *Elements of the Philosophy of the Human Mind*. In 1793, he published his *Outlines*. He read before the Royal Society of Edinburgh, in 1793, his *Account of the Life and Writings of Adam Smith;* in 1796, the *Account of the Life and Writings of Principal Robertson;* and in 1802, the *Account of the Life and Writings of Dr. Reid*. In 1805, he took a prominent part in the Leslie controversy; being the author of a pamphlet setting forth the facts of the case, and also, in the General Assembly, giving vent to his indignation at the proceedings against Leslie.

In 1806, on the accession of the Whig party to power, he received a sinecure office worth £300 a year. The death of his second son, in 1809, gave a blow to his health, otherwise indifferent, and he was unable to lecture during part of the following session; Dr. Thomas Brown, at his request, acting as his substitute. The following year, Brown was appointed conjoint professor, and taught the class till his death in 1820. From 1809, S. lived in comparative retirement at Kinneil House, Linlithgowshire, which the Duke of Hamilton placed at his service. In 1810, he published his *Philosophical Essays;* in 1814, the second volume of the *Elements;* in 1815, the first part, and in 1821, the second part, of the *Dissertation on the History of Ethical Philosophy;* in 1827, the third volume of the *Elements;* and in 1828, a few weeks before his death, the *Philosophy of the Active and Moral Powers*.

On the death of Brown, S. exerted himself to secure the appointment of Sir W. Hamilton to the chair, but the influence used with the Town Council in behalf of John Wilson was overpowering; the votes stood 21 for Wilson, 9 for Hamilton. S. resigned his conjunct professorship on the 20th June 1820.

The philosophy of S. was the following up of the reaction commenced by Reid against the sceptical results that Berkeley and Hume drew from the principles of Locke. Both Reid and S. professed the Baconian method of observation and induction, as against mere ontology, but considered that these processes of investigation could establish certain ultimate truths of a higher certainty than themselves. Hence arose the principles of common sense of Reid, in which S. for the most part acquiesced. S. also followed and improved upon Reid in that systematic exposition of all the powers of the mind which rendered mental philosophy for the first time a subject of study, independent of metaphysical, logical, and ethical applications; although he also followed it out in all these directions with his usual perspicacity and felicity of exposition. His contributions to the philosophy of Taste, in the *Philosophical Essays*, are among the best parts of his writings.

On the whole, although S. was not one of the most original thinkers in his department, yet, by the force of his teaching and the compass of his writings, he did more than almost any man to diffuse an interest in the speculations connected with the human mind. His collected works have been edited by Sir W. Hamilton, in 11 vols., to which Professor Veitch has contributed his biography.

STEW'ARTON, a town of Scotland, county of Ayr, on the right bank of the Annock, five miles north-west of Kilmarnock, and a station on the Glasgow and South-Western Railway. It is a trim, well-built, and prosperous place. S. owes its prosperity to its woollen and Scotch bonnet manufactures; but it also carries on a variety of minor industries, such as carpet-weaving, Ayrshire needle-work, and the making of spindles for mills. Pop. (1881) 3130.

STEW'ARTRY, the name which was given in Scotland to a district governed by a steward, an officer appointed by the king with jurisdiction over crown-lands, and powers similar to those of a lord of regality. While the civil jurisdiction of a steward was equivalent to that of a sheriff, his criminal jurisdiction was much more extensive. The only remaining trace of this jurisdiction exists in the term stewartry, which in place of county is applied to the district of Kirkcudbright.

Galloway was in early times rather a tributary dependency of Scotland than an integral portion of the kingdom, and retained its old Celtic proprietary, and peculiar laws and usages, which were adverse to the introduction of a sheriffdom. It was for a long time ruled by a line of lords, who were among the most powerful feudatories of the Scottish crown. The Comyns, who in the course of time succeeded to the lordship, were overthrown and expatriated by Bruce; and it seems to have been on their forfeiture that Eastern and Central Galloway were erected into the present stewartry. Western Galloway being already under the jurisdiction of the sheriff of Wigton. On the abolition of heritable jurisdictions in 1747, various regalities and baronies which had existed within the district were done away with, and the emancipated stewartry was placed under a steward-depute, whose functions were in every practical point of view the same as those of a sheriff-depute. Act 1 Vict. c. 39, declares that in any existing or future statute the words sheriff, sheriff-clerk, &c. shall be held to apply to steward, steward-clerk, &c.

STEWING, in Cookery, a very economical way of preparing meat and fruits for food. It differs from boiling in this respect, that only a small quantity of water is used, and the heat applied is so gentle as only to *simmer* it. A stew-pan should be well fitted with a lid, and the more slowly the ebullition is carried on the better. As the small quantity of water is retained as gravy, nothing is lost. Meat prepared in this way is tender, and savory, but owing partly to the richness of the gravy is not very digestible.

STEY'ER, a town of Upper Austria, at the confluence of the Steyer and the Enns, 23 miles south-east of Linz. It is a great seat of the iron and steel manufactures of Austria, and also carries on important manufactures of paper, woollens, and hosiery. Pop. (1880) 17,199.

STHAVIRA (a Sanscrit word, meaning *old*) is, in Buddhist hierarchy, the name of the 'elders' or 'venerables,' who, after the death of *the* Buddha S'âkyamuni, taught the doctrine, presided at the Buddhist assemblies, &c., and, since the time of As'oka, were invested with a kind of episcopal power. In the sectarian history of Buddhism, Sthavira is the name of those Arhats who did not follow the schism of the Mahâsânghikas (q. v.), but adhered to the old doctrine. According to another account, the Sthaviras are one of the four divisions of the Vaibhâshika system of Buddhism, and claim for their founder Kâtyâyana, the disciple of S'âkyamuni.—See C. F. Koeppen, *Die Religion des Buddha* (Berlin, 1857); and W. Wassiljew, *Der Buddhismus, seine Dogmen, Geschichte und Literatur* (St. Petersburg, 1860).

STICKING-PLASTER, or COURT-PLASTER, is best prepared in the following manner: Two solutions are first made, one of an ounce of isinglass in eight ounces of hot water, and the other of two drachms of gum-benzoin in two ounces of rectified spirit. These solutions are to be strained and mixed. Several coats of this mixture, kept fluid by a gentle heat, are then to be applied with a camel's-hair brush to a piece of black silk stretched on a frame, each coat being allowed to dry before the next is applied. A layer of a solution composed of one ounce of Chian turpentine in two ounces of tincture of benzoin, is then to be applied to the other side of the silk, and allowed to dry. In place of the ordinary black sticking-plaster, some persons prefer colorless plaster, or *Gold-beater's Skin* (q. v.).

STI'CKLEBACK (*Gasterosteus*), a genus of acanthopterous fishes, referred by many naturalists to the family of Mailed Cheeks

(q. v.) (*Sclerogenidæ* or *Triglidæ*); by others, to a distinct family (*Gasterosteidæ*), in which the first dorsal fin is represented by a number of detached spines, a single strong spine occupies the place of the ventral fins, there are only three branchiostegal rays, the gill-covers are not armed, and the body is mailed by plates on the lateral line, and destitute of scales. The species are found in fresh and brackish waters, and in the sea, in cold and temperate regions; and are small fishes, very interesting from their habits and the beauty of their colors, which they change in a remarkable manner, partly according to the colors of surrounding objects, and partly through the influence of their own passions.

The THREE-SPINED S. (*G. aculeatus* or *trachurus*), having three spines instead of the first dorsal, is extremely abundant in rivers, ponds, and brackish waters in most parts of Britain and of Europe, and is sometimes also found in the sea. Sticklebacks caught in a river readily accommodate themselves to living in a salt-water aquarium. It seldom exceeds two inches and a half, or three inches in length. Cuvier and Valenciennes, Yarrell, and others

Sticklebacks and Nests.

distinguish from this several other species, some of which are also British, differing in size, the armature of the sides, and other particulars (4 to 15 spines); but some naturalists are still inclined to regard them as mere varieties. The common fresh-water species are sometimes so abundant in ponds, ditches, and the still parts of rivers, as in Lincolnshire and other flat parts of the east of England, that they are used for manure. They are seldom used as food, yet they are said to be excellent for this purpose. Oil has sometimes been expressed from them.

In the aquarium, or in their native waters, their combats are very amusing. They are excessively pugnacious, particularly at the breeding season. The larger often devour the smaller, and they destroy the fry of fishes to a prodigious extent; they feed also on aquatic larvæ, and are probably of great use in preventing the excessive multiplication of many kinds of insects. Their nest-building is particularly interesting, and in them nest-building was first observed among fishes. They collect small pieces of straw or stick, with which the bottom of the nest is laid among water-plants, and these they cement together by an exudation from their own bodies, which forms a thread through and round them in every conceivable direction. The thread is whitish, fine, and silken. The sides of the nest are made after the bottom. The nest of the Fresh-water S. is about the size of a small hazel nut. The eggs, about the size of poppy-seeds, are deposited within. The male makes the nest, into which he introduces the female for the laying of the eggs, and he afterwards watches it with great care—a care not unnecessary, as the eggs are most acceptable food to any other S. which can get at them.

STIFF-NECK (known also as WRY-NECK or TORTICOLLIS) is the term commonly applied to a condition of the neck in which lateral movement of the head causes great pain, and which is due to rheumatism of the muscles lying on the side of the neck, especially the sterno-mastoid. In the great majority of cases, only one side of the neck is affected, the head being drawn more or less obliquely towards that side; but occasionally both sides are equally attacked, in which case the head is kept stiffly erect and looking straight forwards. As long as the head is allowed to remain at rest, there is merely a feeling of discomfort; but every movement is extremely painful. This affection is usually caused either by exposure of the part affected to a current of cold air, or by wearing wet or damp clothes around the neck. In addition to the ordinary treatment of sub-acute Rheumatism (q. v.), heat may be advantageously employed, either, as suggested by Dr. Wood of Philadelphia, by placing a batch of carded tow or cotton over the part, and then applying a hot flat-iron, or by the direct application of a small heated iron hammer, as recommended by Drs. Corrigan and Day. For the method of applying this hammer, and for cases illustrative of its use, the reader is referred to the last-named physician's memoir *On the Thermic Treatment of Lumbago and other Forms of Muscular Rheumatism*.

STIGMA. See PISTIL.

STIGMARIA, the root of Sigillaria (q. v.).

STIGMATIZA'TION (Lat *stigmatizatio*, a puncturing, from Gr *stigma*, a puncture), the name applied, by the mystic writers of the Roman Catholic Church, to the supposed miraculous impression on certain individuals of the 'stigmata,' or marks of the wounds which our Lord suffered during the course of his Passion. These stigmata comprise not only the wounds of the hands and feet, and that of the side, received in the crucifixion, but also those impressed by the crown of thorns and by the scourging. The impression of the stigmata, being held to be miraculous was regarded as a mark of the signal favor of our Lord, manifested to those who were specially devoted to the contemplation of his Passion. The most remarkable example of stigmatization is that already referred to in the memoir of FRANCIS OF ASSISI (q. v.), which is said to have occurred on the mountain of Alverno, upon the 15th September 1224, two years before the death of Francis. Being absorbed, according to the account of his biographers, in profound and rapturous contemplation of the Passion of Christ, he saw, as it were, a seraph with six shining wings, blazing with fire, and having between his wings the figure of a man crucified, descend from heaven, and approach him, so as to be almost in contact. After a time, the vision disappeared, but left the soul of Francis filled with reverence and awe; and on his return to calmer thought, he became aware that his body had received externally the marks of the crucifixion.

His hands and feet seemed bored through with four wounds, and these wounds appeared to be filled with nails of hard flesh, the heads of which protruded and appeared upon the palms of his hands, and on the instep, while the points protruded upon the opposite side, and seemed as if clenched with a hammer. His side, moreover, presented a red wound, as though from the point of a lance, and this wound occasionally gave forth blood. These mysterious marks continued, and were frequently seen by St. Bonaventure and others during the two years which intervened between this date and the death of Francis; and they were seen by multitudes after his death.

It would be out of place here to enter into any discussion as to the origin, or the nature, of this strange phenomenon. But the case of Francis of Assisi is by no means a solitary one; very many others, women as well as men, are recorded as having received all or some of the stigmata. The cases of women so visited are more numerous than those of men. A very remarkable one is that of Veronica Giuliani, in 1694, who is related to have received first the marks of the crown of thorns, and afterwards those of the crucifixion; Gabriella da Piezolo of Aquila is recorded to have received the mark of the lance in 1472; Clara di Pugny, a Tertiary of the Dominican order, was similarly impressed in 1514; and Cecilia di Nobili of Nocera in 1655.

Catherine di Raconisio is alleged to have been marked with the crown of thorns in 1583, and the same is related of several others, as Maria Razzi of the island of Chio, Maria Villani, Vincenza Ferreri of Valencia, and Joanna Maria of the Cross, a nun of St. Clare, at Roveredo. In some cases, the visitation, although said to be accompanied with excruciating pain in the seat of the several wounds, was unattended by any external marks. Such was the case of St. Catherine of Siena, of Ursula Aguirre—otherwise known as Ursula of Valencia—of Mary Magdalen di Pazzi, and of Mechtildis von Stanz; while in other cases the wounds were in part visible, and in part invisible. Thus, Hieronyma Carvaglio suffered the pain of the wounded hands and feet without any external mark, while the lance-wound was not only visible in her side, but was reported to bleed upon every Friday, the day especially devoted to the commemoration of the Passion. Blanca de Gazeran experienced the sensation of pain in the seat of each one of the wounds, but the mark of the nail was visible upon the right foot only. The same variety of sensation is recorded in several other cases.

Most of the cases recorded hitherto are of females; and that examples of these are not wanting even in more recent times, the case of the well-known 'Estatica' of Caldaro, about 40 years ago, and that of Louise Lateau, discussed quite recently, sufficiently attest. But, besides that of Francis of Assisi, instances are also recorded in which men were reputed to have received the stigmata. A Capuchin named Benedict, of Reggio, is said to have received the marks of the crown of thorns in 1602. A lay-brother named Carlo di Saeta, or Sazia, was smitten in a vision with the wound in the side. Angelo del Paz, a Franciscan, is related to have borne for many years all the stigmata, as also a Premonstratensian monk named Dodo, and a Franciscan called Nicholas of Ravenna. Several cases also are mentioned of men, who, without the visible or external stigmata, experienced at regular intervals the painful sensation by which the stigmata are accompanied. Many such cases are detailed by the celebrated German mystic, Görres, in his *Christliche Mystik*, vol. ii. pp. 420—456.

STILAGINA'CEÆ, a natural order of exogenous plants, allied to *Urticeæ*, containing about twenty known species of trees and shrubs, natives of the East Indies, Mauritius, and Madagascar. None of them are of importance.

STI'LBITE. See ZEOLITE.

STILICHO, a celebrated Roman general, the mainstay of the Western Empire after the death of Theodosius (q. v.) the Great, is said to have been a Vandal, and was the son of a captain of barbarian auxiliaries in the imperial army. He rose through his military talent to high rank in the army, and Theodosius was so pleased with his rare ability, zeal, and accomplished manners, that he gave him his niece Serena in marriage. S.'s promotion was, however, viewed with great jealousy by Rufinus, the able but evil-minded and ambitious minister of Theodosius, and an inextinguishable feud arose between the two, which it required all the weight of the emperor's influence to repress. In 394, S. departed for Rome in charge of the youthful Honorius (q. v.), who had been committed to his care, placed him on the throne of the Western Empire, and administered in his name the affairs of state. On the death of Theodosius, towards the close of 394, the quarrel for supremacy between S. and Rufinus, the guardian of Arcadius (q. v.), became fully developed, and Alaric (q. v.) at the instigation of the latter, invaded Greece while S. was engaged in chastising the invaders of the Roman territories on the Rhine and in Gaul.

S., on his return, at once set out for Constantinople, and put an end to the struggle between himself and Rufinus by the destruction of his rival in 395. He then marched against Alaric, blocked him up in the Peloponnesus, but, through over-confidence, permitted him to escape across the isthmus with his captives and booty. In 398, his daughter Maria became the wife of Honorius. His old opponent, Alaric, after several inroads upon the eastern provinces of the Western Empire, now invaded Northern Italy, but was signally defeated at Pollentia (March 403) by S., who had hurriedly called in the Roman legions from Rhætia, Gaul, Germany, and even Britain. He was again defeated at Verona, upon which he retired from the empire, and S. obtained the honor of a triumph and a great increase of influence and power. S.'s ambition now led him to attempt the introduction of his own family to the imperial succession (a statement disbelieved by Gibbon, who considers it merely as an invention of the crafty Olympius; though the great historian of the Roman Empire honestly confesses to various heavy blots on the character of his hero), by the marriage of his son with the heir-presumptive Placidia, the daughter of Theodosius, and to attain this end, he made overtures of alliance to Alaric, which were gladly accepted. But the dreadful inroad of Radagaisus, in 406, at the head of more 200,000 (some say 400,000) barbarians, who ravaged the whole country as far as Florence, compelled the great general of the West to shelve for a time his ambitious schemes. With a small but chosen army of veterans, aided by a body of Huns under Uldin (father of Attila), and of Visigoths under Sarus, he so harassed the invaders, that they were forced to give him battle. They were soon routed. Radagaisus, who surrendered, was put to death, and his followers sold as slaves.

S. again resumed his pet scheme; established enmity between Rome and Byzantium by seizing on Eastern Illyricum and inducing Alaric to transfer his allegiance to Honorius. But Honorius, who had been prejudiced against S. by one of his officers, Olympius, refused to take Eastern Illyricum from the Byzantine Empire; and subsequently, by an artful harangue, he so influenced the soldiers of the army of Gaul, that they rose *en masse* against the partisans of Stilicho. S. himself was at Bologna; and on the news of the *émeute*, his most zealous friends urged immediate action against Olympius and the Pavian rebels; but for the first time in his life, vacillation seized S., and he declined. They then, for self-preservation, turned against him, and one of them, Sarus, the Goth above mentioned, drove him out of his camp, and compelled him to flee to Ravenna, where he was soon afterwards slain, 23d August, 408. Thus perished the last of the series of distinguished aliens, who, as emperors, warriors, or politicians, had propped up the Roman empire for 150 years, with a stern and resolute zeal equal to that of the early Romans themselves. After protecting the weak empire from formidable invasion by his own kinsman, administering its affairs with remarkable ability, moderation, and integrity, and restoring its old heroic glory to the imperial arms, S. received the reward which alone an effete and conceited people can be expected to bestow; and three months after his death, Alaric and his Visigoths were at the gates of Rome.

STILL is the apparatus employed for the distillation of liquids, and consists of the copper boiler or *alembic* (see DISTILLATION), in which is contained the fermented liquor whose vapors are to be distilled; of the *neck* or *head*, a pipe which conveys the vapor generated in the boiler into the worm; and of the *worm*, a coiled metal tube which is packed in a vessel called a *refrigeratory*, fitted up in such a manner that the cold water which is poured in at the top comes in contact as extensively as possible with the outside of the tube, and exercises a condensing action upon the vapor which it contains. The vapor thus condensed in its passage through the worm, makes its exit in drops, or in a small stream, into a vessel called the *recipient*, and may be redistilled or not as is required. The various forms of stills are extremely numerous, almost each species of spirit possessing its own form of still, but they all conform to the general description above given.

STILLINGFLEET, EDWARD, Bishop of Worcester was born April 17, 1635, at Cranbourne, in Dorsetshire. He received his early education at the grammar-school of his native place, and in 1648 became a student at St. John's College, Cambridge. He took his degree as Master of Arts; and in 1653 succeeded in obtaining a Fellowship. For some years after leaving college, he was occupied as a private family tutor; and in 1657 he was presented to the rectory of Sutton. In 1659, he came before the world as an author in the work entitled *Irenicum, or the Divine Right of Particular Forms of Church Government examined*. The views here maintained savored somewhat more of latitudinarianism than could be pleasant to the High Church party, and he afterwards saw reason to modify them. His next performance was the *Origines Sacræ, or Rational Account of the Christian Faith, as to the Truth and Divine Authority of the Scriptures*, a work which made his reputation, and is still had in estimation as one of the most masterly treatises extant on the subject of which it treats. In 1664, appeared his *Rational Account of the Grounds of the Protestant Religion*, a defence of the Church of England from the charge of schism in its separation from that of Rome, which was received with great favor, and led to the preferment of its author.

In 1665, the Earl of Southampton presented him to the rectory of St. Andrews, Holborn; he was also appointed preacher at the Rolls Chapel, and shortly after lecturer at the Temple, and Chaplain in Ordinary to Charles II. In 1670, he became, by favor of the king, Canon Residentiary of St. Paul's Cathedral, and in 1678, was preferred to be Dean of the same. In the Court of Ecclesiastical Commission instituted by James II., S. declined to act; and after the Revolution of 1688, he received, in final acknowledgment of his services to the Protestant cause, his appointment to the bishopric of Worcester. He died at Westminster on 27th March 1699, and was buried in Worcester Cathedral.

S.'s chief works, besides those mentioned, were the *Origines Britannicæ, or Antiquities of the British Churches*, and a bulky volume entitled *The Unreasonableness of Separation*, in reply to an attack made upon him by Howe and others. Throughout, he was besides almost constantly engaged in religious controversy, on the one hand with the adherents of the Church of Rome, and on the other with the Noncomformists. Of his numerous polemical treatises, however important in their day, it is not here necessary to treat in detail. His collected works, in 6 vols. folio, were published in 1710; and in 1735, a supplementary volume of Miscellanies was issued by his son, the Rev. James Stillingfleet, Canon of Worcester. S., though keen and unsparing in conflict, was a good and amiable man, and his unquestioned piety and honesty of intention commanded throughout the respect even of his bitterest opponents.

STILL-LIFE is the name applied to that branch of art which concerns itself with the representation of lifeless objects, such as dead animals, fruits, flowers, vases, and house-furniture.

STILTED ARCH, an arch in which the impost moulding is placed at some distance below the springing of the arch.

STI'MULANTS may be defined to be agents which produce a sudden but not a permanent augmentation in the activity of the vital functions. They give increased energy to the circulatory and cerebro-spinal nervous systems, the primary effect being probably on the nervous system, while the circulation is only secondarily affected. In their mode of action they resemble Tonics (q. v.) in some respects; thus immediately after their administration a feeling of increased power is produced, which, however, is not permanent, and is almost always followed by a corresponding depression of vital power; their effects are, however, more immediate than those of tonics. Many of these agents, as, for example, alcohol and the ethers, are closely allied to narcotics, their secondary effect, if given in sufficiently large doses, being to produce sleep, and even coma. The following are the most important of the general stimulants. 1. *Alcohol*, in the various forms of spirits and wines. As a stimulant, alcohol is employed in medicine to support the vital powers in the advanced stages of fevers, particularly those of a low or typhous character; and it is of service in flatulent colic, in some forms or indigestion, in vomiting, and in fainting. Its almost universal use in inflammatory diseases occurring in persons of broken-down constitution, has recently been advocated by a special school, of which the late Dr. Todd may be considered the representative. In cases of severe uterine hæmorrhage and in some forms of fever, it may be given in very large quantity. According to Neligan, in the fever

which proved so fatal to the British Legion in Spain in the year 1835, some of the physicians prescribed as much as 32 ounces of Brandy (a pint and a half) in 24 hours.

2. *Ammonia*, either in the form of *Solution of Ammonia*, or *Liquor Ammonia*, or as *Carbonate of Ammonia*, is a general stimulant, whose action is rapid, but temporary. It is of special use in the advanced stages of continued fever, in the eruptive fevers when the rash has receded (especially in scarlatina), and in the later stages of pneumonia. It is the best internal stimulant to employ in profound intoxication, and in cases of poisoning by sedatives; and as an external stimulant, the vapor is inhaled in cases of fainting. The solution (which must not be confounded with the *Strong Solution of Ammonia*) may be given in doses from 5 to 30 minims, diluted with two ounces of water, mucilage, or any bland fluid. The *Carbonate* (formerly known as the sesquicarbonate, which, in reality, it is) may be given in doses varying from 3 to 10 grains in pills or in cold water. The *Aromatic Spirit of Ammonia* containing both ammonia and its carbonate, is an excellent and agreeable stimulant in fainting, hysteria, flatulent colic, &c., in doses of from half a drachm to a drachm, taken in water or camphor mixture. 3. *Cajeput Oil*, in doses of from 2 to 6 drops on a lump of sugar, or rubbed up with sugar, is a powerful diffusible stimulant, admirably suited for cases of flatulent distention of the stomach and intestines.

4. *Ether* (known also as *Sulphuric Ether*) acts as a general diffusible stimulant; but its effects, which are rapidly produced, are very transient. It is chiefly employed as a stimulant in spasmodic and nervous affections unaccompanied by inflammation, as 'in cramp of the stomach, in spasmodic or flatulent colic, in nervous palpitations, in hiccough, in nervous headache, during a paroxysm of spasmodic asthma, in aphonia, &c. It is also administered frequently with good effect in the advanced stages of fever, when the twitching of the muscles, known as *subsultus tendinum*, and hiccough are present; and as an immediate stimulant in fainting and asphyxia.'—Neligan's *Medicines*, &c., 6th ed., p. 452. It is usually given in doses of about a drachm in some aromatic water. To these more important stimulants may be added camphor, ginger, horse-radish, the preparations of lavender, of the mints, &c. It must not be forgotten that electricity, galvanism, and magnetic electricity operate on the animal system either as general or local stimulants, according to the manner in which they are applied. See ELECTRICITY, MEDICAL.

STING-FISH. See WEEVER.

STING RAY (*Trygon*), a genus of cartilaginous fishes, of the order *Raiæ* (see RAY), and family *Trygonidæ*. In this family, the tail is long and slender, the eyes on the upper (dorsal) aspect, and in the genus *Trygon* the tail is armed with a strong spine notched on both sides. The tail has either no fin, or a merely

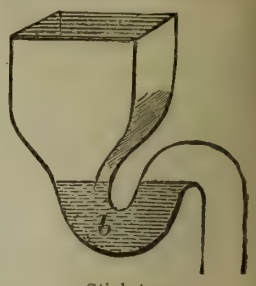
Sting Ray (*Trygon pastinaca*).

rudimental one. Only one species of S. R. occurs in the British seas (*T. pastinaca*), popularly known as the Fire Flaire. It is found in the Mediterranean, and thence to the northernmost parts of Europe. It resembles a skate in general appearance. The flesh is remarkable for its redness of color, and is not esteemed. The S. R. is dreaded from the power which it has of using its muscular and flexible tail as a weapon, twisting it round the object of attack, and inflicting severe lacerated wounds with the serrated spine. These wounds often cause great inflammation, whence a notion has been prevalent from ancient times that the sting is charged with venom; but of this there is no evidence. Other species of S. R. are plentiful in the warmer parts of the world, and they are everywhere dreaded. The spine is used by the savages of the South Sea Islands to point their spears.

STINKPOT, in Warfare, a Shell, often of earthenware, charged with combustibles, which, on bursting, emit a foul smell and a suffocating smoke. It is useful in sieges for driving the garrison from their defences; also in boarding a ship, for effecting a diversion while the assailants gain the deck. The stinkpot is a favorite weapon of the Chinese. Under the more elegant title of Asphyxiated Shell, the French and other modern nations have experimented considerably on this mode of harassing an enemy.

STINKSTONE, or SWINESTONE, a kind of marble or limestone remarkable for the fetid urinous odor which it emits when rubbed. It contains a little sulphur.

STINK-TRAPS, a name given to certain very useful forms of drain-openings, which, whilst allowing liquids to run down, prevent the escape of noxious gases. They are made of iron or earthenware, in a great variety of forms, but on one very simple principle, there being a curved or siphon pipe below the grating or grid (fig.), which always retains sufficient water, *b*, to prevent the outward passages of the gases.



Stink-trap.

STINK-WOOD (*Oreodaphne fœtida*), a tree of the natural order *Lauraceæ*, a native of the Cape of Good Hope, remarkable for the strong disagreeable smell of its wood, which, however, is hard, very durable, takes an excellent polish, and resembles walnut. It has been used in ship-building.

STINT. See SANDPIPER.

STI'PA. See FEATHER GRASS.

STIPE, in Botany, a term used to designate the stem of palms and tree-ferns.

STI'PEND, the provision for the support of the parochial clergy of the Church of Scotland. It consists of payments in money or grain, or both, made out of the teinds or tithes of their parishes. the Teinds (q. v.), originally the tenths of the produce of the lands drawn in kind, have become converted into separate estate, held under a liability for stipend. In a majority of cases, they have been purchased at a valuation by the owners of the lands to which they belong, stipends having first been 'modified' from them, and they are held under the burden of augmenting the minister's stipend to the extent of their value. Sometimes they have passed into the hands of titulars, i. e., grantees from the crown and their successors, or belong to colleges and hospitals, to all of whom payment of tithe is made by the proprietor of the lands according to a valuation or composition; and the teinds formerly held by bishops or other dignified clergy are in the hands of the crown.

In 1617, a commission was appointed by James VI. to modify stipends to the clergy from the parochial teinds. The provision was at first limited to a maximum of 10 chalders of victual or 1000 merks (£55, 11*s*. 1*d*.) *per annum*, and a minimum of five chalders or 500 merks (£27, 15*s*. 6*d*.); but the minimum was raised in 1649 to eight chalders, or three chalders and money for the other five, at a conversion not exceeding £100 Scots or beneath 100 merks for each chalder; and it has been the practice to allow a further sum to the minister to meet the expense of communion elements. The power of assigning, modifying, and localling stipends has, since the Union, been possessed by the judges of the Court of Session, sitting as a Court of Commission of Teinds. When the existing stipend of a clergyman is considered insufficient, and there remains any free teind (i. e., teind as yet unappropriated for stipend), the court have it in their power to award him out of it what augmentation they deem suitable. But by act 48 Geo. III. c. 138, no stipend can be augmented a second time till after the lapse of 20 years from a previous augmentation. The augmented stipend is modified in victual; but the minister receives it not in kind, but in value, according to the highest fiars (q. v.) prices of each year. By 50 Geo. III. c. 84, £10,000 annually was set apart from the revenue for the purpose of raising all stipends to £150, where the teinds of the parish did not provide that sum. Act 5 Geo. IV. c. 72 makes certain provisions out of the public revenue for those clergymen who have neither manse nor glebe, or who have a manse but no glebe, or a glebe but no manse, and whose stipends do not exceed £200 a year.

The terms at which stipend is payable are Whitsunday and Michaelmas. If the incumbent be admitted before Whitsunday, he is entitled to the whole year's stipend; and if his interest cease before that term, he has no claim to any part of it. If he is admitted between Whitsunday and Michaelmas, he is entitled to a half-year's stipend. If his interest cease between these terms, he or his representatives have right to a half-year's stipend; and if it cease after Michaelmas, to the whole year's stipend. No stipend is due till collation have taken place; and stipend continues due to a suspended clergyman. On the decease of a clergyman, a sum equal to a half-year's stipend is due to his executors, under the name of *ann* or *annat* (a word derived from the not altogether analogous *annatæ*, or first-fruits of the canon law), one half of which goes to the widow, and the other half to the chil-

dren or other next of kin, the whole passing to the next of kin where there is no widow. It is additional to the sum otherwise due to the incumbent; so that, if he survive Whitsunday, he will have half the year's stipend, and his executors will have the other half as *ann;* and if he survive Michaelmas, he will have the whole year's stipend, and an additional half-year's stipend will be due to the executors as *ann.* The stipend accruing during a vacancy was formerly at the disposal of the patron of the parish for pious purposes; but has been given by statutes 50 Geo. III. c. 84, and 54 Geo. III. c. 49, to the Ministers' Widows' Fund.

STIPULATION, in Roman Law, was an agreement attended with certain solemnities.—The word is used in English and Scotch Law only in a popular sense, to denote any distinct matter expressly agreed upon by the parties to an agreement or deed.

STI'PULE, in Botany, a leafy appendage at the base of the leaf-stalk in many plants. Sometimes the stipule is solitary; but frequently there are two, one on each side of the leaf-stalk. They are of very various form and character, often very dissimilar to the leaf with which they are connected. In some plants, they are large, enveloping the young leaf, but soon falling off; in many, they are deciduous; but in many they are as permanent as the leaf itself. Their presence or absence, their deciduous or persistent character, and other peculiarities which they exhibit, form distinctive characteristics not only of species and genera, but of natural orders. They are generally green, like leaves; but sometimes membranaceous. In some plants, they assume the form of spines; in *Cucurbitaceæ,* that of tendrils. Organs of the same nature with stipules appear at the base of the leaflets of some compound leaves.

STI'RLING, a market-town, river-port, and royal, parliamentary, and municipal burgh, capital of the county of the same name, stands on the south bank of the Forth, 29 miles north-east of Glasgow by railway. Like Edinburgh, to which city it bears, in its main features, a striking resemblance, it no doubt owes its origin to the strong natural fortress of its Castle Hill. From this Hill, covering the declivity which slopes north and eastward to the plain, extends the oldest part of the town, around which are numerous streets; while many villas have arisen in the environs. The Castle Hill, which rises gradually from the east and fronts the west, with a steep precipitous wall of basaltic rock, overlooks the beautiful and fertile *carse,* or flat, which lies along the banks of the Forth. Among the more prominent public buildings and institutions are the East and West Churches—the former erected by James IV. about 1494, the latter built at a later period; and 'Mar's Work,' an incomplete structure, built by the Earl of Mar, Regent of Scotland, who died in 1572, when the building was in progress. This architectural fragment is richly ornamented.

In the more ancient quarters, one or two pleasing specimens of old Scotch domestic architecture may still be seen. Of these, 'Argyle's Lodging,' with its pinnacled round towers and decorated windows, is the chief. It is now used as a military hospital. The town-house is surmounted with a spire, and has the old jail attached. It contains the jug or standard of dry measure which was given to the keeping of S. by the Scottish parliament; while Linlithgow is said to have received the firlot; Edinburgh, the ell, &c. The new jail is a handsome building. Cowan's Hospital, founded in 1639, is an object of interest. There are also an Athenæum, Corn Exchange, and numerous excellent schools. A magnificent art institute, called the Smith Institute, in honor of the founder, was opened in 1874. The importance of S. in early times was due to its situation and its defences. At the head of the navigation of the Forth, when there were no regular ferries, S. was the key to the Highlands, and the possession of its strengths and its means of communication between north and south was of the greatest importance. The town, besides, was strongly fortified both by nature and art. The ancient bridge of S., the age of which is unknown, but which was in existence in 1571, is composed of four arches, and was defended at each end by gates and towers. This bridge was until quite recent years, the only one by which wheeled carriages could cross the Forth. Vessels of 150 tons can reach the port of S.; but its commerce by river is now of less importance than before the days of railways.

S. is a central railway station, and the means of communication in every direction are ready and abundant. The rich agricultural, mining, and manufacturing districts around are to a great extent the basis of the prosperity of the town itself. Manufactures of ropes, malt, leather, soap, and mineral oils are carried on. The town unites with the the Dunfermline burghs in sending a member to the House of Commons. Pop. in 1881 of parl. burgh, 16,001; of town, 16,012.

S. (formerly *Stryvelyne,* or *Estrivelin*) is one of the most ancient and historically important towns of Scotland. It is of unknown antiquity; and there is no record from which the date of the foundation of even the castle can be determined. It must have been a frontier fortress from the earliest times. Alexander I. died in the castle in 1124. In the vicinity, the battle of Stirling was fought in 1297. See WALLACE. The town was taken by Edward I., after a siege of three months, in 1304. In the vicinity, at Bannockburn (q. v.), the famous battle of that name was fought in 1314. The castle was the birthplace of James II. and of James V. James III. built the Parliament House in the Castle, and otherwise improved and embellished the fortress.

James V. built the palace, the walls of which are profusely covered with grotesque ornamentation. In the older part of the Castle is the 'Douglas Room,' in which William, Earl of Douglas, was assassinated by James II. In 1651, after the battle of Dunbar, the castle was taken by Monk; and it withstood a siege by the Highlanders in 1745. The view from the towers of Stirling Castle is unsurpassed in beauty. Westward, the rich vale of Menteith stretches away to the Highlands, where Ben Lomond, Ben Venue, Ben A'an, and Ben Ledi close the scene. The glittering 'links' of Forth are seen in the Carse of Stirling, surrounded by fertile fields and luxuriant woods; the Abbey Craig, crowned by the Wallace Monument, rises boldly on the north; while on the east are seen the picturesque ruins of Cambuskenneth Abbey.

STI'RLINGSHIRE, a county of Scotland, forming the borderland between the Highlands and Lowlands of the country, is bounded on the N. by Perthshire and by the river and Firth of Forth. Area, 467 sq. m.; pop. in 1881, 112,443. A considerable part of S. is occupied by the carses of Stirling and Falkirk, which were formerly covered for the most part with unproductive moss. On the removal of the moss-soil, part of which was floated off into the Forth by the agency of running water, a rich clay-soil, of various depths, from a plough-furrow to 20, and even 30 feet, was reached, and is now cultivated with the most marked success. The chief elevation is Ben-Lomond (q. v.), in the northwest. The chief rivers are the Forth (q. v.), the Carron—navigable for small vessels to Carron-shore—and the Endrick. Loch Lomond (q. v.) is the only important lake in the county. S. is remarkable for its mineral stores, especially iron-stone, which is wrought on an extensive scale at Carron (q. v.).

Woollen goods, &c., are largely manufactured, especially at Alva, Bannockburn, and in the neighborhood of Stirling (q.v.). Of the area of 298,579 acres, there were in 1881, 114,191 acres under all kinds of crops, bare fallow, and grass. There were 30,922 under corn crops (2811 being under wheat); under green crops, 9998 (4658 in turnips); 23,663 under clover and grasses under rotation; 48,101 under permanent pasture and meadow. In the same year there were in the county 4778 horses, 28,897 cattle, 409,233 sheep, and 1682 swine. The valued rents in 1674 was £9042; in 1880–81, £406,573 (exclusive of canals and railways). The parliamentary constituency in the same year was 3399.

STI'RRUPS (Naval) are eyes of rope pendent from the yards, and supporting certain portions of the tackle connected with the management of the sails.

STITCH in the side is the popular and expressive name applied to the pain felt in pleurisy. It occupies a point or small spot on a level with, or just beneath the breast on the affected side; and patients state that they feel as if some sharp stabbing instrument were being driven in at that spot, whenever the act of inspiration goes beyond a certain limit. It is termed in French *Point de côté.* See PLEURISY. A simple modification of stitch is by no means uncommon, if a person take exercise shortly after partaking of a full meal. The pain in this case is seated lower in the side, and is usually removed by stooping. Hence the popular remedy for this pain is to make a cross upon the foot.

STI'TCHWORT (*Stellaria*), a genus of plants of the natural order *Caryophylleæ,* having a calyx of 5 leaves, 5 deeply-cloven petals, 10 stamens, 3 styles, and a many-seeded capsule opening

Greater Stitchwort (*Stellaria Holostea*).

with six teeth. The species are numerous, and several are very common in Britain, annual and perennial plants, with weak stems and white flowers, which in some are minute, and in others are large enough to be very ornamental to woods and hedge-banks, as in the Wood S. (*S. nemorum*) and the Greater S. (*S. Holostea*). To this genus the common Chickweed (q. v.). is now generally referred.

STI'VER, a coin of Holland, equivalent to a penny sterling, being the $\frac{1}{20}$th of a guilder or gulden. See FLORIN.

STOAT. See ERMINE.

STOCK-BROKER, or SHARE-BROKER, a person employed in buying and selling stock in the public home and foreign funds, also in stock or shares of joint-stock companies. In most of the principal towns stock exchanges are established, and the stock or share brokers are members of such exchanges, and are bound to transact business in terms of the rules and regulations of the exchange to which they belong. In London, in addition to ordinary brokers, there are what are called sworn brokers, who require a license from the city corporation, for which certain fees are exacted, before being entitled to transact business in the public funds. In the provincial exchanges, the brokers require no license, nor do they pay any fee to government or other authorities. The charge for brokerage or commissions varies from $\frac{1}{4}$ in consols to $\frac{1}{2}$ per cent. in railway stocks; the rates for shares being charged according to the amount of the share, and in accordance with a scale adopted by the stock exchanges.

STOCK, or STOCK GILLYFLOWER (*Matthiola*), a genus of plants of the natural order *Cruciferæ*, having cylindrical or compressed pods, and a stigma consisting of two upright appressed plates, the outer side of which often rises into a knob or horn. The species are herbaceous or half-shrubby, natives of the countries around the Mediterranean Sea, most of them thickly clothed with white or grayish stellate hairs; the flowers in racemes, and generally beautiful and fragrant. Some of the species have long been much cultivated, and many fine varieties have been produced by cultivation. *M. incana*, a very rare and even doubtful native of England, is probably the parent of the greater number of the cultivated kinds with hoary leaves, known as Brompton S., &c.; whilst those with smooth leaves, called Ten-week S., German S., &c., are referred to *M. annua*, *M. glabra*, and *M. fenestralis*, which, perhaps, are mere varieties of one species. The sandy shores of Wales and of Cornwall produce a species, *M. sinuata*, the large purple flowers of which are fragrant only at night—a characteristic also of several other species.

Stocks are always raised by gardeners from seed, which even the double kinds often produce, a multiplication of the petals having taken place without loss of the parts of fructification. Of the seedlings, however, some produce double, and others single flowers, so that only some gratify the cultivator. The hoary-leaved stocks are generally treated as biennials, although, in reality, they may almost be reckoned perennial; and it is not desirable that they should flower in the first year, as the plants become stronger when they remain without flowering till the second year, and produce richer racemes of flowers. The smooth-leaved stocks are treated as annuals.—The beautiful little annual called Virginian Stock does not belong to this genus, although it is of the same natural order. Its habit is indeed very different. It is *Malcolmia maritima*, and notwithstanding its popular name, is a native of the shores of the Mediterranean. It has become one of our most favorite flowers, almost rivalling mignonette, and is all the more esteemed because it grows well in the little garden-plots which are exposed to the smoke of towns.

STOCK-FISH, a commercial name of salted and dried cod and other fish of the same family, particularly the Ling, Hake, and Torsk (see these heads). The fish is cured as soon as possible after being caught. It is split up from head to tail, cleansed from all particles of blood by plentiful washings with salt water; a piece of the back-bone is cut away; and after the superfluous water has drained off, the fish are laid in long vats, covered with salt, and kept down by heavy weights. By and by, they are taken out, washed and brushed, and then exposed to sun and air on a sandy beach or upon the rocks. They are afterwards gathered into little heaps, and when they assume a fine whitish appearance, known as the *bloom*, they are considered ready for the market. Great quantities of stock-fish are thus prepared in the northern parts of the world, and are not only used in the countries which produce them, but are largely exported to more southern regions, where they are in great demand. The cod, ling, and hake fishery of Scotland is next in importance to its herring-fishery. In 1873, according to the Report of the Fishery Commissioners, the yield was 160,716½ cwts. of dried fish, besides 12,381½ barrels cured in pickle. The quantity exported was 70,101½ cwts. cured dried. The quantity of stock-fish cured on the more southern coasts of Britain is inconsiderable

STO'CKHOLM, the capital of Sweden, is situated at the eastern extremity of the Maelar Lake, in 59° 20′ N., and 18° 5′ E. long. The pop. was in 1880, 168,775. S., which is one of the most beatiful capitals of Europe, is built partly on the continent, and partly on nine holms, or islands, lying in the channel through which the Maelar Lake discharges its waters into the Baltic, about 36 miles distant. The Helge-aand, Stads, and Riddar holms, which formed the nucleus of the ancient city, founded in 1250 by Birgir Jarl, contain some of the finest public and private buildings, among which we may instance the royal palace, built in 1753, in the Italian style, and situated on a hill, commanding a view of the romantic shores of the lake. Near the palace, which possesses good antiquarian, numismatic, and other collections, a library, gallery of paintings, large gardens, &c., is the colossal statue of Gustavus III., on one of the fine quays, which skirt the chief harbor of S.; the cathedral, or St. Nicolai's; the Knight's Hall, with the adjoinging market, ornamented with the fine statue of Gustavus Vasa, the Council-house, the Riddarsholm Kirke, where all the kings of Sweden since Charles X. have been buried; &c. Among the other public buildings, the most noteworthy are the Observatory, the Church of St. James, the College of Surgery and the Opera-house, with the neighboring and corresponding palace, in the aristocratic quarter of Norrmalm, which, with the new parade-ground, its public gardens, and its fine wide and even streets, ranks as the handsomest part of the town.

The most picturesque of the nine islets of S. is the Södermalm, on whose steep sides the houses, connected more frequently by steps than roads, rise in terraced rows to the even summit, which is crowned by St. Catharine's Church. Numerous public gardens, summer palaces, and country-houses extend along the north-east shores of the lake, and on the margins of the Ladugaard's Holm, the central portions of which present a picturesque blending of rocks, wooded heights, and romantic glens. On this side of S. lies the famous Djurgaard, or Zoological Gardens, one of the finest public parks in Europe, which occupies a peninsula two miles long, and one mile wide, whose natural beauties have been judiciously aided by art. Stone and wooden bridges connect together the various islands of the town. The streets of the older quarters are narrow, crooked, and ill-paved; but in the better parts of the town there are fine straight streets and capacious squares and open places, with well-built stone houses; while in the suburbs the houses are mostly of wood. S. is the seat of the government, and of the chief courts of law and administration, the residence of the sovereign, and the place of assembly for the legislative chambers. It is the center of the literary and social activity of the country, and has numerous scientific, artistic, educational, and benevolent institutions.

In the immediate vicinity of S. are the Karlsberg Academy, for naval and military cadets; and the Ulriksdal Hospital, for invalided soldiers. No city has more picturesque environs, or more numerous public gardens and walks, than S.; while the many channels and canals connected with its large and commodious harbors facilitate traffic and intercommunication with the interior, and with foreign ports. S. is the principal emporium of Swedish commerce; iron, timber, and deal planks are its main articles of export; but it is also the center of an active trade in the various manufactures of the place—as, for instance, leather, cotton, woollen, and silk fabrics, glass and porcelain, iron and steel goods, steam-engines, &c., which it sends, together with the ordinary colonial and other imports, to all the other towns of Sweden.

STOCKING-FRAME. The machine with which stockings, singlet drawers, and other similar garments are woven, was first invented by William Lee of Woodbridge, Notinghamshire. At first, it was a very simple affair, but has now become extremely complicated, although the simple principle upon which it was first originated is retained as the essential. This can only be understood by reference to the art of knitting, which originated it. In knitting, only one thread is used, and this formed into a succession of loops on a knitting-needle; each of these loops, then, has in succession another loop passed through it by means of another

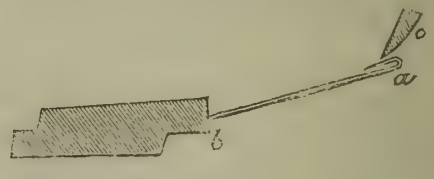


Fig. 1.

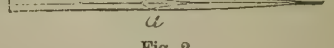


Fig. 2.

and similar needle, and this operation is carried on successively until the whole fabric is made.

In the stocking-frame, instead of one needle to hold the stationary loops while those of the moving row are being inserted, there are as many needles as there are to be loops in the breadth of the web, and these are so made as to alternately form and give off

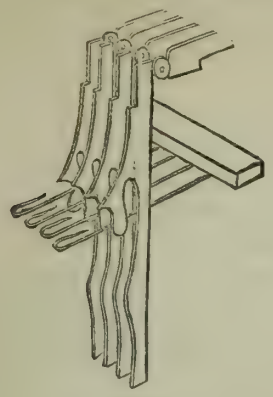


Fig. 3,

the loops. The form of this needle is shown in fig. 1, and fig. 2 shows a front view of its point, in order to exhibit a small indentation, *a*, into which the bent point of the needle *a* (fig. 1), is easily pressed. The other end of the needle is fixed into a small casting of tin, *b* (fig. 1), formed to fit into a frame, and be screwed tightly in, side by side with the rest of the needles. Between the needles are placed thin plates of lead or pewter, called *sinkers*

Fig. 4.

(fig. 3), in two rows; in one row, the sinkers move freely on an axis (fig. 3); in the other, they are all fixed to a bar, and move with it. The object of the loose ones, or *jack-sinkers*, is to make loops by pressing the thread down between the needles, as shown in fig. 4 and 5 at *a*. The other row on the bar, or *lead-sinkers*, are brought down, so as to press simultaneously on the hooks of

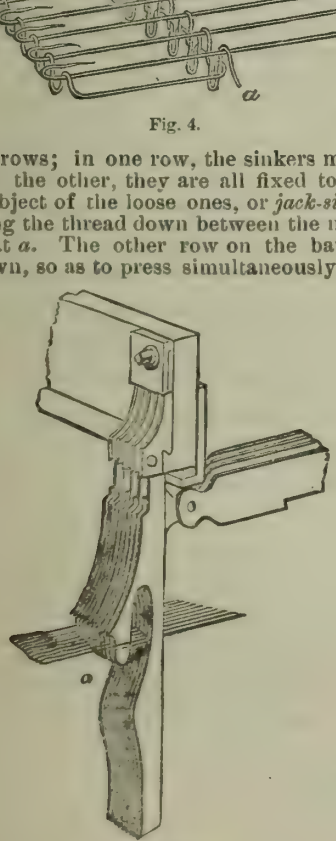


Fig. 5.

the needles, and press their points down into the little depression *a* (fig. 2), so that they will pass through the loops without catching one way, and take them up when opened and drawn in the contrary direction.

The point of the lead-sinker is seen in fig. 1, *c*. These are the essential parts of a stocking-frame, which contains so vast a number of needles and sinkers, and such nice mechanical arrangements for giving them their regular movements, that few machines have so complicated an appearance to the observer; and any attempt to extend this description, would only serve to puzzle rather than explain.

STOCKINGS. See HOSIERY.

STO'CKPORT, a town of England, in the county of Chester, on the river Mersey and 6½ miles south-east of Manchester by railway. It is of great antiquity, but its prosperity is of modern date. S. has extensive manufactures of cottons, woollens, silks, machinery, brass and iron goods, shuttles, and brushes. Pop. (1871) 53,014; (1881) 59,544. S. returns two members to parliament.

STOCKS, an apparatus of wood, much used in former times in England for the punishment of petty offenders. The culprit was placed on a bench, with his ankles fastened in holes under a movable board, and allowed to remain there for an hour or two. The period of their first introduction is uncertain, but in the second Statute of Laborers, 25 Edw. III. (1350), provision is made for applying the stocks to unruly artificers; and in 1376, the Commons prayed Edward III. that stocks should be established in every village. Each parish had in later times its stocks, usually close to the churchyard, but sometimes in a more retired spot;

Stocks.

and in some country places they are still to be seen, and not altogether disused. Combined with the stocks was often a whipping-post for the flagellation of vagrants.

STOCKS. See FUND.

STO'CKTON, a town and port of entry of California, U. S., on Stockton Channel, near San Joaquin, 130 miles east-south-east of San Francisco. It is an important commercial point, and the entrepôt of the southern gold mines. It has three newspapers, several churches, a hospital, and pop. (1870) 10,066; (1880) 20,287.

STO'CKTON-ON-TEES, a municipal borough and seaport in the county of Durham, 11 miles east-north-east of Darlington, on the left bank of the Tees. The broad and handsome High Street is nearly a mile in length, and from it several minor streets diverge at right angles. A new town, known as South Stockton, has sprung up within the last few years on the right bank of the river. The town contains two churches, a Roman Catholic chapel built by Pugin, several dissenting chapels, an athenæum, and other important edifices. The Stockton Races, of some mark in the sporting world, are held here annually. Ship-building, chiefly in iron, is carried on to a great extent; and blast-furnaces, foundries, engine-works, and extensive potteries and iron-works are in operation. Sail-cloth, ropes, linen, and diapers are manufactured; and there are breweries, corn-mills, and spinning-mills. The exports are chiefly iron and earthenware; the imports are corn, timber in deals, spars, &c., and bark. In 1880. 827 foreign and coasting vessels, of 155,632 tons, entered, and 813, of 167,143 tons, cleared the port. The town is connected with the whole railway system of England and Scotland by the North-eastern Railway Company's branches, and there are two stations here. The Stockton and Darlington Railway, the first in the United Kingdom to commence passenger traffic, was opened for the double purpose of the conveyance of passengers and goods, September 27, 1825. At S. the Tees is navigable for vessels of large tonnage; by a cut, by which a bend of the river is avoided, the town is brought 3 miles nearer the sea; the navigation of the river has been much improved, and great facilities for an extensive trade provided. Pop. of parl. borough, (1881) 55,446.

S. suffered severely from the incursions of the Scots in the early part of the 14th c., but even at that time it enjoyed considerable trade. It was taken for the Parliament in 1644, and totally destroyed by the Roundheads in 1652. At the Restoration it had become so poor a place that it contained only 120 houses, and most of these were built of clay.

STOICS, the name for the sect of ancient moralists opposed to the Epicureans in their views of human life. The Stoical system dates from the end of the 4th c. B.C.; it was derived from the system of the Cynics, whose founder, Antisthenes, was a disciple of Socrates. Indeed, the doctrines, but still more the manner of life, and most of all the death, of Socrates, were the chief foundations of the Stoical philosophy.

The founder of the system was ZENO, from Cittium in Cyprus (he lived from 340—260 B.C.), who derived his first impulse from Crates the Cynic. He opened his school in a building or porch, called the *Stoa Pœcile* ('Painted Porch') at Athens, whence the origin of the name of the sect. Zeno had for his disciple CLEANTHES, from Assos in the Troad (300—220 B.C.), whose *Hymn to Jupiter* is the only fragment of any length that has come down to us from the early S., and is a remarkable production, setting forth the unity of God, his omnipotence, and his moral government.

CHRYSIPPUS, from Soli in Cilicia (280—207 B.C.), followed Cleanthes, and, in his voluminous writings, both defended and modified the Stoical creed. These three represent the first period of the system. The second period (200—50 B.C.) embraces its general promulgation, and its introduction to the Romans. Chrysippus was succeeded by ZENO of Sidon, and DIOGENES of Babylon; then followed ANTIPATER of Tarsus, who taught PANÆTIUS of Rhodes (died 112 B.C.), who, again, taught POSIDONIUS of Apamea, in Syria. (Two philosophers are mentioned from the native province of St. Paul, besides Chrysippus—Athenodorus, from Cana in Cilicia; and Archedemus, from Tarsus, the apostle's birthplace. It is remarked by Sir A. Grant, that almost all the first S. were of Asiatic birth; and the system itself is undeniably more akin to the oriental mind than to the Greek.) Posidonius was acquainted with Marius and Pompey, and taught Cicero; but the moral treatise of Cicero, *De Officiis*, is derived from a work of Panætius. The third period of Stoicism is Roman. In this period we have Cato the Younger, who invited to his house the philosopher Athenodorus; and, under the Empire, the three Stoic philosophers whose writings have come down to us—SENECA (6 B.C.—65 A.D.), EPICTETUS (60—140 A.D.), who began life as a slave, and the Emperor MARCUS AURELIUS ANTONINUS (121—180 A.D.). Stoicism prevailed widely in the Roman world, although not to the exclusion of Epicurean views.

The leading Stoical doctrines are given in certain phrases or expressions, as 'Life according to Nature,' the ideal 'Wise Man,' 'Apathy,' or equanimity of mind, the power of the 'Will,' the worship of 'Duty,' the constant 'Advance' in virtue, &c. But perspicuity will be best gained by considering the *Moral* system under four heads—the Theology; the Psychology or theory of mind; the theory of the Good or human happiness; and the scheme of Virtue or Duty.

I. Their Theological doctrines comprehended their system of the Universe, and of man's position in it. They held that the Universe is governed by one good and wise God, together with inferior or subordinate deities. God exercises a moral government; under it the good are happy, while misfortunes happen to the wicked. According to Epictetus, God is the father of men; Antoninus exults in the beautiful arrangement of all things. They did not admit that the Deity intermeddled in the smaller minutiæ; they allowed that omens and oracles might be accepted as signs of the foreordained arrangement of God. They held this foreordination even to the length of fatalism, and made the same replies, as have been given in modern times, to the difficulty of reconciling it with Free-will, which in their system was unusually prominent.

As to the existence of evil, they offered explanations such as the following: God is the author of all things except wickedness; the very nature of good supposes its contrast evil, and the two are inseparable, like light and dark, which may be called the argument from Relativity; in the enormous extent of the Universe, some things must be neglected; when evil happens to the good; it is not as a punishment, but as connected with a different dispensation; parts of the world may be presided over by evil demons; what we call evil may not be evil.

Like most other ancient schools, the S. held God to be corporeal like man; Body is the only substance; nothing incorporeal could act on what is corporeal; the First Cause of all, God or Zeus, is the primeval fire, emanating from which is the soul of man in the form of a warm ether.

It is for human beings to recognize the Universe as governed by universal Law, and not only to raise their minds to the comprehension of it, but to enter into the views of the Creator, who must regard all interests equally; we are to be, as it were, in league with him, to merge self in the universal Order, to think only of that, and its welfare. As two is greater than one, the interests of the whole world are infinitely greater than the interests of any single being, and no one should be satisfied with a regard to anything less than the whole. By this elevation of view, we are necessarily raised far above the consideration of the petty events befalling ourselves. The grand effort of human reason is thus to rise to the abstraction or totality of entire Nature; 'no ethical subject,' says Chrysippus, 'could be righly approached except from the preconsideration of entire Nature, and the ordering of the whole.'

As to Immortality, the S. precluded themselves, by holding the theory of the *absorption* of the individual soul at death into the divine essence; but, on the other hand, their doctrine of advance and aspiration is what has in all times been the main natural argument for the immortality of the soul. For the most part, they kept themselves undecided as to this great doctrine, giving it as an alternative, reasoning as to our conduct on either supposition, and submitting to the pleasure of God in this as in all other things.

In arguing for the existence of Divine power and government, they employed what has been called the argument from Design, which is as old as Socrates. Man is conscious that he is in himself an intellectual or spiritual power, from which, by analogy, he is led to believe that a greater power pervades the universe, as intellect pervades humanity.

II. Next, as to the Constitution of the Mind. We have bodies like animals, but reason or intelligence like the gods. Animals have instinctive principles of action; man alone has a rational, intelligent soul. According to Antoninus, we come into contact with Deity by our intellectual part, and our highest life is thus the divine life.

But the most important Stoical doctrine respecting the nature of man is the recognition of Reason as a superior power or faculty that subordinates all the rest—the governing intelligence. (Very nearly the same phraseology is used by Bishop Butler in setting forth the supremacy of Conscience.) This, however, is not a mere intellectual principle, but an active force, uniting intellect and will. The bodily sensibilities are opposed to this higher Reason and Will, which, however, is strong enough to control them. Another way of expressing the same view was the power of the Mind over the Body, which was dwelt upon by Epictetus in the most exaggerated form. The introduction of so glaring a mistake, as that sickness may effect the body without enfeebling the mind, could only end in practical failures, or else in contradiction.

In order to maintain their contrast with the Epicureans, the S. said that pleasure and pain are not principles of Nature; by which they must have meant that humanity is not in fact, at least exclusively, governed by these, and that, in the regenerated man, they are not governing principles at all. Now, it is true, and a truth important for many practical purposes, that we are sometimes impelled to action without reference to our pleasures and pains; our habits often exemplify this state; it is still better shown in what are called 'fixed ideas,' as in involuntary imitation and sympathy. But these are exceptions; and any system that sets itself against the main fact, that pleasure and pain are the great moving forces of mankind, must somewhere or other contradict itself.

In Seneca, we find something very closely approaching to the Christian doctrine of the corruption of human nature. The littleness of humanity was a favorite theme of Antoninus, and naturally followed from the Stoical mode of contemplating the Universe at large.

The doctrine called the Freedom of Will may be said to have originated with the S., although with them it was chiefly a rhetorical mode of expressing the dignity of the Wise Man, and his power of rising superior to circumstances.

To prepare the way for the Stoical precepts, Epictetus distinguished between things in our power and things not in our power. The things in our power are our opinions and notions about objects, and all our affections, desires, and aversions; the things not in our power are our bodies, wealth, honor, rank, authority, &c., and their opposites. The application is this: wealth and high rank may not be in our power, but we have the power to form an *idea* of these—namely, that they are unimportant, whence the want of them will not grieve us. A still more pointed application is to death, whose force is entirely in the idea.

III. We must consider next the Stoical Theory of Happiness, or rather of the Good, which with them was not identified with happiness. They began by asserting that happiness is not necessary, and may be dispensed with, and that pain is no evil, which, however, if followed consistently, would dispense with all morality and all human endeavor. Substantially and practically, they held that pains are an evil, but, by a proper discipline, may be triumphed over. They disallowed the direct and ostensible pursuit of pleasure as an end (the point of view of Epicurus), but allured their followers partly by promising them the victory over pain, and partly by certain enjoyments of an elevated cast that grew out of their plan of life.

Pain of every kind, whether from the casualties of existence, or from the severity of the Stoical virtues, was to be met by a discipline of endurance, a hardening process, which, if persisted in, would succeed in reducing the mind to a state of Apathy or indifference. A great many reflections were suggested in aid of this

education. The influence of exercise and repetition in adapting the system to any new function, was illustrated by the Olympian combatants, and by the Lacedæmonian youth who endured scourging without complaint. Great stress was laid on the instability of pleasure, and the constant liability to accidents; whence we should always be anticipating and adapting ourselves to the worst that could happen, so as never to be in a state where anything could ruffle the mind. It was pointed out how much might still be made of the worst circumstances—poverty, banishment, public odium, sickness, old age—and every consideration was advanced that could 'arm the obdurate breast with stubborn patience, as with triple steel.'

It has often been remarked that such a discipline of endurance was peculiarly suited to the unsettled condition of the world at the time, when any man, besides the ordinary evils of life, might in a moment be sent into exile, or sold into slavery. Moreover, it is a discipline adapted to a certain class of dispositions existing in all ages—the men that prefer above all things 'equanimity' of mind, and would rather dispense with great occasional pleasures than risk their state of habitual composure.

Next to the discipline of endurance, we must rank the complacent sentiment of Pride, which the Stoic might justly feel in his conquest of himself, and in his lofty independence and superiority to the casualties of life. The pride of the Cynic, the Stoic's predecessor, was prominent and offensive, showing itself in scurrility and contempt towards everybody else; the Stoical pride was a refinement upon this, but was still a grateful sentiment of superiority, which helped to make up for the surrender of indulgencies. It was usual to bestow the most extravagant laudation on the 'Wise Man,' and every Stoic could take this home to the extent that he considered himself as approaching that great ideal.

The last and most elevated form of Stoical happiness was the satisfaction of contemplating the Universe and God. Epictetus says that we can discern the providence that rules the world, if we possess two things—the power of seeing all that happens with respect to each thing, and a grateful disposition. The work of Antoninus is full of studies of Nature in the devout spirit of 'passing from Nature to Nature's God;' he is never weary of expressing his thorough contentment with the course of natural events, and his sense of the beauties and fitness of everything. Old age has its grace, and death is the becoming termination. This high strain of exulting contemplation reconciled him to that complete submission to whatever might befall, which was the essential feature of the 'Life according to Nature.'

IV. The Stoical theory of Virtue is implicated in their ideas of the Good, now described.

The fountain of all virtue is manifestly the life according to nature, as being the life of subordination of self to more general interests—to family, country, mankind, the whole universe. If a man is prepared to consider himself absolutely nothing in comparison with the universal interest, and to regard it as the sole end of life, he has embraced an ideal of virtue of the loftiest order. Accordingly, the S. were the first to preach what is called 'Cosmopolitanism;' for although, in their reference to the good of the whole, they confounded together sentient life and inanimate objects—rocks, plants, &c., solicitude for which was misspent labor—yet they were thus enabled to reach the conception of the universal brotherhood of mankind, and could not but include in their regards the brute creation. They said: 'There is no difference between Greeks and Barbarians; the world is our city.' Seneca urges kindness to slaves, for 'are they not men like ourselves, breathing the same air, living and dying like ourselves?'

The Epicureans declined, as much as possible, interference in public affairs, but the Stoical philosophers all urged men to the duties of active citizenship. Although there had been many good and noble men among the pagans, yet positive beneficence had not been preached as a virtue before the Stoics. They adopted the four Cardinal Virtues (Wisdom, or the Knowledge of Good and Evil; Justice; Fortitude; Temperance) as part of their plan of the virtuous life, the life according to nature. Justice, as the social virtue, was placed above all the rest. But most interesting to us are the indications of the idea of Beneficence. Epictetus is earnest in his exhortations to forgiveness of injuries. Antoninus often enforces the same virtue, and suggests considerations in aid of the practice of it; he contends as strongly as Butler and Hume for the existence of a principle of pure, that is, unselfish, benevolence in the mind, in other words, that we are made to advance each other's happiness.

There is also in the Stoical system a recognition of duties to God, and of morality as based on piety. Not only are we all brethren, but also the 'children of one Father.'

The extraordinary stress put upon human nature by the full Stoic ideal of submerging self in the larger interests of being led to various compromises. The rigid following out of the ideal issued in one of the Paradoxes, namely, that all the actions of the wise man are equally perfect, and that, short of the standard of perfection, all faults and vices are equal; that, for example, the man that killed a cock without good reason was as guilty as he that killed his father. This has a meaning only when we draw a line between spirituality and morality, and treat the last as worthless in comparison of the first. The later S., however, in their exhortations to special branches of duty, gave a positive value to practical virtue, irrespective of the ideal.

The idea of Duty was of Stoical origin, fostered and developed by the Roman spirit and legislation. The early S. had two different words for the 'suitable' (*kathekon*) and the 'right' (*katorthoma*); although it is a significant circumstance that the 'suitable' is the lineal ancestor of our word 'duty' (through the Latin *officium*).

It was a great point with the Stoic to be conscious of 'advance,' or improvement. By self-examination, he kept himself constantly acquainted with his moral state, and it was both his duty and his satisfaction to be approaching to the ideal of the perfect man. When renouncing the position of 'wise,' he yet claimed to be advancing. This idea, familiar to the modern world, was unknown to the ancients before the Stoics. It is very illustrative of the unguarded points and contradictions of Stoicism, that contentment and apathy were not to permit grief even for the loss of friends. Seneca, on one occasion, admits that he was betrayed by human weakness on this point. On strict Stoical principles, we ought to treat the afflictions and the death of others with the same frigid indifference as our own; for why should a man feel for a second person *more* than he ought to feel for himself, as a mere unit in the infinitude of the Universe? This is the contradiction inseparable from any system that begins by abjuring happiness as the end of life. We may be allowed to regard our own happiness as of no importance, but if we apply the same measure to happiness in general, we are bereft of all motives to benevolence; and virtue, instead of being set on a loftier pinnacle, is left without any foundation.

The Stoical system has largely tinctured modern ages, in spite of its severity. It has always had a charm as an ideal, even when men were conscious of not realizing it. It may be still considered as a grand experiment in the Art of Living, from which valuable lessons have resulted; just as a believer in Alchemy, or in the Perpetual Motion, might make useful experimental discoveries. The limitation of wants, the practice of contentment, the striving after equanimity, the hardening of one's self against the blows of fortune, are all familiar to the moralists of later ages. A qualified form of the subordination of self to the general welfare, belongs to the modern theories of virtue.

The chief ancient authorities on the Stoics are the writings of Epictetus, Marcus Antoninus, and Seneca, themselves Stoical philosophers together with notices occurring in Cicero, Plutarch, Sextus, Empiricus, Diogenes, Laertius, and Stobæus. The completest modern account of the system occurs in Zeller's *Philosophie der Griechen*, vol. iii. See also Sir Alexander Grant in the *Oxford Essays* for 1858; and *Stoicism*, by Rev. W. W. Capes (1880).

STOKE-UPON-TRENT, a municipality, parliamentary borough, and manufacturing town of Staffordshire, 145 miles from London by the London and North-western Railway. The 'district' of S. consists of the parish of S., is familiarly named the 'Potteries,' and contains the towns of Burslem, Hanley, Lane-End (with Longton), Stoke, and Tunstal Court. The town of S. is regularly built. Its church, an edifice in modern Gothic, has a tower 112 feet high. The earthenware manufactures of the parish of S. are carried on in about 200 factories. In the vicinity are coal-mines. Pop. of municipal borough (1871) 15,144; (1881) 19.263; of parliamentary borough, including the Potteries, which sends two members to the House of Commons (1871) 130,575; (1881) 152,457.

STOKES, GEORGE GABRIEL, one of the greatest living mathematicians and natural philosophers in Europe, was born, in 1819, at Skreen, County Sligo, Ireland; educated at the school of the Rev. R. H. Wall, D.D., Dublin; afterwards at the Bristol College. He entered Pembroke College, Cambridge, in 1837; graduated in 1841, as Senior Wrangler, and First Smith's Prizeman; became Fellow of Pembroke in the same year; and was elected, in 1849, to fill, as one of the worthiest of Newton's successors, the Lucasian Chair of Mathematics in Cambridge. In 1854, he was appointed Secretary to the Royal Society.

He is best known, popularly, by his beautiful discovery of Fluorescence (see PHOSPHORESCENCE). His paper *On the Change of the Refrangibility of Light*, is printed in the *Philosophical Transactions* for 1852—1853. His recent important physiological application of optical methods to the study of the oxidation of the blood, is noticed under SPECTRUM. But to mathematicians and natural philosophers, S. is known by a number of admirable papers in the *Cambridge Philosophical Transactions*, the *Cambridge and Dublin Mathematical Journal*, and the *Philosophical Magazine*. In them he has greatly extended and improved the mathematical treatment of questions connected with the distortion of elastic solids, the motion of waves in water, the undulatory theory of light, the summation of series, the internal friction of fluids, &c. Another

excellent work by S. is his *Report on Double Refraction*, in the British Association Reports for 1862. Lectures on Solar Physics were published in *Nature* in 1881. He was president of the British Association in 1869; and in 1871 the University of Edinburgh gave him the degree of LL.D.

STOLBERG, CHRISTIAN, COUNT VON, a German poet, born at Hamburg, October 15, 1748. He belonged to one of the oldest German families, originally of Thuringia, and which is mentioned in authentic documents of the 11th century. S. studied at Göttingen from 1769 to 1774, where he was one of a distinguished literary circle in North Germany, embracing Boje, Bürger, Miller, Voss, Hölty, and Leisewitz. In 1777, he married Luise, Countess of Reventlow, whom he had previously celebrated in his verses; and after 1800, lived apart from public life on his estate of Windebye, near Eckernförde in Slesvig, where he died January 18, 1821. As a poet, he was inferior in genius to his younger brother, but his pictures of family life are very fine. His principal works are *Gedichte* (Leip. 1779); *Gedichte aus dem Griechischen* (Hamb. 1782); *Schauspiele mit Chören* (Leip. 1787); and *Vaterländische Gedichte* (along with his brother; Hamb. 1815).

STOLBERG, FRIEDRICH-LEOPOLD, COUNT VON, younger brother of the preceding, was born at Bramstedt, November 7, 1750, studied at Halle and Göttingen, and after a visit to Switzerland and Italy, in the course of which he made the acquaintance of Goethe at Frankfurt, and of Lavater at Zürich, he became, in 1777, minister-plenipotentiary of the episcopal Prince of Lübeck at the court of Denmark. S. filled various other official situations in the course of his public life; but becoming a convert to Roman Catholicism, he resigned all his employments, and henceforth lived mainly in the society of his co-religionists. The causes that led him to take a step which lost him many old and dear friends, were partly the theological strifes between the Rationalists and orthodox Lutherans in Holstein—the country where he mostly resided, and partly his study of the controversial works of the Catholic writers during a second visit to Italy in 1790—1791. He died at Sondermühlen, near Osnabrück, December 5, 1819. S. is a superior poet to his elder brother. There is greater boldness in his ideas and imagery, and he displayed a wonderful facility in versification. We have from him specimens of all sorts of poetry, songs, odes, elegies, metrical romances, satires, descriptive verse, and dramas, which are contained in the *Werke der Brüder Stolberg* (22 vols., Hamb. 1821—1826). See *Friedr.-Leopold, Graf zu Stolberg*, by Nicolovius (Mainz, 1846). A very good account of S.'s change of faith, and of that literary circle of North Germany in which he moved until his conversion, will be found in a book called *Entiner Skizzen* (Sketches of Entin), by Wilhelm von Bippen (Weimar, 1862).

STOLE (Gr. *stolé*, Lat. *stola*, a robe) is the name of one of the sacred vestments used in the Latin Church, and with some modification in the Greek Church also. It originated in a wide and flowing robe of linen, called also *orarium*, which hung from the shoulder, and which had a narrow embroidered border of a different color, as we learn from St. Ambrose's sermon on the death of Satyrus (n. 43), and from Jerome's letter to Nepotianus (Ep. 52). The present stole seems to be the traditionary representative of the embroidered border of the orarium in the Roman Catholic Church, and consists of a narrow band of silk or precious stuff, edged and fringed with gold or embroidery. It is worn over the shoulders by priest and deacons, but in a different fashion —the former wearing it over it both shoulders, with the ends hanging in front, or crossed upon the breast; the latter carrying it only from the left shoulder to the right side, where the pendent ends are fastened. In the Eastern Church the stole is worn pendent, over both shoulders by priests, over the left shoulder only by deacons. The stole is worn at mass, and in the administration of sacraments, in certain blessings, and in more solemn forms of preaching. It is also used, in some cases, as a symbol of jurisdiction, in which sense it is constantly worn by the pope, even when not officiating; and there is a very remarkable usage in Italy and other Catholic countries, illustrative of the same principle as to jurisdiction, of the parish priest, after he has administered extreme unction to a sick person, *leaving the stole upon the foot of the bed, not to be withdrawn until the death or recovery of the invalid*. Like the other sacerdotal vestments, the stole must be blessed by a bishop, or a priest delegated by a bishop. In the English Church the stole is now generally used by the clergy, and is worn with the same difference by priests and deacons. In the case of dignitaries, doctors, and chaplains of noblemen or bishops, it is worn in the form of a scarf. The use of the stole in the English Church appears to rest only upon ancient custom, as it is not specified in any rubric or canon. It is usually of black silk, fringed at the ends, with sometimes crosses embroidered.

STOLEN GOODS, in point of Law, stand in this situation in England: a *bonâ fide* purchaser of such goods, who has not bought them in market overt, is bound to restore them to the true owner; but if the goods are sold in market overt, the purchaser is entitled to keep them, unless the owner has duly prosecuted and convicted the thief. Market overt means the open market in towns and places where a legal market is held, and the old doctrine was, that as all sales were conducted by exposure of goods in an open place, the owner of the lost goods was likely to find them easily by going to the nearest market—a doctrine which is now quite inapplicable to modern habits. In the City of London every shop is held to be a market overt within the above rule, but this only applies to the City proper, and not the suburbs and western parts of the metropolis. The above rule, as to stolen goods, does not apply to valuable securities which are stolen, if the security has been paid or discharged *bonâ fide* by the person liable, or if the security is a negotiable instrument, and it have been *bonâ fide* transferred or delivered for a just and valuable consideration, without any notice, and without any reasonable cause to suspect that the same had been obtained by felony or misdemeanor. The law is obviously harsh as regards owners, for a man who has had the misfortune to have his goods stolen, must go to the further loss and expense of prosecuting the thief before he can recover them.—In the law of Scotland, it is otherwise. The owner has not only an action against the thief, but against third parties, whether they have bought them or taken them in pledge *bonâ fide* or not. But as to bank-notes, and bills payable to bearer, or blank indorsed, the property in these passes with the possession, and the real owner cannot vindicate them against one who has *bonâ fide* acquired them in the course of trade. As to giving reward for recovery of stolen goods, see REWARD, also RESTITUTION.

STOLP, a garrisoned town of Prussia, chief town of a circle in the province of Pommern, is situated on the river Stolp, about 15 miles from its mouth, and 40 north-east of Köslin. S., which is composed of an old and new town, with four suburbs, has a castle, 4 churches (one of which, the *Marienkirche*, built in 1311, has a tower nearly 190 feet high), a hospital for invalids, amber and other manufactures, and an active general trade. Pop. (1880) 21,591.—At the mouth of the river, lies Stolpmünde (pop. 1118), the port of S., which carries on some shipbuilding and commerce.

STOMACH. The Anatomy and Physiology of this organ are treated of in the article DIGESTION (q. v.).

STOMACH, DISEASES OF. In the discussion of the diseases of any organ, it is customary to begin with the consideration of its inflammation. In the stomach, however, acute *gastritis*, or inflammation of the mucous membrane of that organ, is so rare a disease, except as a result of the administration of an irritant poison, that it might almost pass unnoticed. Thus Louis states that during six years' experience at La Charité (one of the leading Parisian hospitals), in which he made notes of 6000 cases of disease, and 500 dissections, he did not meet with a single case of fatal idiopathic (or spontaneous) gastritis. The simple fact, however, that this disease is almost always the result of poison, gives it a special interest, and renders it especially necessary that the physician should be so thoroughly acquainted with its symptoms, as to be able with certainty to detect it, and thus to be led to investigate its cause.

The symptoms which indicate that an irritant poison has been received into the stomach, are a gradually increasing sensation of uneasiness or heat, which shortly assumes an acute burning character in the epigastric region. This pain is accompanied with vomiting, which becomes increasingly frequent as the pain augments, and often with hiccup. There is usually extreme tenderness on pressure, and the patient bends his body forward to relax the muscular tension. During the accession of these symptoms, there is a marked degree of excitement, as indicated by the acceleration of the pulse and breathing, and the heat of the skin. This condition is, however, soon exchanged for one of prostration. The skin becomes cold and clammy, the pulse thready and feeble, and the breathing catching and intermittent; until finally, after a variable period of exhaustion, the patient sinks, usually retaining his mental faculties to the last. Although the above-described symptoms are always more or less present, each irritant poison occasions some special symptom, and some characteristic lesion; and the period at which death ensues varies for different poisons. Hence, quite apart from the results of analysis, a fair conjecture can usually be made as to the individual poison which has been administered.

Sub-acute gastritis is by no means a rare affection, and it occurs in two distinct forms—'one in which the malady is caused by a constitutional state, the effects of which are shown in a variety of other organs, as well as in the stomach; another in which it is due to causes connected chiefly or exclusively with this organ, which is submitted to an irritative process somewhat analogous to that typified by the gastritis of irritant poisoning.'—Brinton, *On Diseases of the Stomach*, 1859, p. 101. The first of these forms is well illustrated in certain cases of scarlatina, in which, if death takes place between the third and seventh day of the disease, distinct marks of inflammation are seen in the stomach,

The other variety, which is often of a chronic form, is best seen in cases of delirium tremens; the affection being sub-acute or chronic, according as it has been produced by a single prolonged debauch, or by a protracted habit of drinking spirits; the patient's final malady being induced by a deficiency of food, or the want of the ordinary stimulant. Purely chronic inflammation may be induced by various causes, of which the most common are the abuse of alcoholic drinks, habitual excess in eating, the eating of indigestible food, and the excessive use of irritating medicines.

The treatment of gastritis varies so much with each individual case, that we shall only lay down a few general principles. The first point is the removal of the cause; to be attempted in cases of irritant poisoning, either by the removal of the poison (by the stomach-pump or emetics, as, for example, sulphate of zinc), or by its neutralization by means of an antidote. In very severe cases, leeches may be applied to the epigastrium; but counter-irritants, such as turpentine on a hot moist flannel, or mustard-poultices, are generally of more service. Continuous fomentation with water, as hot as can be borne, often gives great relief; while at the same time iced water, or small lumps of ice swallowed whole, usually relieve the thirst and mitigate the pain. Enemata of purgative materials, if the bowels are constipated, or of a soothing character (as thirty drops of laudanum in a little starch or gruel), if the bowels are irritable, may be prescribed with advantage. When the stomach begins to be able to retain food, it must be given in the form of a bland liquid, in small doses, at distant intervals. Chronic gastritis must be treated in much the same manner as Indigestion (q. v.). The most essential point of treatment is the due regulation of the diet.

Ulcer of the stomach is the most important of the idiopathic diseases of that organ, both from its frequency, from the facility with which it may be detected during life, from the fact that at any period of its protracted course it may prove suddenly fatal, and from its being usually curable. The first and most characteristic symptom of this disease is pain, which commences as a mere dull feeling of weight or tightness, then gradually augments into a burning sensation, and at last assumes a gnawing character, and occasions a kind of sickening depression. This pain comes on in from two to ten minutes after the ingestion of food, and lasts for an hour or two; vomiting often ensues, after which the pain ceases. The place of its most common appearance and greatest intensity is the center of the epigastric region, or slightly below the free end of the ensiform cartilage of the sternum; and the painful spot is usually of a circular form, with a diameter varying from one to two inches. The pain in this region is succeeded, in the course of a few weeks, by a gnawing pain in the back, ranging in position from the eighth dorsal to the second lumbar vertebra, and most commonly lying between the two shoulder-blades. The pain in both the epigastric and the dorsal region is almost always much increased by pressure; it is also specially affected by certain kinds of food and drink, being increased by the ingestion of hard and indigestible substances, and lessened by a bland and pulpy diet. As a general rule, the pain is aggravated by tea, beer, and hot food; although exceptions occasionally occur.

The next symptom in this disease is vomiting or regurgitation, expelling the food previously taken or a glairy alkaline fluid. The vomiting usually occurs when the pain is most intense, and is a dangerous symptom, since it tends to starve the patient, and to increase the fatigue of an already weakened frame. At this stage, the disease is sometimes terminated by the occurrence of perforation, ending in rapidly fatal peritonitis; and if this accident does not occur, the dyspeptic symptoms become complicated by hæmorrhage from the stomach, sometimes so rapid that it distends the stomach and adjacent small intestine with a single gush, and causes fainting and almost immediate death; but more commonly occurring as a slow and intermittent drain of blood, giving rise to anæmia. If death from the above causes (inanition, perforation, or hæmorrhage) does not terminate the disease, the symptoms frequently subside in something like the inverse order in which they occurred, and recovery, often after many years' suffering, ensues. With regard to frequency of ulcer of the stomach, Dr. Brinton, who has carefully studied this disease, states that this lesion may be detected in (on an average) 5 per cent. of persons dying from all causes; that it occurs twice as frequently in females as in males, and that it is specially a disease of middle and advancing life—27 being the average age in females, and 42 in males. Nothing is known with certainty regarding the causes of this disease, except that advancing age, privation, mental anxiety, and intemperance so frequently coincide with it, that they may be regarded in some degree as producing it.

In relation to treatment, strict attention to diet is of the first importance. When the symptoms are urgent, the patient should maintain the recumbent position, and should be fed on lukewarm milk, thickened with biscuit-powder, given in doses of one, or at most, two table-spoonfuls every two hours. The pain is often relieved by the application of a mustard-poultice to the painful spot; and benefit is frequently derived from the internal administration of bismuth (in doses of ten grains), either given alone or combined with the compound kino powder (in five-grain doses). When there is hæmorrhage, small lumps of ice may be swallowed; and if all food is rejected by vomiting, beef-tea injections must be thrown into the lower bowel. Aperients are sometimes required, but they must be given with caution; and if castor-oil can be taken without increasing the pain or vomiting, it is the most harmless remedy of its class.

Cancer of the Stomach is a disease of much interest, from its being obscure in its symptoms and difficult of detection in its early stage, frequent in its occurrence, and always fatal in its termination. The typical course of this disease is graphically sketched by Dr. Brinton in the following paragraph: 'An elderly person perhaps hitherto free from dyspepsia, begins to suffer from a capricious, and soon a diminished appetite; which is by and by associated with occasional nausea, or even vomiting, and with a sense of uneasiness or distention of the stomach. His complexion, already pale and unwholesome, next acquires a muddy, yellowish, or faint greenish hue. His gastric symptoms now increase; often by a sudden and marked augmentation, which corresponds to what is, in other cases, their first appearance. Vomiting, if already present, becomes more frequent and urgent; local uneasiness deepens into pain; and both these symptoms are excited or increased by taking food.

'At a somewhat later period, hæmorrhage generally occurs, usually but scanty in amount, and therefore depending to a great extent on casual circumstances for its detection. About this time, a tumor often becomes perceptible near the middle of the epigastric region of the belly. As the local symptoms increase, the cachexia of the patient also augments; and is evidenced not only by the color already mentioned, but also by debility and emaciation; and at last by prostration, which ends in anasarca, delirium, and death.'—*Op. cit.*, p. 225. From the records of 600 cases, Dr. Brinton finds that most deaths from this disease occur between the ages of 50 and 60 years. The form of cancer which most frequently attacks the stomach is the scirrhus or hard cancer. Out of 180 cases, scirrhus occurred in 130 (or nearly three-fourths of the whole), medullary or encephaloid cancer in 32, colloid in 17, melanotic deposit in 3, and villous cancer in 1. In the treatment of this formidable disease, more good is done by careful attention to the diet than by any medicine. Good milk or strong beef-tea thickened with biscuit-powder, may be given in the same manner as recommended in ulcer; and milk mixed with a little old Jamaica rum will sometimes stay on the stomach when everything else is vomited. If there be pain, opiates must be given, and they may be prescribed either in the ordinary way, or as enemata, the latter having the advantage of not inducing constipation.

Hæmatemesis, or *Vomiting of Blood*, must be looked upon rather as a symptom than a disease. Thus, it may occur by the ulcerative destruction of the walls of a comparatively large blood-vessel, as in gastric ulcer and in cancer; but it generally is of the kind termed capillary. The latter kind of hæmorrhage happens under various circumstances, of which the following are the principal: 1. The bleeding may be idiopathic, or unaccompanied by any structural change. This variety is extremely rare. 2. It may take the place of some habitual hæmorrhage, or, in other words, be vicarious. Thus it frequently takes the place of the menstrual discharge. 3. It is often a consequence of disease or injury of the stomach; for example, it frequently occurs after the ingestion of strongly irritant poisons, or even an immoderate dose of alcohol into the stomach. 4. It may be a consequence of disease in adjacent viscera, occasioning an overloading of the veins of the stomach; thus it is frequently caused by enlargement of the spleen, and occurs in those states of the liver in which there is obstruction of the portal circulation; and under this category we must place the gastric hæmorrhage which not unfrequently occurs in the advanced periods of pregnancy, in consequence of the pressure exerted by the enlarged uterus on the venous circulation of the abdomen. 5. It may result from changes in the composition of the blood, such as occur in scurvy, purpura, and yellow fever. The treatment must be directed against the disease on which the hæmorrhage depends, rather than against the mere symptom; but from whatever cause it arises, if it is proceeding to a dangerous extent, the patient should be kept perfectly quiet in bed, and should swallow small pieces of ice.

Hot applications may also be applied to the extremities, with the view of directing the blood to those parts. The medicines most likely to be of service are acetate of lead, gallic acid, dilute sulphuric acid, and oil of turpentine; but they should only be given on medical authority.

Some of the other affections of the stomach are discussed in special articles. See CARDIALGIA, INDIGESTION, SARCINA, &c.

STOMA'PODA (Gr. mouth-footed), an order of malacostracous crustaceans, to which *Squillidæ*, Glass-crabs, &c. belong. All of them are marine. They are most abundant in tropical seas, but some are found in those of temperate parts of the world. They

have seven or eight pair of legs, mostly near the mouth. The gills are external, adhering to the appendages beneath the abdomen, which is elongated, and terminates in an extended tail-fin. The rings which bear the eyes and the antennæ are not confounded with the rest of the head, as in the *Decapoda*, but are more distinct. The carapace often leaves the latter rings of the thorax exposed. The heart is very different from that of the *Decapoda*, assuming the form of a long cylindrical vessel, which extends throughout the length of the abdomen.—The S. inhabit deep parts of the sea, many of them living at the bottom, whilst some, as Glass-crabs, are found floating at the surface.

STO'MATA (Gr. mouths) are minute openings in the epidermis of leaves and other green parts of plants exposed to the air, communicating with intercellular spaces. Their existence was first noticed by Grew, who described them in his *Anatomy of Plants* in 1682. They are generally formed by two semilunar cells, which are as lips to the orifice, and are filled with green matter; but sometimes the cells arranged around them are more numerous. They are generally of an elliptical form, but sometimes circular, and sometimes quadrangular. These differences are very characteristic of particular species, genera, or orders of plants. In a moist state of the atmosphere they are open; but when it becomes dry, they are closed, or nearly so. It appears that they are organs of transpiration, and that their opening and closing according to the moisture or dryness of the atmosphere regulates it in a manner suitable to the requirements of the plant. They do not occur in any part of the plant covered by the soil, nor in submerged leaves, nor on the lower side of floating leaves. Succulent plants have very few of them; so that these plants retain for a long time the moisture which they have imbibed, and are thus adapted for living in a dry atmosphere. S. are generally most abundant on the under side of leaves; but in leaves which grow vertically, they are often almost equally numerous on both sides. In general, they are irregularly placed; but in grasses and many other endogenous plants with parallel-veined leaves, they are in regular rows; and in some other plants they occur in little groups. The number in a square inch varies from 200 in the mistletoe, to almost 450,000 in the under side of the leaves of *Salanum sanctum*.—S. are not found in mosses, lichens, algæ, and fungi; but they exist in some of the *Hepaticæ*, as in *Marchantia*, in which their structure is more complex than in the higher plants; each of them consisting of a kind of shaft, composed of four or five rings placed one upon the other, every ring made up of four or five cells, and the lowest ring apparently regulating the aperture by the contraction or expansion of the cells which form it.

STONE, a market-town of Stafford, stands 7 miles north-north-west of the town of that name, on the left bank of the Trent. Shoemaking, tanning, malting, and brickmaking, are the chief branches of industry. Near the church are some remains of an Augustinian monastery. Pop. (1871) 3732; (1881) 5669.

STONE, a weight in use throughout the north-west and central countries of Europe, but varying much in different countries. It is chiefly employed on the continent for weighing wool, hemp, flax, and feathers, the flax-stone containing twice as many pounds as the one used for wool and feathers. In all the principal commercial states of Germany, the stone (of flax) is the $\frac{1}{4}$th of a cwt. (centner = 100 or 112 lbs.), i. e., 20 lbs., in Prussia and the Zollverein, Hamburg, Lübeck, and Bremen; 22 lbs. in Austria, &c.; in Britain, it is the $\frac{1}{8}$th of a cwt., or 14 lbs.; while in Sweden it is equivalent to 32 lbs. In Great Britain, though the stone of 14 lbs. is the only legal imperial weight of the kind, stones of other values are in regular use, as a stone of 24 lbs. for wool, and one of 8 lbs. for butcher-meat.

STONE. See CALCULUS and LITHOTOMY.

STONE is used for a great variety of purposes—for building, paving, millstones, grindstones, honestones, ornamental purposes, &c. Besides what is said under special headings (see BUILDING STONE, QUARRY, MILL, GRINDSTONES, HONES, MARBLE, GRANITE, SLATE, &c.), the following general remarks may be added here. The desirable properties in a building-stone are, that it should be compact, insoluble in water, not easily altered by the atmosphere, and not liable to take on a vegetable coating. These qualities depend upon its chemical composition and on its mechanical structure.

Building stones may be divided into three classes—siliceous, calcareous, and composite. Siliceous stones (including granite, porphyry, gneiss, greenstone, basalt, sandstone, slate, serpentine, &c., and containing from 45 to 99 per cent. of silica), are, as a general rule, the most durable for building. Their durability is affected by certain of their ingredients, as by the felspar in granite, and salts of iron in sandstone. Calcareous stones (simple limestone, travertin, marble, &c.) are slightly soluble in pure water, and more so in carbonic acid water; they are liable to splinter by water freezing in their pores, are acted on by acid gases (e. g., the sulphurous acid gas produced by the combustion of most kinds of coal), and are somewhat liable to be stained by minute plants. Still, some of them are lasting enough in a country atmosphere. The failure of the magnesian limestone selected for the British Houses of Parliament is a good instance of a stone lasting for centuries in a country church, and yet quite unable to withstand the wasting action of the atmosphere of a great city. Composite stones, in which neither the silica nor the lime greatly predominates, are unimportant.

The most exhaustive account of the building stones of the British Islands is given in the parliamentary Blue Book embodying the Report of the Commissioners appointed to select a stone for the Houses of Parliament, published in 1839. Much scientific information regarding all kinds of stone will be found in the catalogue of the Rock Specimens of the Museum of Practical Geology, London.

STONE, ARTIFICIAL. Artificial stone, properly speaking, would include burned clay wares used for building purposes, as bricks, Terra Cotta (q. v.), &c., as well as the various cements. We shall confine ourselves here to a description of the siliceous artificial stone produced by the cementing properties of soluble alkaline silicates on sand, which has excited a great deal of attention within the last thirty years. So far back as 1825, Professor J. N. von Fuchs of Munich published a paper on various applications of these silicates, and so laid the foundation of a new industry. To M. Kuhlmann of Lille, however, is mainly due the merit of working out the practical application of the soluble silicate of potash or soda to the manufacture of hydraulic lime, cement, and especially to artificial stones. Mr. Frederick Ransome of Ipswich has also done great service by his successful exertions in producing an artificial stone from the same substances. The process, as at first practised by Mr. Ransome, consisted in mixing the gelatinous silicate of soda with sand and a little powdered glass and clay, in the proportions of sand, 10 parts; glass, 1 part; clay, 1 part; and silicate of soda, 1 part. These ingredients were thoroughly incorporated in a pug-mill, and brought to the consistency of putty. The plastic nature of the substance at this stage allows it to be moulded with ease into an endless variety of forms, even of an elaborately ornamental kind. After leaving the moulds, the objects are dried in close ovens, and then removed to kilns, where they are fired at a gradually increasing temperature, which finally reaches a red heat. In the kiln, the goods are bedded up in dry sand, to prevent any of the twisting or loss of shape which so commonly disfigures large objects in baked clay. When the firing is completed, the material is in the state of a semi-vitrified mass, with the appearance, properties, and composition of a fine sandstone.

A later patent of Mr. Ransome's consists in producing a hard and durable material altogether without baking, by effecting a double decomposition with the silicate of soda and the chloride of calcium. Such materials as sand, chalk, or other minerals are intimately mixed with a proper quantity of a solution of silicate of soda, this being secured, as before, by the operations of a pug-mill. In this plastic condition, they are moulded into any required form, after which they are saturated with a solution of chloride of calcium. The silica combining with the calcium forms at once an insoluble silicate of lime, which cements into a firm mass all the particles of sand, lime, &c., used in the composition. The chlorine, on the other hand, combines with the soda to form common salt (chloride of sodium), which can be readily removed by washing.

In order to avoid the difficulty experienced in removing all traces of chloride of calcium from artificial stone made by this last process, Mr. Ransome in 1872 succeeded in making a very compact stone by mixing lime and a natural soluble silica found in a rock forming a stratum of the lower chalk in Surrey with sand and silicate of soda. In point of strength this material excels Portland stone, not breaking so readily by a given transverse strain.

The objects into which artificial stone is manufactured are very miscellaneous; whatever, in fact, is made of real stone can also be formed in the artificial. Among the more prominent applications of it, we may notice grindstones, millstones, tombstones, monuments, chimney-pieces, balustrades, fountains, vases, and statuary.

STONE CHAT (*Saxicola rubicola*; see CHAT), one of the most common of the British *Sylviadæ*, a pretty little bird, rather smaller than the redbreast, black on the upper parts and throat in summer; the breast of a dark reddish color; some white on the sides of the neck, the wings, and the tail. It makes its nest on the ground, or on a low branch. Some stone-chats spend the winter in Britain, but the greater number migrate to more southern regions.

STONECROP. See SEDUM.

STONE-CUTTING AND DRESSING MACHINES. Stone is a substance which in none of its varieties is easily operated on

by machinery, owing chiefly to its brittleness, its unequal hardness, and the natural cracks which so frequently impair its solidity. Accordingly, though many ingenious machines have been invented for working stone, it is as yet only in some of the plainer kinds of work that they can be said to have entirely superseded hand operations.

Some stones and slates are soft enough to be cut with ordinary toothed saws much in the same way as wood is cut. More generally, however, the sand-saw is employed, which we shall presently describe in noticing marble-cutting. For the cutting of common kinds of stone, which are not to receive a fine polish, a machine, which promises to be very efficient, has been recently patented by Mr. George Hunter of Maentwrog, Caernarvon, and is now in operation at various large quarries, both of stone and slate. The cutting portion consists (fig. 1) of a circular disc, A, A (two of

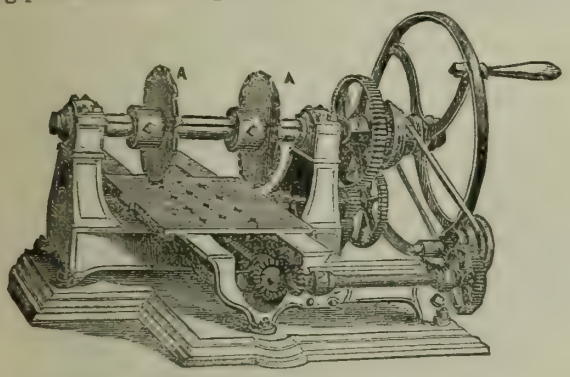


Fig. 1.

these are shown in the figure, but the number varies), round the circumference of which a number of pointed steel tools are fixed into sockets, thus giving it the appearance of a large toothed saw. This machine will cut sandstone at the rate of 5 to 6 inches, slate at 3 inches, and soft limestone at 3 inches per minute, supposing these to be in blocks each 2 feet thick.

So far as the sawing or slicing of stones is concerned, the tendency of late years is to rely on the use of the diamond—the dull black variety which is of no use as a gem. Some American stone-cutting machines have saws with teeth set with these diamonds, and are said to cut ordinary sandstone at the rate of 75 square feet per second for each saw. Machines for dressing the face of stones by means of a series of chisels in imitation of the hand-work of the mason have recently been tried and have given fair results.

It is considerably more than a century since machinery for sawing and polishing marble was first established at Ashford, near Bakewell, in Derbyshire, that county being still the seat of the principal marble manufacture of England. Marble is cut into slabs by means of a series of thin plates of soft iron used like saws, but having no teeth. The saw-blades are fixed into a rectangular frame, to which a reciprocating horizontal motion is given. The block of marble to be cut rests on a carriage below the frame, and a small rill of mixed sand and water is constantly falling into the saw-cuts.

After the marble has been sawn into slabs, it is cut up into narrow pieces, when so required, by means of small circular saws with smooth edges, sand and water being employed as above.

The sawn slabs are next submitted to the grinding process. This, for pieces of moderate size, is usually done upon a large circular cast-iron plate, called a *sanding-bed* or *grinding-bed*, mounted upon an upright spindle, and supplied with sand and water. The workman places the piece of marble with its face downwards upon the grinding-bed, and exerts the proper amount of pressure. The marble is held in its place by means of guide-rods stretched across the plate. Slabs too large to be manipulated in this way are ground with plates of iron operating upon their surface.

The marble, when properly ground, is polished on a polishing bed or table, with an arrangement for securely fixing it while the rubbing is being proceeded with. The polishing rubbers are sometimes blocks of wood faced with felt, and sometimes bunches of hemp compressed between two side-plates. They are attached to a swing-frame with a pendulum-like motion, which draws them backwards and forwards over the surface of the marble. Flour emery is used to charge the rubbers in the first instance, and putty-powder (oxide of tin) for the finishing polish. Instead of emery, sometimes the fine-grained stone known as Water of Ayr stone is used to prepare the marble for the putty-powder.

Cylindrical objects, such as columns or vases, are first formed roughly into shape with a hammer and chisel, and then turned, with a pointed steel tool, upon a lathe, to which a slow motion is given. When thus brought to an accurate form, a rapid motion is given to the lathe, and the tool-marks ground away by the use of coarse, and then fine, and still finer sandstones—the polishing being completed with emery and putty powder while the object is still upon the lathe.

Machinery is also applied to the production of flat objects with curved and moulded outlines. Fig. 2 represents the essential parts of a machine for this purpose. It operates by the use of a rotatory cutter, which is guided in its action by a template formed accurately to the intended shape of the article. The cutter, *a*, is of steel or stone, and is attached to the lower end of a spindle driven by bevelled wheels. There is a flange at *b*, which allows the cutter to penetrate the marble till it reaches the template, *c*, and no further. In the process of cutting, the marble, which we will suppose is to receive the shape shown at S (fig. 3), but only

Fig. 2.

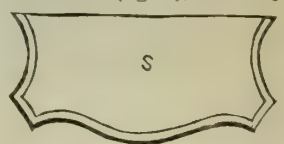


Fig. 3.

seen on edge at *d*, in fig. 2, is constantly drawn up against the cutting-tool by two weights, the one pulling the table, *h*, in one direction, the other the carriage on which *h* rests, in a direction at right angles to the former, thus compelling the cutter to follow the outline of the template. The shape of the cutting-tool is, of course, exactly the reverse of the moulding to be formed.

In the cutting and polishing of granite, the machinery and processes are so nearly the same as those employed for marble, that it is unnecessary to describe them separately. Suffice it to say, that all objects to which the sawing apparatus cannot be applied, require to be worked to shape with great care by means of steel chisels and iron mallets, which only remove small portions at a time. Owing to the great hardness of the material, any defect in the chiselling greatly increases the labor of polishing. So slow, indeed, are the operations with granite, that a saw-blade will not cut through an inch in depth during a whole day, and a good-sized sawn slab will take a week to polish.

STONE-FLY (*Perla*), a genus of Neuropterous insects, of the tribe or family *Planipennes*. The hind wings are broader than the fore-wings, and folded at the inner edge. The body is elongate, narrow, and flattened; the wings close horizontally on the body; the abdomen is generally terminated by two bristles (*setæ*). The larvæ are aquatic, and much resemble the perfect insect, except in the want of wings. A number of species are common in Britain, and are well known to anglers as an attractive lure for fishes.

STONE-FRUITS, in Popular Language, are those fruits which are botanically designated *drupes*, and in which the rind is fleshy, and the putamen bony. Many of the finest dessert fruits are of this description. Those best known in temperate climates generally belong to the natural order *Rosaceæ*, sub-order *Amygdaleæ*, the order *Drupaceæ* of Lindley, as the peach and nectarine, plum, cherry, apricot, &c. In tropical countries, many stone-fruits occur, belonging to *Chrysobalanaceæ* and other natural orders.

STONEHA'VEN, a seaport town of Scotland, capital of the county of Kincardine, and a station on the railway from Dundee to Aberdeen, is situated on a rocky bay at the mouth of Carron Water. It is divided into an Old and New Town, on different sides of the river, and connected by a bridge. The harbor can admit only small vessels. S. has very considerable haddock and herring fisheries, and some slight manufactures. Pop. (1881) 3957. Two miles south, on a projecting rock, stands the famous castle of Dunnottar, once the residence of the Earls Marischal.

STO'NEHENGE (Sax. *Stanhengist*, hanging or uplifted stones), a very remarkable structure, composed of large artificially raised monoliths, situated on Salisbury Plain, two miles from the town of Amesbury, in Wiltshire. Its neighborhood abounds in sepulchral tumuli, in many of which ancient British remains have been found. The fabric of S., which was comparatively entire in the early part of the present century, has been so much defaced in recent times as to be at first view little more than a confused pile of moss-grown stones; but a minute inspection will still enable one to trace its original form. When entire, it consisted of two concentric circles of upright stones, enclosing two ellipses, the whole surrounded by a double mound and ditch circular in form. Outside the boundary was a single upright stone, and the approach was by an avenue from the north-east, bounded on each side by a mound or ditch. The outer circle consisted of 30 blocks of sandstone, fixed upright at intervals of 3½ feet, and connected at the top by a continuous series of imposts, 16 feet from the ground. The blocks were all squared and rough-hewn, and the horizontal imposts dove-tailed to each

other, and fitted by mortise-holes in their under sides to knobs in the uprights.

About 9 feet within this peristyle was the inner circle, composed of 30 unhewn granite pillars, from 5 to 6 feet in height. The grandest part of S. was the ellipse inside the circle, formed of 10 or 12 blocks of sandstone, from 16 to 22 feet in height, arranged in pairs, each pair separate, and furnished with an impost, so as

Stonehenge.

to form 5 or 6 trilithons. Within these trilithons was the inner ellipse, composed of 19 uprights of granite similar in size to those of the inner circle; and in the cell thus formed was the so-called altar, a large slab of blue marble.

There has been much speculation regarding the origin and purpose of S., which are still involved in much obscurity. A curious legend, first found in the *British Chronicle* of the 10th c., and repeated by Geoffrey of Monmouth and Giraldus Cambrensis, ascribes it to Emrys or Ambrosius, the last British king, who, in the 5th c., aided by the incantations of the magician Merlin, is said to have erected it in memory of 460 Britons, who were murdered by Hengist the Saxon. In modern times, the most prevalent opinion has been that, in common with other similar structures elsewhere, it was a temple for Druidical worship; but this belief has been somewhat shaken by the discovery of the sepulchral character of many other monuments, which had been also presumed to be Druidical. The circular form has suggested the idea of a connection with the worship of the sun; and S. may possibly have been used for the religious rites of various successive races and creeds; and also as a court of justice or battle-ring for judicial combats. The outer circle is evidently of a much later date than the rest, and seems to belong to a period when iron tools were in use. See STANDING STONES.

STO'NEHOUSE, EAST, a parish of Devonshire, included within the limits of the parliamentary borough of Devonport (q. v.), and forming in effect a portion of Plymouth (q. v.). Among other government establishments, it contains the Royal William Victualling Yard, naval hospital, and marine barracks capable of accommodating 1000 men. Pop. of parish, (1881) 15,041.

STONE PERIOD. See BRONZE, AGE OF.

STONE-POCK, an old name for a variety of modified smallpox, in which the vesicles dried up into hard tubercles instead of proceeding onwards to maturation.

STONE, PRESERVATION OF. The mechanical preservation of stone can be effected to a great extent by coating the surface with boiled linseed oil, or with oil-paint; but these methods are not much in favor, as they destroy the crystalline appearance which constitutes the beauty of most natural stones. As promising a better result, many experiments have been tried, especially of late, with certain chemical solutions that are not likely to mar the inherent beauty of a stone. The substances which have been most used are those soluble silicates which we have referred to under ARTIFICIAL STONE. The earlier process of Kuhlmann consisted in coating the surface with a soluble silicate of soda or potash, which is also known by the names of soluble glass, water-glass, and flint liquor. This was applied with a brush, and silification was produced by the silica of the solution entering into combination with the lime of the stone; but this took a considerable time, so that, on an exposed front, it was liable to be washed out before the proper hardening took place. The later process of Ransome consists in cleaning the surface of the stone from extraneous matter, and then applying alternate solutions of the above alkaline silicate and chloride of calcium, which forms an insoluble silicate of lime in the pores of the stone. This plan has been tried with a portion of the new Houses of Parliament many years ago, and is now extensively used in London, Edinburgh, Glasgow, and elsewhere. Ransome's process is indeed practically the only one in use. But the preservation of the Houses of Parliament has been the subject of inquiry since this invention was applied to them; and the committee which sat did not succeed in discovering any preserving agent which they felt justified in proposing. The chemists engaged in this inquiry selected, from a vast number of proposals then made, the following processes, as claiming a careful investigation: 1. Application of silicates of the alkalies, in various states of concentration; 2. Application of silicates, in conjunction with various saline compounds, intended to produce double decomposition; 3. Application of hydrofluoric or hydrosilicic acid, or their saline compounds; 4. Application of phosphoric acid and acid phosphates; 5. Applications of solutions of the alkaline earths, or their bicarbonates, in water.

STONE-WARE. See POTTERY.

STO'NINGTON, a town and port of entry of Connecticut, U. S., at the eastern extremity of Long Island Sound, 63 miles east of New Haven, and at the junction of one of the railway and steamer routes between New York and Boston. It has a fine harbor, with 17,000 tons of shipping, engaged in coasting trade and fisheries, and numerous manufactories. S. was settled in 1649. Pop. (1880) 7355.

STO'NY POINT, a small rocky promontory on the right bank of the Hudson River, at the entrance of the Highlands, 42 miles north of the city of New York. This and the opposite Verplancks Point were fortified in the war of the Revolution, and were the scene of several contests.

STONYHURST COLLEGE, 7 miles north-east of Blackburn, Lancashire, a Roman Catholic institution, founded in 1794, was affiliated to London University in 1863, and prepares candidates for matriculation at the universities, and for the civil and military services. It has a staff of about 20 professors and masters.

STOOL OF REPENTANCE, the name ordinarily given in Scotland to a low stool conspicuously placed in front of the pulpit in churches, on which persons who had become subject to ecclesiastical discipline for immoral conduct were required to sit during public worship, in profession of their penitence, or on which they stood at the close of the service to be 'rebuked' by the minister. It was also familiarly called the *cutty* stool, a term applied to small stools of similar form, common in houses, but which came to be often employed in conversation and in humorous verses with special reference to that which stood in the church. The Stool of Repentance, although used in some places within the present century, has now fallen into complete disuse; whilst the practice of formal public rebuke has also generally been laid aside.

STOP, or REGISTER, a name given to the different ranges of pipes in an organ. Each stop consists of a series of pipes, of the same quality of tone, extending throughout the whole or a large part of the compass of the instrument, and furnished by a draw-stop or knob, on drawing which out, the air is admitted to the particular stop, so that the keys will play on pipes of that character. Some of the stops do not give the note which corresponds in pitch with the key struck, but a note an octave or two octaves lower, or one of the harmonics higher in pitch. Compound or mixture stops consist of more than one row of pipes to each key, corresponding to the different harmonics of the ground tone. The stops of different organs vary much in number and kind; a very large number are to be found in many of the organs in Germany and Italy. See ORGAN.

STO'PPAGE IN TRA'NSITU is a valuable right or privilege of a vendor of goods to resume possession, after he has parted with them under a contract of sale, and before the goods have reached the vendee. It occurs when goods are consigned entirely or partly on credit from one person to another, and the consignee becomes bankrupt before the goods arrive. In this event, the consigner has a right to direct the captain of the ship or other carrier to deliver the goods to himself or his agent instead of the consignee, who has thus become unable to pay for them. This right was first allowed as equitable by the Court of Chancery, and the courts of common law followed the example. There are certain circumstances, however, in which the right to stop *in transitú* may be defeated, as where the consignee of the goods indorses the bill of lading to a *bonâ fide* indorsee. When the vendee has appointed the carrier who is to receive the goods, their delivery to the carrier is treated for many purposes as delivery to the vendee himself; yet it is not too late for the vendor to stop the goods so long as they have not come into the actual possession of the vendee. The right to stop *in transitú* is not allowed to a vendor unless in case of the bankruptcy of the vendee or his stoppage of payment.—The same rule extends to Scotland.

STOPPAGES, MILITARY AND NAVAL, are certain deductions made from the pay of officers and men, in consideration of supplies made to them, or in aid of certain institutions. These stoppages were formerly more numerous than now. Thus, every officer and man had to pay towards Chelsea and Greenwich hospitals, and a soldier had to pay for his kit by a stoppage from the bounty. These stoppages have been remitted. Those now remaining are, under ordinary circumstances, limited in the navy to payment for slops (i. e., clothing) issued to men, or for wilful damage: in the army, for forage, 8½*d.* each ration by cavalry officers, and 6*d.* for artillery officers (though their horses eat the same); for messing on board ship; for diet in hospital, if sick

through the man's own fault; for cost while in prison; for damages to barracks; and as a fine for drunkenness.

STO'RAX, a fragrant resinous substance, the *styrax* of the ancients, obtained from the Storax-tree (*Styrax officinalis*), a native of the countries around the Mediterranean Sea, and belonging to the natural order of *Styracaceæ*, an order of exogenous plants, containing more than 100 known species. The species of this order are found in the tropical and subtropical parts of Asia, extending also into Europe and Africa, and the warm parts of America. *Styrax officinalis*, which produces S., is a tree of 15—20 feet high, a native of the Levant. S. is obtained by wounding the bark, when it exudes and hardens in the air. It appears in the form of reddish-yellow tears about the size of a pea, opaque, soft, and adhesive; or in dry brittle masses, wrapped in the leaves of a kind of reed, when it is called *S. calamita*. S. has a fragrant odor and an aromatic taste, and is stimulating and expectorant it was formerly much more in use in medicine than now. Benzoin (q. v.) is the produce of a species of *Styrax*. The *Liquid S.* of the shops is doubtfully regarded either as produced by *Styrax officinale*, or by a species of *Liquidambar* (q. v.). It seems probable that there are two kinds.

STORK (*Ciconia*), a genus of birds of the same family (*Ardeidæ*) with herons and bitterns; large birds; with long legs, four-toed, the three front toes webbed to the first joint; the tail short; the wings large; the bill longer than the head, straight, strong, pointed, and without any groove, the nostrils pierced longitudinally in the horny substance; the eyes surrounded by naked skin. In some storks the whole face and throat are destitute of feathers. The species are not numerous (about a dozen), but they are of very wide geographic distribution. The COMMON S., or WHITE S. (*C. alba*), is a native of the greater part of the Old World, a migratory bird, its range extending even to the northern parts of Scandinavia. It is common in most parts of Europe, but is especially familiar in Holland and North Germany. The storks arrive annually in February and March, and in autumn return to Africa in large flocks, flying mostly by night. It is about three feet and a half in length. The head, neck, and whole body are pure white; the wings partly black; the bill and legs red. The neck is long, and generally carried in an arched form; the feathers of the breast are long and pendulous, and the bird often has its bill half hidden among them. The flight is very powerful and high in the air; the gait slow and measured. In flight the head is thrown back, and the legs extended. The S. sleeps standing on one leg, with the neck folded, and the head turned backward on the shoulder. It frequents marshy places, feeding on eels and other fishes, frogs, lizards, snakes, slugs, young birds, small mammals, and insects. It makes a rude nest of sticks, reeds, &c., on the tops of tall trees, or of ruins, spires, or houses. There are four or five eggs; white

Storks and nests.

tinged with buff; and the old nest is re-occupied next year. In many parts of Europe, especially in Holland, it is a very common practice to place boxes for storks, and it is considered a fortunate thing for a household that the box on the roof is occupied.

Storks are protected by law in some countries, on account of their good services not only in destroying reptiles and other troublesome animals, but in the removal of offal from the streets of towns, in which they stalk about with perfect confidence, even in the midst of throngs of people. They have been celebrated from ancient times for the affection which they display towards their young; and have also had the reputation—not so well founded—of showing great regard to their aged parents. Before they take their departure from their summer haunts, they congregate in large flocks, which make a great noise by the clattering of their mandibles, and are popularly regarded as holding consultation. The S. has no voice. It is a very rare bird in Britain, and was so even when the fens of England were undrained. The flesh of the S. is rank, and not fit for food.—Another species, the BLACK S. (*C. nigra*), rather smaller, the plumage of the upper parts glossy black, the under parts white, is also common in many parts of Europe, Asia, and Africa.—The AMERICAN S. (*C. maguari*) is very similar to the Common Stork; it is common in South America, particularly Brazil.

STORMS are violent commotions of the atmosphere, occurring in all climates, particularly in the tropics, and differing from other atmospheric disturbances in the extent over which they spread themselves, their destructive power, and the sudden changes which take place in the direction of the wind. There is, perhaps, no question in science in which there has been so large an admixture of speculation with fact, as in the attempts made to reduce the phenomena attendant on storms under general laws; the reason being, that meteorological observatories were too few in number, and too wide apart, to enable any one to give the barometer pressure, the general course of the winds, and the rainfall, without drawing largely on conjecture. Now, however, owing to the growing popularity of meteorology, and the countenance happily given to it by most civilized nations, sufficient data may be obtained for a fuller and more satisfactory statement of the facts.

On the next page are two charts of Europe, showing, from actual observations made at upwards of 100 localities scattered over that continent, the barometric pressure, and direction and force of the wind, at 8 A.M. of the 1st and 2d of November 1863, during part of the course of two storms which passed over Europe at that time. The isobarometric lines, or lines showing where, at the above hours, the height of the barometer was the same, are given for every two-tenths in the difference of the pressure. Hence, where these lines approach near each other, or crowd together, the difference of pressure, or the atmospheric disturbance, was the greatest; and the least where they are most apart—a distinction of the utmost importance in determining where the storm may be expected to rage in greatest fury. The arrows show the direction of the wind, being represented flying with it. The force of the wind is shown (1) by plain arrows, ⟶, which represent light and moderate winds; (2) by arrows feathered on one side only, ⟶, which represent high winds; (3) by arrows feathered on both sides, ⟶, which represent strong gales, storms, or hurricanes.

The mean atmospheric pressure, at the level of the sea, may be stated to be 29·9 inches. When, therefore, the barometer falls below 29·9, the equilibrium of the atmosphere is more or less destroyed according to the amount of the fall, and it is within this *area of low barometer* that a storm may be expected to occur. Hence, while we trace these low pressures, as they advance over the earth's surface from day to day, we trace at the same time the progress of the storms.

Form and Extent of Storm Areas.—The circular isobarometric lines on the charts represent very accurately the general shape storms assume. The area of almost every storm is either circular or slightly elliptical, and when elliptical, the major axis of the ellipse seldom exceeds twice the length of the minor axis. Rarely in Europe, but in America less rarely, the form of storms is much more elongated. The outline is occasionally very irregular, but in all such cases the storm will be found to have parted into two or more distinct storms, which remain separate for some time and then re-unite. This circular form of storms, which an examination of some hundreds, especially in Europe, has shown to be their general characteristic, is a most important feature, whether as determining the practical rules for the guidance of sailors in storms, or for the forecasting of storms at particular seaports, in respect of the direction from which they may be expected to come, and the veerings of the winds during their continuance. The extent over which storms spread themselves is very variable, being seldom less than 600 miles in diameter, but often two or three times that amount, or even more. Almost the whole of Europe is sometimes overspread by a single storm at one time. The area of storms is by no means constant from day to day, but varies in size, sometimes expanding and sometimes contracting. And it is worthy of remark, that when a storm contracts its area, the central depression gives signs of filling up, and the storm of dying out. On the other hand, when it increases in extent, the central depression becomes deeper, the storm increases in violence, and

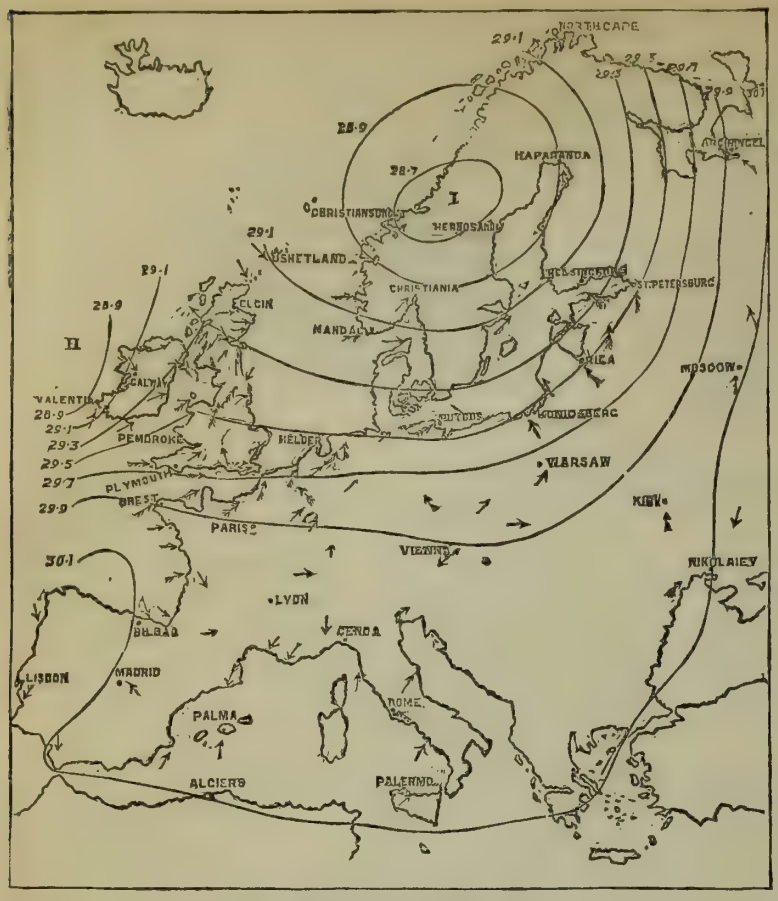


Fig. 1.—At 8 A.M., November 1, 1863.

occasionally is broken up into two, or even three depressions, which become separate storms, with the wind circling round each.

Direction in which Storms advance.—It may be premised that by the direction of a storm is meant, not the direction of the wind, but the path followed by the center of disturbance. The direction in which their progressive motion takes place differs in different parts of the world—being probably determined by the prevailing winds. See WINDS. Thus, about half the storms of middle and northern Europe travel from the south-west toward the north-east, and 19 out of every 20, at least, travel toward some point in the quadrant from the north-east to the south-east. Storms are thus rarely found traveling towards a westerly point; in some of the few instances which have been noted, this western course has been arrested at Norway, or Denmark, and they have retreated eastwards. Storms do not always proceed in the same uniform direction from day to day, and though the change which occurs in the direction of their progressive motion is generally small yet occasionally it is very great. Thus, of the many interesting features peculiar to the storm which passed over Europe in the beginning of December 1863, none were more remarkable than the sudden changes of its progressive motion. It was first observed on the west of Ireland, from which it advanced east to Liverpool, then turned south through Worcester and Oxford to Cherbourg in France; it thence retreated north through Oxford to Shields, from which it proceeded east to Copenhagen. By the time it arrived at Copenhagen its extent was only a fourth of what it had been the previous day, and the central depression half an inch less.

Twelve hours later, the atmospheric equilibrium was restored, the storm having died out on reaching the Baltic Sea. The storms of the Mediterranean follow a different course. Many of them proceed from the north to the south, influenced probably by the heated air rising from the Sahara; a considerable number proceed from the east, and pass to the westward over Greece and Italy to the Alps; while very few are observed to travel in an easterly direction. By far the greater number of the storms of North America take their rise in the vast plain which lies immediately to the east of the Rocky Mountains, and thence advance in an eastern direction over the United States; some of them, crossing the Atlantic, burst on the western shores of Europe. But the relation of the American to the European storms is not yet well established, nor will be till observation has collected more facts, and discussion has sifted their significance. If once the connection be fully established, the system of forecasting storms to European ports will become much more certain and complete than it is at present. The storms of the West Indies generally take their rise from near the region of calms, and tracing out a parabolic course, proceed first towards the north-west, and then turn to the north-east about 30° N. lat., many of them traversing the east coasts of North America as far as Nova Scotia. South of the equator they follow an opposite course. Thus, in the South Atlantic and Indian Ocean, they first proceed toward the south-west, and then gradually curve round to the south-east. The hurricanes of Hindustan usually pursue a parabolic path, first traversing the eastern coast towards Calcutta, and then turning to the north-west up the valley of the Ganges. The typhoons of the Chinese Seas resemble, in the course they take, the hurricanes of the West Indies. Observations are wanting from other parts of the world to determine the course of storms.

Probably the course tracked out by storms is determined by the general system of winds which prevail, modified by the unequal distribution of land and water on the surface of the globe. Facts seem at present to point to this general conclusion, viz., *Storms follow the course of the atmospheric current in which the condensation of the vapor into the rain which accompanies them takes place.*

Rate at which Storms travel.—If the position of the center of Storm I. on the 2d November be compared with its position on the 1st on the charts, it will be found to have traveled 420 miles in 24 hours, or at the rate of 17½ miles an hour. Similarly Storm II. will be found to have traveled in the same time 400 miles, or at the rate of 16⅔ miles an hour. This is not far from the average rate of the progressive movement of European storms. It is to be noted that storms travel with

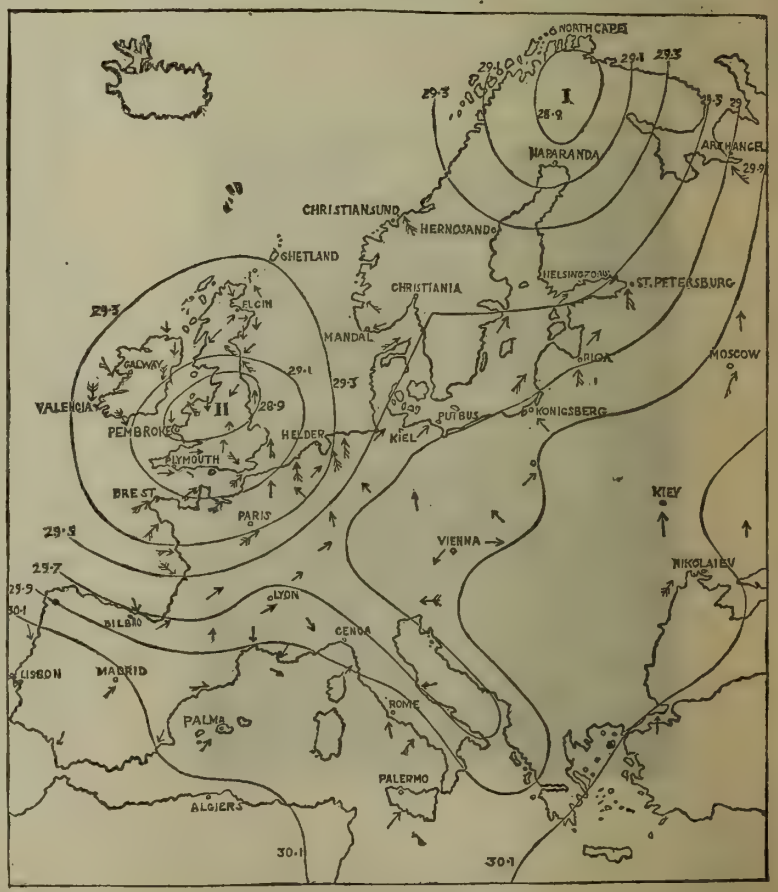


Fig. 2.—At 8 A.M., November. 2, 1863.

a less velocity over the ocean than over land. Within the tropics, the onward motion of storms sometimes rises to 40 miles an hour; whilst at other times the rate of motion is so slow as to be almost stationary.

Relations of Temperature, Rain, and Cloud to Storms.—The temperature increases a few degrees at places toward which and over which the front part of the storm is advancing, and falls at those places over which the front part of the storm has already passed. In other words, the temperature rises as the barometer falls, and falls as the barometer rises. When the barometer has been falling for some time, clouds begin to overspread the sky, and rain to fall at intervals; as the central depression approaches, the rain becomes more general, heavy, and continuous, and corresponding to the atmospheric depression at the place where it falls. After the center of the storm has passed, or when the barometer has begun to rise, the rain becomes less heavy, falling more in showers than continuously; the clouds break up, and fine weather ushered in with cold breezes ultimately prevails. It should be here remarked, that if the temperature begins to rise soon and markedly after the storm has passed, a second storm may be expected shortly.

Observations of the Wind.—First as to the direction of the wind. If the winds in Storm II. on the 2d November be attentively examined, they will be observed whirling round the area of low barometer in a circular manner, and in a direction contrary to the motion of the hands of a watch, with—and be this particularly noted—a constant tendency to turn inwards towards the center of lowest barometer. The wind in storms neither blows round the center of lowest pressure in circles, nor does it blow directly towards that center, but takes a direction nearly intermediate, approaching, however, nearer to the direction and course of the circular curves than of the radii to the center. The greater the force of the wind is at any place, it will be observed to approach the more nearly the direction here indicated. And where the direction of the wind differs to any material degree from this general law, it is light, and consequently more under local influences, which turn it from its course. Thus, the center of the storm being near Liverpool, the direction of the wind is south-west at Paris, south at Yarmouth, north-east at Silloth, north at Dublin, and north-west at Cork—instead of south at Paris, south-east at Yarmouth, north at Silloth, north-west at Dublin, and west at Cork, if it had blown directly to the area of lowest pressure; and west at Paris, south-west at Yarmouth, east at Silloth, north-east at Dublin, and north at Cork, if it had circulated in the direction of the isobarometric curves. Hence in this storm the winds circulate round the center of least pressure, or, to speak more accurately, the whole atmospheric system flows in upon the center in a spiral course. This rotatory peculiarity is common to all storms in the northern hemisphere that have yet been examined. In the southern hemisphere, a rotatory motion is also observed round the center of storms, but it takes place in a contrary direction, or in the direction of the motion of the hands of a watch, instead of contrary to that direction, as obtains north of the equator.

Professor Taylor has the merit of having first applied Dové's law of rotation to explain the direction of the rotation of storms round their center. This may be explained by referring to Storm II. on the 2d November. On that morning, the pressure over England being much less than in surrounding countries, if the earth had been at rest, air-currents would have flowed from all directions to England, to fill up the deficiency, in straight lines. The earth, however, is not at rest, but revolves from west to east; and as the velocity of rotation diminishes as the latitude increases, it is evident that the current which set out, say from Lyon to the north, would, on account of its greater initial velocity when it arrived at Paris, blow no longer directly to the north, but to a point a little to the east of north; in other words, it would no longer be a south, but a south-west wind. Again, since the current from the north of Scotland had a less velocity than those parts of the earth's surface on which it advanced, it lagged behind, and consequently, by the time it arrived at Silloth in the north of England, had changed from a north to a north-east wind. Similarly the north-west current changed to a north, the south-west to a west, &c. The west and east currents, since they continued in the same latitude, would have blown in the same direction, if they had not been disturbed by contiguous currents. Hence in a storm the whole system of winds rotates round the center. As a further confirmation of the truth of this theory, it is observed that when a high barometric pressure covers a limited space, the wind is always observed gently *whirling out of this area of high barometer*, but in exactly opposite directions in both hemispheres from those assumed when it blows round and in upon an area of low pressure. It follows in the northern hemisphere that as storms advance, the general veering of the wind at places lying north of the path of their center is from north-east by north to west; and at places south of their center, from north-east by east and south to north-west, and conversely in the southern hemisphere.

Next, as to the force of the wind: The rule is simple, and without exception—viz., the wind blows from a high to a low barometer, and with a force proportioned to the difference of the barometric pressures. Hence, where the isobarometric lines crowd together, the violence of the storm is most felt, and where they are far asunder, the winds are moderate and light. We thus see the importance of observations from a distance in forecasting the weather. To take an illustration: the importance of observations from Norway and Sweden to all seaports on the east coast of Britain cannot be overestimated. For if the pressure be high in Norway and low in the south of Great Britain, violent easterly gales will sweep down on Scotland, and unless foreseen and provided against, strew the coast with wrecks; whereas, if the pressures be nearly equal, little danger need be apprehended, even though the barometer be low in Britain. As the wind nears the center of the storm it gradually abates, till on reaching the center a lull or calm follows. Calms and light winds also prevail along the ridge of highest barometer, or the region where the pressure is greatest, and on receding from which the pressure diminishes on each side. It may not inaptly be compared to the watershed in physical geography, since from it the wind flows away towards the places where the pressure is less.

We have stated that the progressive motion of storms varies from 15 to 40 miles per hour, which measures the time taken in passing from one place to another, but it gives no indication of the violence of the storm. This is determined by the rotatory velocity of the wind round the center of the storm, which in Europe and America frequently amounts to 60 or 80 miles an hour continuously for some time. In intermittent gusts, a speed of 120 miles an hour has been several times observed in this country—a velocity which is perhaps sometimes surpassed by storms within the tropics.

Of the different theories hitherto proposed, we need only refer to the rotatory and the centripetal theories. The rotatory, or, as it is commonly called, the cyclonic theory, was first proposed by Piddington, and has since been elaborated by Redfield, Reid, Dové, and others. By this theory storms are considered as revolving round an axis either upright or inclined to the horizon, while at the same time the body of the storm has a progressive motion over the surface of the globe; the barometric depression, as caused by the centrifugal force, driving the air from the center to the circumference of the storm. Dové, certainly the ablest advocate of this theory, holds that cyclones are formed when two atmospheric currents, the equatorial and polar, flow side by side, they being, as it were, the eddies formed at the line of junction. To this theory several objections may be urged. Observations from the numerous observatories recently established in Europe and America, in no case exhibit a true cyclonic movement of the winds round the center of the storm; that is, they do not rotate in circles returning on themselves, even when the barometric depression is deepening and the storm expanding, but invariably exhibit, along with the rotatory motion, a constant tendency to blow in upon the center of the lowest pressure. Hence it is clear that the barometric depression is not caused by the centrifugal force of the storm. The same may be shown from theory; for though the wind were to blow round a circle 400 miles in diameter, at the rate of 70 miles an hour, the centrifugal force would depress the barometer at the center only $\frac{1}{200}$th of an inch; whereas half an inch, or even a whole inch of depression often occurs. Again, if cyclones arose from the flowing of the polar and equatorial currents side by side, the rotatory motion would not always be in one direction, but would be determined by the relative position and strength of the two currents. The whole facts of the rotation of the wind are explained when it is considered as caused by air currents flowing towards a low barometer along the globular surface of the earth rotating eastwards.

The rotatory character of storms has been denied by Espy, who maintains that the wind blows from every quarter towards the center of the storm, and that the central depression is caused by the development of heat, which occurs whenever the vapor of the atmosphere is condensed into cloud or rain; the heat thus developed rarefying the surrounding air, and causing an upward current. The most valuable part of this theory lies in directing the attention of meteorologists to the heat of condensation, which must play an important part in the movements of the atmosphere. It is, however, insufficient, since it leaves some important points unexplained. Thus, more heat being set free when vapor is converted into snow than rain, a greater depression ought to follow a fall of snow than of rain, which is not found to be the case; it also leaves unexplained the appearance of high pressures, sometimes suddenly appearing on the scene, and seeming to divert the storm from its course, or drive it before them. But the weak point of this theory is the centripetal direction of the winds. Espy worked from imperfect data, and never being able to lay down the isobar lines, he could only guess at the true center of the storm. Further, he was misled by a peculiarity of American storms; as these are generally in the

form of elongated ellipses moving *eastward*, many of the winds blow directly to the center, or nearly so.

It will be seen that much yet requires to be done before a complete and satisfactory theory of storms can be propounded. The most important desideratum is a large addition to existing meteorological observatories over the globe, by which, the weather being as it were photographed from day to day, storms with their attendant phenomena may be traced from the beginning to the end of their career; and then, the whole facts being known, the explanation or theory will doubtless soon follow.

STO'RNOWAY. See LEWIS-WITH-HARRIS.

STO'RTHING (from *stor*, great, and *thing*, court), the Legislative Assembly of Norway (q. v.). Its members are elected by certain deputies, who, in their turn, are chosen by a constituency comprising every native Norwegian of 25 years of age, who is a burgess of any town, or possesses property in land to the value of £33, the qualification for being elected, if 30 years of age, being the same. When the storthing is in session, every member is paid an allowance equivalent to about 13*s*. 4*d*. per day. When elected, the storthing meets of its own authority, without any writ from the king, and divides itself into two chambers, the *Lagthing* and the *Odelsthing*, the former composed of one-fourth, the latter of the remaining three-fourths of the members. Since 1869, the sittings have been held annually.

STORY, JOSEPH, an American jurist and judge, was born at Marblehead, Massachusetts, September 18, 1779, was educated at Harvard College, and though admitted to the bar in 1801, gave his attention chiefly to general literature and poetry. Having published a volume in 1804, *The Power of Solitude*, and other poems, which met with no success, he bade farewell to the muses, and devoted himself to law and politics. Elected to the state legislature in 1805, he became a leader of the republican, or, as it was afterwards called, the democratic party, and defended the measures of Jefferson. In 1808, he was elected to congress, where he gave a moderate support to the war measures of Mr. Madison, who, however, in 1811, appointed him associate justice of the Supreme Court of the United States, a place he filled with great credit for 34 years.

In 1820, as a member of the Massachusetts constitutional convention, he advocated a property basis for the senate. In 1829, he became law professor at Harvard. His later politics were of the Federalist school of Washington and Hamilton, and these tincture his *Commentary on the Constitution of the United States*. His *Conflict of Laws*, and other legal treatises, have passed through many editions. His legal writings and decisions are among those oftenest quoted in the higher courts of law. He died September 10, 1845.—In 1854 appeared S.'s *Miscellaneous Writings*; and in 1851 a life of him by his son, WILLIAM WETMORE STORY (born 1819), also educated as a lawyer, but better known as a sculptor and poet. *Roba di Roma* (1862) is the most successful prose work of the latter; the *Tragedy of Nero* (1875) his most notable poem.

STOTHARD, THOMAS, R.A., an eminent designer and painter, was the son of a London publican, who kept the *Black Horse* in Long Acre, and was born there in 1755. He received a respectable education in different boarding-schools, and on his father's death, having shown a predilection for the use of the pencil, was bound apprentice to a pattern-drawer in the city, but was released from his engagement before the term of expiry, and betook himself to more artistic work. His first notable effort was a series of designs for the *Town and Country Magazine*, which was followed by his imaginative composition for Bell's *British Poets*, and the *Novelist's Magazine*. The popularity of these was so great, that for many years his services were constantly in request by the leading publishers in London. His earliest pictures exhibited at the Royal Academy were 'The Holy Family,' and 'Ajax defending the Body of Patroclus.' In 1791 he was chosen an associate, in 1794 a member, and in 1813 librarian of the academy. He died 27th April 1834.

S. was really an admirable and facile illustrator. Not less than 3000 of his designs are known; but his paintings, although gracefully enough 'composed' and finely colored, are destitute of the originality that comes from a study of nature, and painfully resemble enlarged 'illustrations' for books. Perhaps the best known and the most agreeable of the set is his 'Canterbury Pilgrims,' engraved in 1817; others are the 'Flitch of Bacon,' the Fête Champêtre,' and the paintings executed for the staircase at Burleigh, the seat of the Marquis of Exeter. See Mrs. Bray's *Life of Thomas Stothard, R.A., with numerous illustrations from his Works* (1851).—His son, CHARLES ALFRED STOTHARD (born 1786, died 1821), acquired a great reputation as an antiquarian draughtsman.

STOU'RBRIDGE, a market-town in the county of Worcester, and 20 miles north-north-east of the town of that name, on the left bank of the Stour. It contains iron-works and glass, earthenware, and fire-brick factories. 'Stourbridge clay,' upon which the action of fire has less effect than upon most varieties of clay, is an article of export. Glass-house pots, crucibles, &c., are made of it. Pop. (1871) 9376; (1881) 9756.

STOU'THRIEFF, in the law of Scotland, means robbery committed in a dwelling-house.

STOVE, a fireplace in which the fire is generally quite shut in. The term is also applied to a room or closet heated for the purpose of drying and other operations, and to hothouses, in which the artificial heat is constantly maintained at a high temperature. Stoves for domestic purposes will be noticed under the head of WARMING AND VENTILATION. Particular kinds of hothouse stoves are already noticed in the articles BARK-STOVE and DRY STOVE. Stoves are also used for *forcing* fruits, so as to procure them in winter or spring. In the management of stoves, the general rule is that the temperature must never be allowed to fall below 60° F. The free access of air is, of course, desirable, but the windows are not opened unless the temperature reaches 70° F., and care must be taken that cold blasts do not enter, which are often very injurious.

STOW, or STOKE (A.-S., *stoc*, a stockaded place), a component element of many names of places, as Bristow, or Bristol, Stockholm.

STOW, JOHN, one of the earliest and most diligent collectors of English antiquities, was born in London in the year 1525. He was brought up to his father's trade of a tailor in Cornhill, but ultimately abandoned it for antiquarian pursuits. Writing in 1575, he says: 'It is now ten years since I, seeing the confused order of our late English chronicles, and the ignorant handling of ancient affairs, leaving mine own peculiar gains, consecrated myself to the search of our famous antiquities.' A patriotic sacrifice, which ought to have insured to the devoted antiquary from his king and country an old age of ease and honor, but which only brought him to want and beggary! In his 79th year, S. obtained letters patent from James I. authorizing him to become a mendicant, or, as it is expressed in the state document, 'to collect amongst our loving subjects their voluntary contributions and kind gratuities.' He died April 5, 1605, and was buried in the parish church of St. Andrew Undershaft, in Aldgate Ward, where his monument of terra-cotta, erected at the expense of his widow, may still be seen. The principal works of S. are his *Summary of English Chronicles*, first published in 1561, and subsequently reprinted every two or three years, with a continuation to the date of each new publication; *Annals of England*, 1580, and reprinted in 1592, to which year the annals are brought down; and *A Survey of London*, the most important of his writings, published in 1598. Besides these original works, S. assisted in the continuation of Holinshed's Chronicle, Speght's edition of Chaucer, Leland's *Collectanea*, &c. He had collected or transcribed a vast number of MSS., and much valuable information which might otherwise have perished; and in the use of his stores he was liberal to others, while as an original historian he was faithful and impartial.

STOWE, HARRIET ELIZABETH BEECHER, American authoress, daughter of the Rev. Dr. Lyman Beecher, and wife of Rev. Professor Calvin Ellis Stowe, was born at Litchfield, Connecticut, June 15, 1812. At the age of 15, she was engaged with her elder sister, Catherine, as teacher in a girls' school in Hartford. She was married to Professor Stowe in 1836, and became a frequent contributor to periodicals, published some stories in a volume entitled *The May-flower*, and other spirited juvenile stories for the Sunday-school libraries. The ability of Mrs. S. as a delineator of character, and especially of New England character, was known to many; but her full power was scarcely suspected, until, in 1851, she commenced in *The National Era*, an anti-slavery paper at Washington, a serial tale, entitled *Uncle Tom's Cabin*. When completed in 1852, it was published at Boston, and its popularity was so immense, that it soon sold in four stereotype editions to the extent of 400,000 copies The English reprints are estimated to have circulated 500,000, and it was rapidly translated into all European and some Asiatic languages, and was extensively dramatized and illustrated. In 1853, she published a *Key to Uncle Tom's Cabin*, and made a visit to Europe, where she was received with distinguished consideration. The events and impressions of this triumphant tour are recorded in her *Sunny Memories of Foreign Lands* (2 vols. Bost. 1854). In 1856, she published *Dred, a Tale of the Dismal Swamp*, another anti-slavery story, which had a wide circulation. This was followed in 1859 by *The Minister's Wooing*, a story of New England life in the 18th c.; &c. In 1869, Mrs. S. contributed to *Macmillan's Magazine* an article entitled *The True Story of Lady Byron's Life*, some statements in which, reflecting on the character of Lord Byron, gave rise to much stormy criticism, and occasioned her writing (1870) *Lady Byron Vindicated*, in which she replied to her critics. Mrs. S. was in 1868–70 joint-editor of *Hearth and Home*, and contributes to the *Independent* and other journals. Among her more recent works are *Little Foxes* (1865);

The Chimney Corner (1868); *Men of Our Times* (1868); *Pink and White Tyranny* (1871); *My Wife and I* (1872); *Poganuc People* (1878); *Queer Little People* (1881).

STOWELL, WILLIAM SCOTT, LORD, the eldest brother of Lord Eldon (q. v.), was born at Heworth, Durham, October 17, 1745. He was educated at Newcastle; went to Oxford in 1761, and became a college tutor. In 1779, he took the degree of D.C.L., removed to London, was called to the bar (1780), and admitted to the Faculty of Advocates at Doctors' Commons. Dr. Johnson introduced him to the Literary Club, and he became well known in the most intellectual society of London. As an advocate, he at once obtained a large practice, and his promotion was rapid. In 1788, he was appointed judge in the Consistory Court, knighted, and nominated a privy councillor. In 1798, he became judge of the Court of Admiralty, the highest dignity to which he could attain in his own branch of the profession. Both as an ecclesiastical and admiralty judge he won high distinction. He wrote no systematic treatise or text-book, but his judgments were admirably reported, and supply the best evidence of his extensive legal learning, his sagacity, and his great literary ability. He is the highest English authority on ecclesiastical law and the law of nations, and his judgments—those, especially, relating to the rights of belligerents and neutrals—have been described as the most valuable contribution made by an English judge to general jurisprudence since the time of Lord Mansfield. As a politician, Sir William Scott was not remarkable. He represented Oxford in the House of Commons for 20 years, but he took no part in the business of parliament, although, like his brother, he was a zealous supporter of the Conservative party and the established church. At the coronation of George IV. he was raised to the peerage under the title of Baron Stowell of Stowell Park. In 1828, he retired from the bench, and in 1836 he died. Lord S. was twice married, but only one child, Lady Sidmouth, survived him.

STOW'MARKET, a small market-town of Suffolk, on the Gipping, 12 miles north-west of Ipswich. Iron, leather, paper, and gun-cotton are manufactured. The Gipping is navigable to S. Pop. (1871) 4097; (1881) 4052.

STRABA'NE, a market-town of the county of Tyrone, Ireland, on the river Mourne, 130 miles north-north-west from Dublin, with which it communicates by railway. It communicates with Londonderry, and thus with the sea, by canal and river. The chief industry is connected with the linen trade, and there is also a valuable fishery. S. has four churches—one Protestant episcopal, two Presbyterian, and one Roman Catholic—besides two Methodist meeting-houses. The population in 1881 was 4196.

STRABI'SMUS. See SQUINTING.

STRA'BO, an ancient geographer, born at Amasea in Pontus, about the middle of the 1st c. B.C. By the mother's side he was of Greek descent, and also closely connected with the Mithridatidæ; of his father or his father's family nothing is known. How the name Strabo ('squint-eyed') must have originated, is obvious, but whether any of the family were so called before him is uncertain. S. was well educated under the grammarians, Tyrannio of Amisus in Pontus, and Aristodemus of Nysa in Caria, and the philosopher Xenarchus of Seleucia in Cilicia. He does not appear to have followed any professional calling, but to have spent his life in travel and study, from which it may safely be inferred that he was possessed of wealth, or at least of considerable means. He died sometime after 21 A.D., but how long, we have no evidence to show. S.'s *Geography* is a work of great value in those parts especially which record the results of his own extensive observation. 'Westwards,' he says in a passage in the 2d Book, 'I have travelled from Armenia to the parts of Tyrrhenia adjacent to Sardina; towards the south, from the Euxine to the borders of Ethiopia. And perhaps there is not one among those who have written geographies who has visited more places than I have between these limits.' Yet it must not be supposed that he describes with equal accuracy or fulness all the countries of whose geography he treats.

Some he seems to have visited hurriedly, or in passing elsewhither; others he knows like a native. For example, his accounts of Greece, particularly the Peloponnesus, are meager in the extreme, and of many of the obscurer regions he writes chiefly from hearsay. He makes copious use of his predecessors, Eratosthenes, Artemidorus, Polybius, Posidonius, Aristotle, Theopompus, Thucydides, Aristobulus, and many other writers now lost to us, but he strangely depreciates the authority of Herodotus, and quotes few Roman writers except Fabius Pictor and Julius Cæsar. The *Geography* comprises 17 books, of which the first two are introductory, the next eight are devoted to Europe, the six following to Asia, and the last to Africa. The style is pure and simple. The *editio princeps* of S. appeared at Venice in 1516; the latest and best is that by Gustaf Kramer (Ber. 1844, *et seq.*).

STRADELLA, ALESSANDRO, a Neapolitan musical composer born about 1645; he is famous both in respect of his influence on the music of that age, and of the tragical history of his life and death. His works, which consist of numerous airs, duets, cantatas, madrigals, an oratorio, and an opera, contributed largely to form the taste of the succeeding composers, particularly Purcell, Clari, Steffani, and Alessandro Scarlatti. S. was renowned for his exquisite voice and polished manner; and when engaged in Venice, instructing a young lady of rank, who lived in a criminal intimacy with a noble Venetian, the musician and his pupil became mutually enamoured, fled to Rome, and were married there. They were traced thither by two bravos in the employ of the Venetian, who discovered them in the church of San Giovanni Laterano, where S. was assisting at the performance of an oratorio of his own; and both assassins, it is said, were so captivated with his voice and strains, that they at once abandoned their object, and betrayed to him the plot in which they had been engaged. Pursued by other bravos to Turin, S. was stabbed, but not mortally, when lodged in the palace and under the protection of the Duchess of Savoy. Some years afterwards, however (about 1687), he went to Genoa, in pursuance of an engagement to compose an opera, and the day after his arrival, both he and his wife were mortally stabbed in their bedchamber by the emissaries of their unrelenting persecutor.

STRADE'LLA, a city of Northern Italy, 10 miles south-east of Pavia, with 7193 inhabitants. It is situated on the slope of a hill. S. was formerly a fortified city, depending on the bishops of Pavia.

STRAFFORD, THOMAS WENTWORTH, EARL OF, eldest son of Sir W. Wentworth of Wentworth, Woodhouse, Yorkshire, was born April 13, 1593. In 1611, he married Lady Margaret Clifford, eldest daughter of the Earl of Cumberland. Subsequently, he was chosen member of parliament for the county of York. In 1615, he was appointed *Custos Rotulorum* for the West Riding of the same county. Being again returned to parliament for Yorkshire in 1621, shortly after his election he took up his residence in London. Slighted by the Duke of Buckingham, who then ruled the court and cabinet of Charles I., Wentworth signalized himself as an opposer of the administration. In 1626, he was made sheriff of his county, with the view of preventing him from attending parliament. So resolutely did he oppose the arbitrary royal loan, exacted in the following year, that the government deemed it advisable to put him in prison. But Buckingham was little aware of the energy of his opponent. S., having obtained his release, came to the following parliament, resolved to make his power felt both by king and minister. He spoke eloquently on the question of grievances, and was conspicuous in obtaining the royal assent to the Petition of Right. He was obviously a man worth gaining; and his patriotism, if it had any genuine element, was, unhappily, not strong enough to withstand the temptation now held out to his personal ambition. With his elevation to the peerage, as Baron Wentworth, in 1628, he seems not only to have lost all solicitude for popular liberty, but openly to have become its most determined enemy.

As President of the 'Council of the North,' he seems to have abused his powers not only for political purposes but often simply to gratify his own pride. The legality of the jurisdiction exercised by the council, created by Henry VIII., was altogether very doubtful; and interdicts against it were at various times applied for from the Courts at Westminster. S. declared openly that he would 'lay by the heels' any judge presuming to interdict the council from the exercise of such powers as he chose to hold that it possessed. Nevertheless, this was done by Judge Vernon. In 1631, S. was made Deputy of Ireland, and in 1639, Earl of Strafford and Lord Lieutenant of Ireland. According to his views, that country belonged to the crown by right of conquest, and neither the natives, nor the descendants of the conquerors themselves, had any rights which could interfere with its sovereignty. His government was of despotic violence, but the administration of justice, in ordinary cases, was prompt and vigorous. Outrage was suppressed, and commerce flourished under his strong hand. Understanding fully the feelings, policy, and resources of the party to which he had originally belonged, S. had matured a vast political scheme, to which, in his confidential correspondence, he gave the expressive name of 'Thorough.' His object was to do in England what Richelieu was doing in France—to make Charles as absolute as any continental monarch; to put the estates and personal liberty of the whole people at the disposal of the crown; to deprive the courts of law of all independent authority; and to punish with merciless severity all who murmured against the government, or who applied to any tribunal for relief from its despotism. Happily, the people of England were too strong for him.

On his entering the House of Peers, on the meeting of the Long Parliament in 1640, the message from the House of Commons was called in, and Mr. Pym, in the name of the Commons of England

impeached 'Thomas, Earl of Strafford,' of high treason. This course was afterwards abandoned, and the Commons proceeded by bill of attainder. It passed the House on April 21, 1641. Immediately after, it passed in the House of Lords, and received the royal assent. S. certainly merited his fate, but nothing can excuse the cowardice of the king. The earl was executed on May 12, 1641. The attainder was reversed in the reign of Charles II., and his son succeeded to the honors.—See Hallam's *Constitutional History;* Macaulay's *History of England*, with authorities cited in these works.

STRAIN, the name given to any one of the periods into which a musical composition is divided by double bars, the strain being further subdivided into periods, sections, phrases, and feet.

STRAITS SETTLEMENTS are the British settlements in the Straits of Malacca, comprising Singapore (q. v.), Malacca (q. v.), and the Prince of Wales Island (q. v.), or Penang, including the province of Wellesley. Each of these settlements is described in its own place, and its area and population given. The S. S. were transferred from the control of the Indian government to the colonial secretary in 1867. The seat of government is at Singapore. Area, 1350 sq. m. Pop. (1881) 390,000.

STRA'LSUND, a fortified town and seaport of Prussia, province of Pommern, is situated on a narrow strait called the Strela Sunde, which divides the mainland from the island of Rügen. It forms an island, partly surrounded by the sea, and partly by large pools of salt water, and is connected with the mainland by three bridges. The natural strength of the place is greatly increased by formidable fortications. Right in front of the harbor lies the fortified island of Dänholm. S. has narrow but pretty regular streets, and many of the houses are finely gabled, which gives the town a quaint and ancient look. S. carries on a large export-trade, especially in malt and corn, and has manufactures of leather, sugar, starch, mirrors, and cards. In 1872, 242 ships entered the port. Pop. (1881) 29,481. S. was founded in 1209 by Prince Jaromar of Rügen, became a member of the Hansa, and rapidly rose into importance. During the Thirty Years' War, it was unsuccessfully besieged (1628) by Wallenstein; and after being, with some alternations of fortune, in the possession of Sweden for about 200 years, it finally passed to Prussia in 1815, but still retains much of its ancient municipal independence.

STRANGE, Sir Robert, eminent as an engraver, was born in Pomona, one of the Orkney Islands, July 14, 1721. After some little abortive study of law at Edinburgh, he was apprenticed to an engraver there of the name of Cooper, under whom he made rapid progress. In 1745, he deserted art for arms, joining the army of Charles Edward, not so much from enthusiasm in his cause, as to find favor with a Miss Isabella Lumisden, who would only consent to be gracious to him on that romantic condition. The only exploit recorded of him in this relation is not one of glorious battle. After the final collapse of the adventure, he was in hiding in the house where Miss Lumisden resided; and on occasion of its being searched by the soldiery, he shrouded himself under the folds of her ample petticoat, and thus cleverly evaded detection. It is extremely satisfactory to know that very soon after the lady requited his heroism by marrying him. He now went abroad with his wife, and at Paris he prosecuted his art under the tutelage of the celebrated Le Bas, and afterwards of Descamps. In 1751, he returned to Britain, and settling himself in London, speedily attained the very highest rank in his profession. On again going abroad in 1760 to execute plates of the most famous pictures of the old masters, his eminence was recognized by the academies of Paris, Rome, Florence, Bologna, and Parma, all of which conferred on him the honor of membership; and subsequently in 1787, the distinction of knighthood testified to the high favor he found in his own country. After a life of honorable and successful industry, he died on 5th July 1792, leaving a handsome fortune to his family. To this day, S. is ranked at the very head of British engravers, and his reproductions of the nobler specimens of the old masters are much prized by the connoisseur. In the very amusing work entitled *Memoirs of Sir Robert Strange, Knight, Engraver, and of his Brother-in-law, Andrew Lumisden, Private Secretary to the Stuart Princes* (2 vols. 1855), by James Dennistoun of Dennistoun, a full account will be found of him, with an intelligent criticism of his chief works.

STRANGLES is a contagious eruptive disorder peculiar to young horses. It is ushered in by sore throat and cough, a muco-purulent nasal discharge, and the eruption of a swelling in the space between the branches of the lower jaw. In about ten days this swelling comes to a head, bursts, and in favorable cases the patient is soon well again. From exposure to cold, poverty, or other causes, the swelling, however, occasionally appears in less favorable situations, as about the glands lying within the shoulder, in those of the groin, or even in those of the mesentery. Such irregular cases are apt to be protracted, accompanied by much weakness, and sometimes prove fatal. Bleeding, physic, and irritant dressings are injurious. Good food and nursing, with fomentations to the throat, and steaming of the head, favor the healthier maturation of the swelling. When there is debility, coax the animal to eat by offering him at short intervals small quantities of scalded oats, malt, bran, or green food, and allow him several times daily a pint of sound ale.

STRANGULATION may be defined to be 'an act of violence in which constriction is applied directly to the neck, either around it, or in the fore part, so as to prevent the passage of air, and thereby suddenly suspending respiration and life.'—Taylor's *Principles and Practice of Medical Jurisprudence*, 1865, p. 673. This definition, as Dr. Taylor observes, obviously includes Hanging (q. v.). *Hanging* has been already briefly noticed in a special article, but the medico-legal relations of this and the other varieties of strangulation have still to be considered. The primary cause of death from hanging has been considered in the article just referred to, but it is necessary to add that if a person who has hanged himself has been cut down sufficiently soon to allow of the respiratory process being restored, he is by no means safe: death often taking place from secondary effects at various periods after the accident. The most prominent morbid appearance in these instances was extreme congestion of the brain.

When the suspension of the body has not continued for much more than five minutes, and the parts about the neck have not suffered violence, there is a probability that resuscitation may be established; although many cases are recorded, when after only a few minutes' suspension, it has been found impossible to restore life. It is believed that death takes place very rapidly, and without causing any suffering; the violent convulsions that are so often observed being similar to those which occur in epilepsy. A man named Hornshaw, who was on three occasions resuscitated from hanging—a feat which he performed in London for the amusement of the public—stated that he lost his senses almost at once; and other persons who have been restored state that the only symptoms of which they were conscious were a ringing in the ears, a flash of light before the eyes, then darkness and oblivion. The treatment to be adopted after the patient has been cut down may be briefly summed up as follows: Exposure to a free current of air, cold affusion if the skin is warm, the application of ammonia to the nostrils, of mustard poultices to the chest and legs, and of hot water to the feet, and the subsequent abstraction of blood if there should be much cerebral congestion; artificial respiration should also be tried if the above means fail to re-establish the respiratory process. From the post-mortem appearances, together with circumstantial evidence, the medical practitioner is not unfrequently called upon to decide such questions as these: Was death caused by hanging, or was the body suspended after death? Was the hanging the result of accident, homicide, or suicide? For the full discussion of these questions, the reader is referred to chapter 53 of Dr. Taylor's volume. In case of strangulation from other causes than that of hanging, the post-mortem symptoms are similar, but the injury done to the parts about the neck is commonly greater. In manual strangulation, the external marks of injury will be in front of the neck, about and below the larynx; and if death has been caused by a ligature, the mark round the neck will be circular, whereas in hanging it is usually oblique. The internal appearances are much the same as in the case of hanging.

STRA'NGURY (Gr. *strangx*, that which oozes out, *oureo*, I micturate) is perhaps to be regarded as a symptom rather than a disease. It shows itself in a frequent and irresistible desire to pass water, which is discharged, however, in very small quantity, and whose passage from the bladder is accompanied with scalding and cutting pains along the course of the urethra. The pain often extends to the bladder and even to the kidneys, and is sometimes so severe as to implicate the lower bowel (the rectum), and to produce the straining condition known as *Tenesmus*. It is usually caused by irritating substances in the urine, especially by *cantharides* or Spanish flies (whose irritant principle is liable to find its way into the renal secretion, whether the above-named drug is taken internally or merely applied to the skin as a blistering agent), and by oil of turpentine, when administered internally in small doses, and is generally present in cases of gravel. Severe as the affection is, it is very transitory, and yields readily to treatment. After the removal of the cause, if it can be recognized and the removal is possible, a drachm of laudanum in a wine-glassful of starch mucilage should be thrown into the lower bowel, and mild mucilaginous draughts (of barley-water, for example) should be freely given in order to render the urine less irritating. The warm bath is also useful, and if it cannot readily be obtained, hot local fomentations often tend to relieve the pain and allow the urine to pass more freely.

STRANRAE'R, a royal and parliamentary burgh, seaport, and market-town, of Wigtownshire, at the head of Loch Ryan, 6 m. N.-E. of Portpatrick. There are no manufactures, the town de-

pending almost wholly on the agricultural interest. The oyster fishery in Loch Ryan was at one time very productive, but has latterly fallen off greatly. A mail-steamer runs daily between S. and Larne, in Ireland. Upwards of 1200 vessels annually enter and clear the port. Agricultural produceand cattle, leather, and shoes are exported. Pop. of royal burgh (1871) 3615, of parl. borough, 5941; of parl. borough (1881) 6342. S. is one of four Wigtown burghs which unite to send a member to parliament.

STRAP, in Carpentry, an iron band fixed round two or more timbers, sometimes with branches along each, to hold them all firmly together.

STRA'SBOURG (Ger. *Strassburg*), a fortified town, formerly the capital of the French department of the Bas-Rhin, but, since 1871, capital of the new German Province of Alsace-Lorraine, stands at the confluence of the Ill and the Brusche, and not far from the left bank of the Rhine, 89 miles north of Basel, and 312 miles east of Paris by rail. The citadel, originally built by Vauban, 1684, was demolished by the Germans during the bombardment of 1870, but in 1873 they began to rebuild it, and this in conjunction with a system of 12 detached forts, being erected at several miles' distance from the walls, will make the position one of great strength. The most celebrated building is the minster, or cathedral, founded in 1015, which is one of the most sublime specimens of Gothic architecture. Of the two western towers one, that at the south corner, has not been completed. The other, finished in 1399, rises, according to Baedeker, to a height of 495 feet above the pavement—14 feet higher than the original top of the Pyramid of Cheops, while the towers of Cologne Cathedral rise to a height of 512 feet. The minster has a remarkable astronomical clock representing the planetary system. Other notable structures are the Protestant church of St. Thomas, with the tomb of Marshal Saxe, and various monuments to distinguished S. scholars; the *Temple Neuf*, or New Temple, the synagogue of the Jews, the Town-house, the Palace of Justice, the arsenal, the episcopal palace, and the theater. The university of S. was the only complete university in France—i. e., the only one which has the full complement of faculties—besides that of Paris. It was founded in 1621, became specially famous in the branches of medicine and philology, went to the ground during the great Revolution, and had its place supplied by an *Ecole Centrale*.

In 1803, a Protestant academy was established with 10 chairs, for teaching theology, philology, philosophy, and history. Five years later, Napoleon founded an imperial academy, with faculties of law, medicine, physical science, and philosophy; and in 1819, a partial fusion of these academies took place, greatly to the benefit of both. The university was reopened in 1872, after the war, as the Kaiser Wilhelm University. In 1882 it had 104 professors and 825 students (of whom 216 were from Alsace-Lorraine). The famous library of S., consisting of nearly 200,000 volumes, and rich in *Incunabula* (q. v.), was entirely destroyed by fire during the bombardment in 1870, but was replaced by a new collection that has now swelled to over 525,000 volumes. The trade of S., especially its transit-trade, is very extensive, and it has a great variety of manufactures—beer, ham, sausages, fat-liver pies, watches and clocks, leather, cottons, woollens, silks, cutlery, musical and mathematical instruments, jewelry, brandy, potash, tobacco, &c. The Basel and Baden railways, the railway to Paris, and the communication with Rotterdam and London by means of the Rhine steamers, as well as with the Danube and all the great rivers of France by means of canals, have greatly added to its facilities for conducting commerce. The country round about S. is fertile and carefully cultivated, with beautiful gardens, mansions, and villages. Pop. (1871) 85,529; (1880) 104,471, of whom about one-half are Catholics.

S., the *Argentoratum* of the Romans, was extant before the time of Cæsar, but is first mentioned by Ptolemy. The Romans had a manufactory of arms here. In the 5th c., it appears to have received the name of *Strata-Burgum* or *Strata-Burgus*, perhaps from the invading Franks, whence the modern German Strassburg and the French Strasbourg. It became a free town of the German Empire, and in 1681 passed with the rest of Alsace into the hands of the French, under whom its population and prosperity greatly increased. On Sept. 28, 1870, after a bombardment of seven weeks, S. surrendered to the Germans, and in 1871 was annexed to Germany.

STRA'TEGY is defined by military writers to be the science of manœuvring an army out of fire of the enemy, as *tactics* is the art of managing it in a battle, or under fire. Strategy is the greater science, as including all those vast combinations which lead to the subsequent available displays of tactics. A good strategist has to attend to the establishing of his bases and dépôts, although some brilliant generals have dared to act without these last aids—notably, Sherman in America in 1864, and Wellington in 1813, advancing from Portugal through Spain into France. The strategist must know how to diffuse the influence of his arms over a broad area, while yet holding his force well in hand to strike crushing blows. Such was Wellington's Salamanca campaign; in which, though retreating himself to his former base, he compelled the French to evacuate Valentia.

Strategy must not be confounded with stratagem, although there is relationship between the two. Stratagem is any device for deceiving the enemy as to the point or strength of an attack. Such are ambuscades, feints, bugle-calls to imaginary troops, concealment of infantry by clouds of cavalry, and many other efforts.

STRA'TFORD, a thriving town of Essex, on the Lea, 3 miles east of London. It is the seat of various and extensive manufactures. There are flour-mills, distilleries, and chemical works. In the town and its suburbs, many London merchants have built residences. The prosperity of the town has been much increased by its connection with the Eastern Counties Railway. Pop. (1851) 10,586; (1871) 23,286; (1881) 38,489. On the opposite side of the Lea is the parish of Stratford-le-Bow, or Bow, with (1871) 26,055 inhabitants.

STRATFORD-UPON-AVON, a municipal borough and township of England in the county of Warwick, and 8 miles southwest of the town of that name, is situated on the right bank of the Avon. Pop. (1871) 3863; (1881) 8053. The town is neatly built, and has quite a modern look, most of the old houses having disappeared. Some trade is carried on in corn and malt. S. is the birthplace of Shakspeare. The house in which he was born is still preserved, and there is a Memorial Theater, with library and picture-gallery, in honor of the poet. The great poet is buried in the parish church.

STRATFORD-DE-REDCLIFFE. STRATFORD CANNING, VISCOUNT, English diplomatist, was the son of a London merchant, and cousin of the celebrated George Canning. He was born 1788, educated at Eton, and entered himself of King's College, Cambridge, in 1806, but left in 1807, on receiving an appointment as précis writer in the Foreign Office. He was appointed secretary of embassy at Constantinople in 1809. He returned to Cambridge in 1812 for the purpose of resuming his studies, and took the degree of M.A. He was sent as envoy to Switzerland in 1814. About this time he published an ode full of spirit and power, entitled *Buonaparte*. It is called by Lord Byron a 'noble poem.' In 1820, he went as plenipotentiary to the United States, and remained at Washington three years. In 1824, he was sent on special missions to St. Petersburg and Vienna. In 1825, his introduction to Eastern diplomacy commenced with his appointment by Mr. Canning, then foreign secretary, as ambassador extraordinary to the Sublime Porte. Here his good offices were warmly exerted on behalf of the Greeks. In 1831, he was accredited with a special mission to Turkey, to fix the boundaries of the new kingdom of Greece, and to settle the treaty in virtue of which Otho ascended the Greek throne. He went to Madrid and Lisbon on a special mission in 1832. He had previously sat in the House of Commons for Old Sarum and Stockbridge during a brief interval in his diplomatic career. In 1834, he was elected for King's Lynn, which he represented until 1841, when, having twice refused the governor-generalship of Canada, he was appointed by the government of Sir Robert Peel ambassador at Constantinople. Here his influence was strenuously exerted in the cause of civilization and progress.

In 1852, the Derby administration recommended the crown to confer upon him the title and dignity of Viscount. When the long-standing quarrel between the Greek and Latin monks in Palestine involved the powers of Europe in the struggle, S. remembered how the Emperor Nicholas of Russia had, from 1829 to 1853, sought to establish a predominant influence, excluding all others, over the Porte, with the view of settling the future destinies of Turkey, to the profit of Russia when the propitious juncture arrived. At the time when Prince Menchikoff was sent to Constantinople upon a mission from the czar, S. was absent in England on leave. He returned to Constantinople in April 1853, and prepared to resist M.'s demands. The keenly contested diplomatic struggle between S. and the Russian ambassador extraordinary is narrated with dramatic power by Mr. Kinglake in his *Invasion of the Crimea*, who calls S. the 'Great Eltchi.' S.'s influence with the Porte prevailed, for, to adopt the words of Mr. Kinglake, 'as though yielding to fate itself, the Turkish mind used to bend and fall down before him;' and he placed on England the responsibility of a defensive alliance with the sultan against the czar. As Russia would not withdraw her troops from the principalities, the sultan declared war against Russia, and France and England came to the aid of the Porte. S. retired from the Turkish embassy in 1858 upon a pension. He afterwards took a frequent part in the debates of the Upper House on questions of foreign policy. S. was created a Knight of the Garter in 1869; he died Aug. 14, 1880. In 1873 he published *Why am I a Christian?* and in 1876 a play, *Alfred the Great in Athelney*.

STRATH, a Gaelic word signifying a broad valley, is often prefixed in the north of Scotland to the names of rivers, as

Strathearn, Strathallan, Strathmairn, Strathspey, in each of which cases it signifies the open valley through which the river flows. In such cases, however, as Strathmore (great valley), it simply signifies a valley-like depression. In the south of Scotland, the word is not used, the Northumbrian word *dale* being used instead, as Clydesdale, Annandale, Teviotdale, Tweeddale.

STRATHA'VEN, a town of Scotland, in Lanarkshire about a mile W. of Avon Water, and 14 miles S. E. of Glasgow. On the north side is the picturesque ruin of Avondale Castle, and from 5 to 7 miles south-west are the battle-fields of Drumclog and Loudoun Hill. The more recently built part of the town is neat and spacious. Pop. (1881) 3812, chiefly engaged in weaving and trading in cheese and cattle.

STRATHCLY'DE. In the 8th c., the ancient confederacy of the Britons was broken up into the separate divisions of Wales and English and Scottish Cumbria. Scottish Cumbria, otherwise called S., thenceforth formed a little kingdom, comprising the country between Clyde and Solway, governed by princes of its own, and having the fortress-town of Alclyde or Dumbarton for its capital. Becoming gradually more and more dependent on Scotland, it was annexed to the Scottish crown at the death of Malcolm I., on failure of the line of native sovereigns. Edgar bequeathed S. to his youngest brother David, again separating it from the crown of Scotland, which went to his intermediate brother, Alexander I. David held it throughout Alexander's reign in spite of that king's opposition, and on Alexander's death without issue in 1124, it was permanently reunited to the Scottish kingdom under David I.

STRATHMO'RE (the Great Valley), the most extensive plain in Scotland, is a low-lying tract extending across the country from Dumbartonshire north-east to Stonehaven in Kincardineshire, is bounded on the north by the great mountain-rampart of the Highlands, and on the south by the Lenox, the Ochil, and the Sidlaw Hills, and is 100 miles long and from 5 to 10 miles broad. S. proper, however, extends only from Perth to near Brechin in Forfar (about 40 miles).

STRATHPEFFER, a valley and watering-place in Ross-shire, 4¼ m. west of Dingwall by rail. There are two chief wells, and a pump-room.

STRATHSPEY', a kind of Scottish national dance slower than the reel, which is said to derive its name from having been first practised in the district called Strathspey.

STRATIO'TÉS, a genus of plants of the natural order *Hydrocharideæ*. *S. aloides*, popularly WATER SOLDIER, is common in lakes and ditches in the east of England. It is a singular plant with numerous leaves, which are strap-shaped and spring from

Water Soldier (*Stratiotes aloides*).

the root, from which also springs the two-edged flower-stem, bearing the spathe with beautiful and delicate white flowers. In autumn the whole plant disappears, the root alone remaining at the bottom of the water; from which a number of young plants arise in spring, filling up ditches, so that nothing else can grow in them. It is a very ornamental aquatic plant.

STRA'TUM, pl. *strata* (Lat. strewn or spread out), the term applied by geologists to the layers into which most of the rocks that form the crust of the earth are divided. It implies that the layers have been spread out over the surface, and that they were formed in this way we may infer from the deposits that are now taking place in lakes and seas into which rivers laden with muddy sediment empty themselves.

All the aqueous rocks, which cover so large a proportion of the earth's surface, are stratified. They were formed from the abraded materials of older rocks (aqueous or igneous), which have been washed down and rearranged. The kind of rock produced depended upon the material to which the carrying agent had access. Fine mud would produce shales, sand sandstones, and calcareous matter limestones. In a section, these different kinds of rocks are frequently found to interchange within a short space. This is produced either by the water obtaining different materials, or changing its velocity. Thus the fine sediment which has fallen from slowly flowing water may be covered by a layer of sand brought down by a flood, and this again may have spread over it a covering of shells and corals, and such changes may go on alternately for an indefinite period. Each of the different beds composed of the same kind of material is called a stratum. Thus, in the series mentioned, there would be a 'stratum' of clay, one of sand, and then one of calcareous matter. An assemblage of strata having a common age is called a 'formation,' and this term is also extended to rocks which agree in their composition or origin. Thus we speak of stratified and unstratified, aqueous and igneous, freshwater and marine, primary and secondary, metalliferous and non-metalliferous formations. As a formation is composed of many different beds, so a stratum is frequently made up of several 'laminæ' or 'layers.' The laminæ have a more or less firm cohesion, but the strata easily separate from each other. Sometimes the cohesion of the laminæ is so great, that it is as easy to split the rock against as with the grain. In such compact rocks the lamination is obscure, or altogether imperceptible in fresh specimens, but whenever they are exposed to the influence of the weather, it becomes obvious. The laminæ have been produced by short interruptions in the deposition, similar to what might be the result of tidal or other intermittent action. The degree of cohesion may be the result of rapid succession in the acts of deposition, but it is frequently produced by metamorphic action subsequent to deposition. The planes of stratification want the complete coalescence characteristic of lamination; when the contiguous layers are closely united, it is the result of the adhesion of two bodies, and not of their coalescence into one.

STRAU'BING, a town of Lower Bavaria, on the right bank of the Danube, 25 miles south-east of Ratisbon, lies in a very fertile valley, and carries on a river-trade in corn, cattle, and horses. In a little chapel here there is a monument to Agnes Bernauer (q. v.). Pop. (1880) 12,625.

STRAUSS, DAVID FRIEDRICH, author of the famous *Leben Jesu*, was born on the 27th January 1808, at Ludwigsburg, in Würtemberg. His education was begun in his native town, and completed in the theological seminaries of Blaubeuren and Tübingen. In 1830, his head filled with Hegel's philosophy and Schleiermacher's theology, he entered on the simple life of a country pastor, but already in the following year he was in Maulbronn acting as professor in the seminary, and went thence to Berlin for six months to continue his Hegelian studies, and hear the lectures of Schleiermacher. Returning to Tübingen in 1832, he became *repetent* in the theological seminary, and in the next years held also philosophical lectures in the university as a disciple of Hegel. Known as yet only to a narrow circle, he became all at once a man of mark by the publication, in 1835, of his *Life of Jesus critically treated* (2 vols. Tüb.; 4th ed. 1840; translated into English, 1846). In this work, written from the point of view of a Hegelian philosopher, and designed only for the learned, he attempted to prove the received gospel history to be a collection of myths gradually formed in the early Christian communities, and sought, by an analytical dissection of each separate narrative, to detect, where it existed, a nucleus of historical truth free from every trace of supernaturalism. The book made a real epoch in theological literature, and produced a violent excitement in and out of Germany, calling forth numberless replies from opponents, frightening many by its bold disregard of consequences back into the ranks of orthodoxy, and stirring up others to similar investigations.

The first consequence to the author was his dismissal from his academical position in Tübingen, and transference to the Lyceum of Ludwigsburg. He resigned the new post, however, very soon in 1836, and retired into private life at Stuttgart, to have leisure to defend himself. In 1837, he published his *Streitschriften* against his opponents; and in 1838, *Zwei friedliche Blätter*, a more conciliatory exposition of his views. Early in 1839, he was called by the Board of Education in Zürich to be Professor of Dogmatics and Church History in the university; but the step raised such a storm of opposition amongst the public, that the proposition had to be dropped, and even the government itself had to resign in the same year. Thrown back on his literary labors, S., who had published during the year his *Charakteristiken und Kritiken*, sent forth shortly afterwards his second great work, *Die Christliche Glaubenslehre*, a review of Christian dogma 'in its historical development and its struggle with modern science' (Tüb. 1840—1841). This formed a natural sequel to the purely critical investigation of the origins of Christianity in the first work. When S., after a long

period of silence, next appeared on the literary field, it was no longer as a professed theologian. In 1847, he drew attention by a work entitled, *Der Romantiker auf dem Throne der Cäsaren, oder Julian der Abtrünnige*, full of direct allusions to the political situation of the day. His fellow-townsmen put him forward as a candidate for the German revolutionary parliament of 1848, but he was unable to stand against the clerical influence brought to bear upon the country-people of the district. His speeches on this occasion were published under the title of *Six Theologico-political Popular Addresses*, and his native place compensated the defeat by sending him as its representative to the Würtemberg Diet. From this position, however, when he unexpectedly displayed conservative leanings, and incurred a vote of censure from his constituents, he retired before the end of the year.

A life of the Swabian poet Schubart (1849), and another biographical work, *Christian Märklin, a Picture of Life and Character from the Present* (1851), giving an insight into his own mental development, were his next literary efforts, before another period of silence. His third period of activity was opened in 1858 by a remarkable life of the Reformer, Ulrich von Hutten (Eng. trans. 1874), followed up by the publication of Hutten's *Dialogues* in 1860. These books, though primarily of strictly historical interest, were nevertheless calculated for the present state of religious affairs in Germany, and contained fiercely contemptuous denunciations of the tactics of the reactionary party in the church. A collection of miscellaneous *Minor Writings* appeared in 1862, and a new *Life of Jesus, composed for the German People*, in 1864 (Eng. translation, 1865). The title of the work indicates its popular cast, the peculiar features of it being a long critical statement of the labors of others in the same field down to the present day, and an attempt to construct a life out of all the positive results that have been gained. The mythical hypothesis is retained, but applied differently. Still later publications, which appeared in 1865, are *Der Christus des Glaubens u. der Jesus der Geschichte* (Berlin), a criticism of the newly published lectures of Schleiermacher on the life of Jesus, and a brochure, *Die Halben u. die Ganzen*, directed against Schenkel and Hengstenberg. The polemic against Schenkel, Professor of Theology in Heidelberg, a leader of the liberal party in the church of Baden, and author of the *Charakterbild Jesu* (1864), arose out of an earlier notice of this book by S. In 1872, he published his last work, *Der alte und der neue Glaube*, in which he endeavors to prove that Christianity as a system of religious belief is practically dead, and that a new faith must be built up out of a scientific knowledge of nature. S. died in 1874. An edition of his collated works (*Gesammelte Schriften*) began to be published in 1876. The literary, critical, and polemical powers of S. must be pronounced to be of the highest order. No more effective German prose than his has been written since Lessing.—See *Life of S.* by E. Zeller (Eng. trans. 1874).

STRA'WBERRY (*Fragaria*), a genus of plants of the natural order *Rosaceæ*, suborder *Roseæ*, tribe *Potentillidæ*, remarkable for the manner in which the receptacle increases and becomes succulent, so as to form what is popularly called the fruit; the proper fruit (botanically) being the small *achenia* which it bears upon its surface. The genus differs from *Potentilla* (q. v.) chiefly in having the receptacle succulent. The calyx is 10-cleft, the segments alternately smaller; the petals are five; the style springs from near the base of the carpel. All the species are perennial herbaceous plants, throwing out runners to form new plants; and the leaves are generally on long stalks, with three leaflets, deeply toothed. One South American species has simple leaves. Only one species, the WOOD S. (*F. vesca*), is truly a native of Britain. It is common in woods and thickets. Its fruit is small, but of delicious flavor. Another species, the HAUTBOIS S. (*F. elatior*), is not unfrequently to be seen in woods and hedges, but has probably escaped from gardens. It is really a native of North America. The many kinds cultivated in gardens are regarded as varieties of these species, and of the CAROLINA S. (*F. caroliniana*), the PINE S. (*F. grandiflora*, or *F. ananas*), and the CHILI S. (*F. chilensis*), American species, the leaves and fruit of which are larger than those of the Wood Strawberry. In no genus, however, are the species more uncertain to which the cultivated kinds are to be referred. Some of these are remarkable for the large size of the fruit. New varieties are continually coming into notice, and the utmost care is necessary to keep the larger and finer varieties from degenerating. The cultivation of the S. is most extensively carried on in Britain and in Belgium. New kinds are produced from seed; but plantations of strawberries are generally formed of the young plants, which are abundantly produced by runners. The rows are from eighteen inches to two feet apart, according to the kind. The finest fruit is said to be produced when the plants are kept distinct from each other in rows, but this is not generally done.

Tiles are sometimes placed around the plants and under the fruit; and it is an old English practice to lay straw between the rows, to preserve the fruit from rotting on the wet ground, from which the name S. has been supposed to be derived; although more probably it is from the wandering habit of the plant, *straw* being a corruption of the Anglo-Saxon *strae*, from which we have the English verb *stray*. S. beds require to be renewed after a few years. Strawberries are often forced in hothouses, in order to produce the fruit at a very early season. The uses of the S. as a dessert fruit and for preserves are well known. There is no more wholesome fruit.

The ALPINE S. (*F. collina*), a native of Switzerland and Germany, differs considerably from the other kinds in its taller stems and more erect manner of growth. The fruit, which is either red or white, is not very large, but is produced in great abundance, and, unlike other strawberries, parts from its calyx almost on being touched. The Alpine S. continues to produce fruit long after the other kinds.

The INDIAN S. (*F. indica*), a native of the Himalaya, requires only a little protection in Britain from severe frost, and with this care grows luxuriantly and produces fruit in abundance. The flowers are yellow, not white, as in other strawberries, and are not produced upon common flower-stalks, rising from the center of the plant as in the other species, but upon single-flowered stalks, which spring from the axils of the leaves upon the runners. The fruit is very beautiful, growing with its apex upwards. It is not, however, of good quality.

STRAW-MANUFACTURES. The industrial applications of the straw of wheat are of great commercial importance, especially that of plaiting, which is one of the oldest arts practised by mankind, many specimens having been found in the tombs of the ancient Egyptians, and mention being made of plaiting by Herodotus and other early writers. The earliest notice we have of its systematic use in Europe as an article of clothing is in the records of the reign of Mary, Queen of Scots, who, we are told, observed that the peasants of Lorraine wore hats made of straw plait, and that this manufacture was beneficial to them, and she consequently conceived the idea of introducing it into Scotland, which was done about the year 1562, but without much success. Her son, James I., however, carried it into England, where it soon throve, and has been from that time a permanent branch of industry. It was first regularly established in Bedfordshire, which has ever since been the chief seat of the trade.

At first, the plait was what is called *whole straw;* that is, the straw was cut into suitable lengths without knots, and merely pressed flat during the operation of plaiting, and so it continued until the reign of George I., when it was in great demand for ladies' hats, and some plait was made of split straw. Since that time, this kind has been chiefly used, and a much improved method has been substituted for the clumsy one of using a common knife for splitting it. The instrument now employed (fig. 1) is made of steel, and consists of a number of little square blades set in a circular manner around the stem, which at one end terminates in the point *a*, and at the other is bent and fixed into the handle *b*. The point, *a*, being inserted into the hollow of the straw, is pressed forward, and cuts it into as many strips as there are blades in the cutting-tool; these vary in number according to the fineness of the work to be produced.

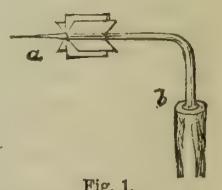


Fig. 1.

It is found that the fine straw-plaiting, which is now produced better in England than in any other country except Italy, can only be made from one or two varieties of wheat, that called the White Chittim being generally preferred, and next to it the Red Lammas, which only succeed as a straw-crop upon the light rich soils of the more southern of the midland counties. The harvesting is a matter of great anxiety, as the straw is liable to many injuries from wet and other causes. The value of this crop can be best understood by the fact that an acre will yield from 25 to 40 bushels of wheat, and from 15 cwts. to a ton of straw, which, when in good condition, is worth £7 or £8.

The crop is bought up by straw-factors, who employ people to draw the straw, and remove the ears, which are all cut off by hand for thrashing. The straws are afterwards cut into lengths, and

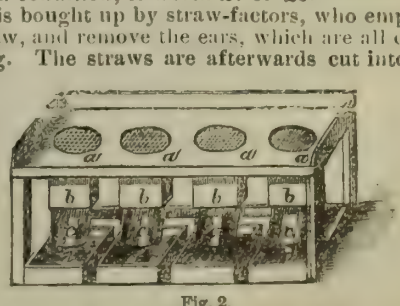


Fig. 2.

cleared of the outer sheath or leaf; they are then sorted into various thicknesses by an apparatus consisting of a series of sieves about eight inches in diameter, arranged as in fig. 2. *a, a, a, a;*

the boys who usually do this work hold a handful on end over the first sieve, which has the narrowest spaces, and the thinnest straws only fall through it; they are next placed on the second, and so on to the last. As they fall through each successive sieve, they pass down the hollow shafts *b*, *b*, *b*, *b*, by the shoots of tin or sheet-zinc *c*, *c*, *c*, *c*, into the boxes *d*, *d*, *d*, *d*, from which they are removed and tied into bundles ready for the splitters, who next take them in hand and reduce them to strips of the sizes required.

The plaits are made by women and children in their own cottages, and are collected by the dealers and sold in the Luton and Dunstable markets, in which the chief part of this business is transacted. They are very various in pattern, and are sold by the *score* of 20 yards, the prices ranging from 2*d*. to 3*s*. per score for the ordinary kinds, but very fine plaits have been known to fetch as high as £3 to £4 per score.

It is computed that 70,000 persons are employed in this trade, of whom nearly 60,000 are females and boys, and that they produce annually about 12,000,000 scores, or 240,000,000 yards of plait. The plait is made up into bonnets and hats chiefly at Luton and Dunstable, and sent up to the London warehouses for sale, whence they are sent to all parts of the world. A large trade is also done in the fine plaits of Tuscany; the Leghorn plaits are very fine, and fetch high prices.

Besides its value for plaiting, straw is now much used in the manufacture of Paper (q. v.).

STRELITZ, more properly *Streltzi* (arque-bussiers), the ancient Russian militia-guard, first raised by Ivan Vassilevitch the Terrible, in the second half of the 16th century. At that time, and for long afterwards, they were the only standing army in Russia, and at times amounted to between 40,000 and 50,000 men. They were located at Moscow in time of peace, in a quarter of the capital which was set apart for them, and being the bravest and most trustworthy troops in the army, were made objects of special favor and distinctions. But like all such petted corps, the Roman Prætorians, the Turkish Janizaries, and the Egyptian Memluks, their general turbulence, frequent revolts against the government (notably during the Demetrian insurrections), and incessant conspiracies rendered them more formidable to the Russian government than to external enemies. The S. having, at the instigation of the Grand Duchess Sophia and the chiefs of the Old Muscovite party, revolted against Peter the Great, that iron-handed ruler caused them to be decimated (1698) in the great square of Moscow, and the remainder to be banished to Astrakhan. The feeble remnant still manifesting their characteristic turbulence and disloyalty, Peter exterminated them almost completely in 1705. Few Russian families at present can claim kindred with the old Streltzi, but to this the family of Orloff (q. v.) forms a prominent exception, being descended from a Strelitz who was pardoned by Peter the Great while the axe was being raised over him.

STRENGTH OF MATERIALS. The strength of materials depends upon their physical constitution—viz., their form, texture, hardness, elasticity, and ductility.

The resistance of materials in engineering works is tested in reference to various strains; such are—1. Extension or tension; 2. Compression or crushing; 3. Transverse or cross strain; 4. Shearing strain; 5. Torsion or twisting strain.

1. *Extension.*—When a rod is suspended vertically, and a weight attached to its end tending to tear it asunder, all its fibres act equally, and its strength evidently depends on the strength of the individual fibres and their number, that is, the area of cross-section of the rod. The following table gives the resistance to *rupture* of some of the most common materials:

	Per Square Inch.	
Fine sandstone	200	lbs.
Brick	300	"
Common lime	50	"
Portland cement	240	"
Deal (timber)	5	tons.
Cast iron (ordinary)	6½	"
" Stirling's (toughened)	12½	"
Wrought iron, boiler-plate	20 to 24	"
" bars	25	"
Cast steel	60	"

Ropes (hemp), four-fifths ton per pound-weight per fathom.

With regard to the elongation of materials under tensional strain, it has been observed that up to a certain limit, which is different for different substances, the elongation is proportional to the extending force, a physical truth the promulgation of which is due to Hooke (q. v.); up to this limit also the body nearly recovers its original form on the removal of the force: this limit is called the limit of elasticity. When this limit is passed, the permanent elongation or destruction rapidly increases until rupture takes place.

The extension of wrought iron is about $\frac{1}{10,000}$th of its length per ton of strain per square inch, and that of cast iron $\frac{1}{5000}$th. The limit of elasticity of wrought iron is attained under a strain of 12 tons per square inch; and in the case of American pine 1½ ton per square inch.

2. *Compression or Crushing Strain.*—The strength of pieces of stone, wood or iron, whose height is small in proportion to their area, and which absolutely crush under the strain, is proportional to the area of their horizontal section. The following table gives the resistance to crushing of some of the more common materials:

Cast iron	50	tons per	square inch.
Wrought iron	16	"	" "
Brickwork	30	tons per	square foot.
Sandstone	200	"	" "
Limestone	490	"	" "
Deal	450	"	" "
Oak	650	"	" "

Up to a certain strain, which is called the limit of elasticity, the diminutions in length of the body are proportional to the compressing force; and are practically the same in amount as the elongations in the case of tensional forces. In the case of wrought iron, the limit is 12 tons per square inch; after that strain its shape and proportions become permanently altered; and where these are of consequence, as in most practical cases, we come to the limit of its utility, which is reached when the load is about 16 tons per square inch. It then oozes away beneath additional strain, as a lump of lead would do in a vice.

The mode of ultimate failure of cast iron is quite distinct from that of wrought iron. It crushes suddenly by the sliding off of the corners in wedge-shaped fragments, being a crystalline mass, without sufficient ductility to allow of its bulging horizontally; the angle of rupture at which these wedges slide off being tolerably constant and varying from 48° to 58°. The limit of elasticity is attained in cubes of deal under a compression of 100 tons per square foot; and in those of oak 150 tons per square foot.

Pillars, round or square, may be divided into three classes—1. Those whose height is not more than 5 times their diameter; 2. Those whose height is between 5 and 25 times their diameter; 3. Those whose height is at least 25 times their diameter. The first follow the same laws as cubes or pieces of small height above discussed, and are absolutely crushed; their strength being proportional to their cross section. The second are broken across, partly by crushing and partly by bending. The third give way purely from bending as with a transverse strain, and their strength is found by experiment to be directly proportional to the fourth power of their diameter, and inversely proportional to the square of their length. Thus, in the case of two long pillars of equal length, but of which one has its diameter double that of the other, the strength of the former will be 16 times that of the latter; from which will be apparent the advantage of the tubular form for pillars, as it gives a large diameter, combined with lightness.

In the case of long columns whose length is 25 or more times their diameter, if we represent the strength of a long cast-iron column of any dimensions by 1000, the strength of a wrought-iron column of the same dimensions will be 1750; of cast steel, 2500; of Danzig oak, 110; of red deal, 80.

3. *Transverse or Cross Strain.*—When a beam fixed at one end is loaded with a weight at the other, it is bent from its original form, and takes a curved shape. The fibers on the upper or convex side of the beam are extended, and those on the under or concave compressed; while at the middle of the beam, there are fibers which are neither extended nor compressed, where the compression ends and the extension begins: this surface of fibers is called the neutral surface. As long as the beam is not strained beyond the limit of its elasticity, the extensions and compressions for a given strain are nearly equal, and therefore the neutral surface passes through the center of gravity of the cross section of the beam.

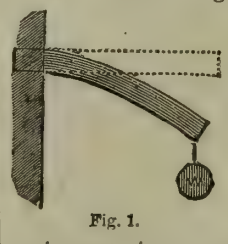


Fig. 1.

If we strain the beam beyond this limit, and approach the breaking strain, the extensions and compressions are no longer equal, and therefore the position of the neutral surface is not readily determined. For example, in the cases of stone and cast iron, the amount of compression is much less than that of the extension, and in the case of timber, greater. Also the extensions and compressions are no longer proportional to the strains. From these causes the position of the neutral axis, and the amount of strain on the different parts of the cross section at the moment of rupture, cannot be determined by theory.

Different theories have been proposed to determine the relative strength of similar beams, while their absolute strength is left to experiment. That of Galileo consists in supposing the beam in-

compressible, and that it gives way by extension turning round the lower edge, each point of the section giving an equal resistance before rupture. That of Mariotte and Leibnitz supposes the beam in like manner to turn round its lower edge, but considers that the resistance given out by each point of the section is proportional to its distance from that edge.

The theory now generally adopted consists in supposing the extensions and compressions to continue up to the point of rupture proportional to the strains, as is actually the case up to the limit of elasticity, and therefore, that the beam turns round a neutral axis, passing through the center of gravity of the cross section, the force given out by each point being proportional to its distance from the neutral axis. This last theory is found to give the best results in the case of timber and wrought iron, especially wrought iron arranged in the forms usual in girders. The second represents nearly the method of failure of stone, and the first that of cast iron.

Though none of these theories give accurate results, they yet give us means of determining, from particular experiments, the strength of any other beam whatever. For example, these theories agree in giving the strength of a rectangular beam to be proportional to the area of cross section multiplied by the depth, and inversely proportional to the length of the beam, since the strain increases directly as the length. This, when expressed mathematically, is

$$W = C\frac{bd^2}{l} \qquad (I.)$$

Where w = breaking weight in tons.
b = breadth of beam in inches.
d = depth of beam in inches.
l = length of beam in inches.
C = a constant number for beams of the same material, to be determined by experiment.

This result is borne out by experiment—that is to say, the constant C being determined by experiment on one beam, the strength of any other is found by multiplying its breadth by the square of its depth and by the constant C, and then dividing by its length. In the case of a beam supported at each end and loaded by a weight in the middle, as in fig. 2, the strength is also given by the formula,

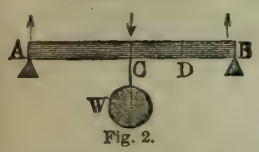


Fig. 2.

$$W = c\frac{bd^2}{l} \qquad (II.);$$

but c, in this case, is 4 times the value of C in the formula for a beam loaded at one end. The truth of this may be seen from the consideration that the beam ACB, fig. 2, may be treated as if it were two beams, each fixed at the point C at one end, and pressed upwards by the reaction of the supports at A and B, their other ends. This reaction is evidently equal to $\frac{W}{2}$; so that the breaking weight of the whole beam ACB, supported at both ends, resolves itself into that of the beam CB or AC of length $\frac{l}{2}$, acted on by the weight at one end $\frac{W}{2}$; this by formula (I.) is,

$$\frac{W}{2} = C\frac{bd^2}{\frac{l}{2}}$$

$$\text{or, } W = 4C\frac{bd^2}{l} = c\frac{bd^2}{l};$$

$$\text{therefore, } c = 4C \text{ or } C = \tfrac{1}{4}c.$$

Experiments on the transverse strength of beams are generally made in the manner of fig. 2. The following table, from experiments by Mr. Barlow, gives the value of c for beams supported at each end and loaded in the middle:

	Tons.
Cast iron	13½
Wrought iron	12
English oak	2½
Red pine	2⅘

These numbers when substituted in the formula give the breaking weight, ¼d of this will be the safe load in practice. The transverse strength of cast iron is considered so good a test of its value, that in specifications of iron-work, it is generally required to be of such a quality that a bar of it, of certain dimensions, will bear a specified weight at the center; for example, 'that a bar of it, 42 inches long, 2 inches deep, and 1 inch wide, set on bearings 36 inches apart, shall bear, without breaking, 30 cwt. suspended in the middle.' If a beam be loaded uniformly over its length, as in fig. 3, it will bear twice as much as if the load be condensed at the center, as in fig. 2. Also, if the load be placed some distance from the center, as at D, fig. 2, the load it will bear is to the load borne at the center, C, inversely as the rectangle of the segments into which the beam is divided by the point of application of the load are to one another, that is, as AC × CB or $\frac{l^2}{4}$ is to AD × DB, from which it follows that it will bear less weight at the center than at any other point.

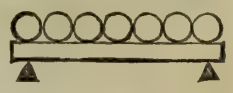


Fig. 3.

Since the strength of a rectangular beam is proportional to the square of the depth, multiplied by the breadth, it is evident that by increasing the depth and diminishing the breadth we shall, up to a certain limit, increase the strength of a beam without increasing its weight; for example, let A and B, fig. 4, be the sections of two beams, of which A is 2 inches broad and 2 deep, and

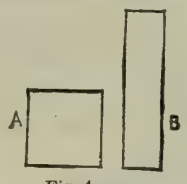


Fig. 4.

Fig. 5.

B 4 inches deep and 1 inch broad, they are of the same sectional area—viz., 4 square inches, but the strength of B is to the strength of A as $4^2 \times 1$ is to $2^2 \times 2$, or as 16 to 8, that is, 2 to 1, that is to say, B is twice the strength of A. Hence arises the advantage of the double T forms so generally used in iron girders, fig. 5, the strength of which forms are proportional to the area of the top or bottom plates multiplied by the depth. For a beam of the form in fig. 5, loaded as in fig. 2, the following formula will give the breaking weight:

$$W = C\frac{ad}{l}$$

Where a = the area of the top or bottom flange in square inches.
C = 4 times the destroying load per square inch of the material, under direct tension or compression in tons.
d = depth of the beam in feet.
l = length between supports in feet.
W = breaking weight at the center in tons.

For cast-iron beams, when the area of the bottom flange is made 6 times that of the top, which has been found by experiment to be the best arrangement, and the strength is measured by the tensional strain, supported by the bottom flange, that is, 6½ tons per square inch,

$$C = 6\tfrac{1}{2} \times 4 = 26 \text{ tons.}$$

For wrought-iron beams,

$$C = 4 \times 20 = 80 \text{ tons for the lower flange}$$
$$\text{and } C = 4 \times 16 = 64 \text{ tons for the upper flange.}$$

Another way of throwing the great body of the material at a distance from the neutral axis is, to make it into the shape of a tube or hollow cylinder. Let B be the section of a hollow cylinder, the thickness of whose walls is represented by the shaded ring; and A be the section of a solid cylinder of the same material. If the area of A is equal to that of the ring in B, the two cylinders will contain the same quantity of matter, but B. will be stronger than A, nearly in proportion as cg is longer than dg.

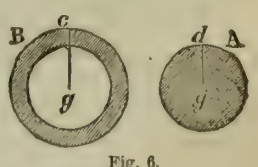


Fig. 6.

The principle of hollow structure prevails both in nature and art, wherever strength and lightness have to be combined. It is seen in the stems of plants, especially of the grasses; the bones of animals are also hollow, and those of birds, where great lightness is required, are most so. A feather, with its hollow stem, is perhaps the best instance of the union of strength and lightness that could be given. In art, again, we have hollow metal pillars; and sheet-iron for roofing and other purposes is *corrugated*, or bent into ridges and furrows, to give it depth. Each ridge or furrow is, as it were, half a tube, and resists bending with twice or thrice the energy it would if flat.

The most striking application of the principle of hollow structure is seen in tubular bridges. Fig. 7 represents a section of the tube of the Conway Bridge. The object being to resist a vertical strain, the form is made rectangular, and the chief mass of the material is thrown into the top and bottom. The tube may, in fact, be considered as an immense beam or girder constructed on the principle of fig. 5, the top and bottom being the two flanges, and the two sides serving to connect them, instead of the one rib in the middle. As it is constructed of plate-iron, the top requires more metal than the bottom, in order to resist the compression; but instead of putting the metal into one thick plate, or into several plates laid the one on the other, it is made to form a set of minor tubes or cells, which give additional stiffness and strength to the whole tube. The floor, in like manner, contains cells. Each of the tubes over the Conway is 24 feet high, 14 feet wide (outside), and 420 feet long, and weighs 1300 tons; yet these enormous hollow beams sustain not only their own weight, but the heaviest railway-trains without sensible deflection.

Fig. 7.

Fig. 8 represents an ingenious contrivance for strengthening the wooden beams supporting a bridge. An iron rod, fixed to the beam AB at the two ends, is kept at a distance by struts *c*, *c'*. The beam cannot now be bent downwards without stretching the rod; which thus has to bear the tensive strain, while the beam itself sustains only the compressive strain.

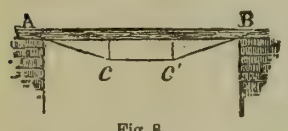


Fig. 8.

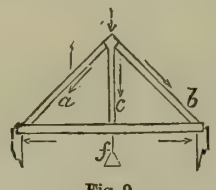


Fig. 9.

Another way of removing part of the strain from a girder, is to fix a king-post, *c*, and two oblique pieces on its upper side, as in fig. 9. The whole is now one composite girder; and when any weight, *f*, bears upon it, the whole of the compressive strain is thrown upon the pieces *a*, *b*, and only the tensive strain is left for the beam to sustain.

When a beam AB is fixed at one end, and loaded at the other, the strain is greatest at B, and is less at other points, as *c*, *c'*, in proportion as Ac, Ac', the levers at which it acts, are less than AB. The beam may therefore be made to taper off towards the end, and we may determine the exact form the beam should have, in order to be equally strong at every point. For supposing the breadth uniform, the strength increases as the squares of the depths *c'd'*, *cd*, while the strain increases as the levers Ac' Ac; and thus, if Ac: Ac' : : cd^2 to $c'd'^2$, the strengths are equal at those points. This proportion will always hold good, if the curve of the beam is that of a parabola; and, accordingly, this is the shape given to the beams of steam engines.

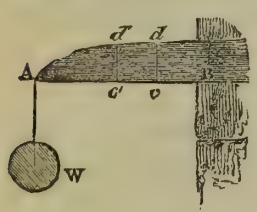


Fig. 10.

In beams supported at both ends, the strain is greatest in the middle; girders are therefore made strongest in the middle, and taper towards the ends.

4. *Shearing Strain.*—This force is called into play when a plate is cut by shears, or when a riveted or bolted joint is torn asunder, in which case the rivets are sheared across. The effect of it is to cause the particles in one plane to slide over those in another; this is resisted by their mutual coherence, and the magnitude of the resistance depends on the number of the particles, that is, on the area of cross section of the body sheared. The following laws are the result of experiment—1. The ultimate resistance to shearing is proportional to the area of section of the bar sheared. 2. The ultimate resistance of any bar to a shearing strain is nearly the same as the ultimate resistance of the same bar to a direct longitudinal strain.

5. *Torsion.*—If one end of the axle or shaft of a wheel is immovably fixed, and a power acts at the circumference of the wheel (or at the end of a lever or winch), the power may be so increased as to twist the shaft asunder at its weakest point. If a shaft A has twice the diameter of another shaft B, there will be four times as many fibers in the section of fracture of A, to resist the twist, as in that of B. But as the separation takes place by the one end of the fracture turning round upon the axis of the shaft, making the ends of the separating fibers describe circles, those fibers that are furthest from the center will have the greatest power of resistance, and the sum of their moments, or their united effect, will be in proportion to their mean distance from the center. This mean distance in A is twice that in B; therefore, the resistance in A is 2×4, or 8 times the resistance in B. Generally, *the strength of shafts to resist torsion is as the cubes of their diameters.* The torsive strengths of shafts 1 inch diameter, and with weights acting at 1 foot leverage, being found by experiment for different materials; the strength of shafts of other dimensions is found from these 'constants' by multiplying by the cube of the diameter, and dividing by the length of the lever. It is evident that the torsive strength of a hollow shaft will be greater than that of a solid one of the same quantity of material, on the same principle that its transverse strength is greater. The rule used by Boulton and Watt for calculating the diameters of their wrought-iron shafts was as follows:

$$\text{Diameter of shaft in inch.} = \sqrt[3]{\frac{120 \times \text{horse-power}}{\text{Revolu. per minute.}}}$$

This is found to make the shafts rather too light; and the following variation gives safer practical results:

$$\text{Diameter of shaft in inch.} = \sqrt[3]{\frac{240 \times \text{horse-power.}}{\text{Revolu. per minute.}}}$$

STREPSI'PTERA (Gr. twisted-wings), an order of insects called RHIPIPTERA (Gr. fan-winged) by Latreille, but first established by Kirby. The first-known species were observed by Rossi, and referred by him to the order *Hymenoptera*. The order S. consists of a small number of species, very singular in structure and habits, apparently forming a connecting link between *Coleoptera* and *Hymenoptera*. The species are all small, and in their larval state, live parasitically in the bodies of bees and wasps. Their natural history has been the subject of much attention since they were discovered; but much still remains obscure. The species form the two genera, *Stylops* and *Xenos*.

STRE'TCHING-COURSE, in Masonry or Brick-work, is a course in which the stones or bricks are placed with their longest sides along the face of the wall. The stones are called *stretchers*, as those placed at right angles to them with their end exposed are called *headers*.

STRE'TTO (Ital. bound), in Music, a term which signifies that the movement to which it is prefixed is to be performed with rapidity gradually accelerating towards the close.—The term *stretto* is also applied to the recurrence in a fugue of the subject in one part before it has come to a close in another. See FUGUE.

STRI'Æ, the fillets between the flutes of columns, pilasters, &c.

STRICKLAND, AGNES, an English authoress, the daughter of Thomas Strickland, Esq., was born at her father's seat, Reydon Hall, near Southwold, in Suffolk, in the year 1806. She was the third daughter of a family of six daughters and two sons, nearly all of whom have contributed something to the literature of our time. Her first compositions were mostly in the poetical vein, and consisted of anonymous contributions to periodicals. About the year 1825, however, she published in conjunction with her sister Susanna (afterwards Mrs. Moodie), a volume of *Patriotic Songs;* which was followed, in 1826, by a little volume bearing her own name exclusively, and entitled *Worcester Field, or the Cavalier; a Poem, in Four Cantos, with Historical Notes*, which was favorably received by some of the reviews. *Worcester Field* was followed by *The Seven Ages of Woman, and other Poems* (Lond. 1827); and this by *Demetrius, a Tale of Greece, in Three Cantos* (Lond. 1833), written in the meter of Byron's *Corsair*. In 1836, she published a little volume entitled *Floral Sketches, Fables, and other Poems;* republished in 1861. With this the list of Miss A. S.'s poetical works ends.

Among her prose works are: *The Rival Crusoes*, published without date; *The Pilgrims of Walsingham, or Tales of the Middle Ages, an Historical Romance* (2 vols., 1835); *Tales and Stories from History* (1836); *Alda, the British Captive* (1841); *Historical Tales of Illustrious British Children* (1847; new ed. 1858); *Historic Scenes and Poetic Fancies* (1850); *Old Friends and New Acquaintances* (2 series, 1860—1861). All these, however, are but of small import in comparison with her well-known work, *Lives of the Queens of England from the Norman Conquest, with Anecdotes of their Courts*, in 12 vols. (Lond. 1840—1848; new ed., 8 vols., 1851—1852). In this work, the materials for which she discovered by diligently ransacking among the treasures of the British Museum and other great public repositories of historic documents, Miss S. was largely assisted by her sister Elizabeth, an assistance which she gratefully acknowledges in her Preface. It was dedicated to Queen Victoria; and as each volume successively appeared, its picturesque style and anecdotical character made it a general favorite, especially among that class of readers whose object in reading history is rather amusement than philosophical instruction. At the same time, it must be owned that in these *Lives* she has added materially to our stock of historical information. Miss S.'s *Lives of the*

Queens of England, concluding with the biography of Queen Anne, have been followed by the *Lives of the Queens of Scotland, and English Princesses connected with the Regal Succession of Great Britain*, in 8 vols. (Edin. and Lond. 1850—1859); and these by her *Lives of the Bachelor Kings of England* (Lond. 1861), containing the lives of William Rufus, Edward V., and Edward VI. Miss S. published a novel entitled *How will it end?* (1865); *Lives of the Seven Bishops* (1866). In 1871 she received a pension of £100 She died in July 1874.

STRI'CTURE is a term employed in Surgery to denote an unnatural contraction, either congenital or acquired, of a mucous canal, such as the urethra, œsophagus, or intestine. When, however, the affected part is not mentioned, and a person is stated to suffer from stricture, it is always the urethral canal that is referred to. Contraction of this canal may be either permanent or transitory; the former is due to a thickening of the walls of the urethra, in consequence of organic deposit, and is hence termed organic stricture; while the latter may be due either to local inflammation or congestion, or to abnormal muscular action: the first of these varieties may be termed inflammatory or congestive stricture; and the second, spasmodic stricture. The last-named form seldom exists except as a complication of the other kinds of stricture. There are two principal causes of organic stricture—the first being inflammation of the canal, and the second injury by violence. Inflammation is by far the most common cause, and gonorrhœa is the common agent by which it is excited. Not unfrequently, stimulating injections thrown into the urethra, with the view of checking the gonorrhœal discharge, excite an inflammatory action, which gives rise to stricture. Fortunately, it is only in exceptional cases that a stricture results from inflammation of the urethra, the inflammation, in the great majority of cases, terminating by resolution, and leaving the canal as healthy as before the attack. It is when the complaint assumes a chronic character that it most commonly lays the foundation of stricture. Stricture from the second cause arises from such cases as falling across spars, scaffolding, ladders, &c., or on some sharp object which punctures the perinæum, as from earthenware vessels which break under the sitter.

The earlier symptoms of stricture are a slight urethral discharge and pain in the canal, behind the seat of the stricture, at the time of micturition. The stream of urine does not pass in its ordinary form, but is flattened or twisted; and as the disease advances, it becomes smaller, and ultimately the fluid may only be discharged in drops. The straining efforts to discharge the urine often induce Tenesmus (q. v.).

As the case advances, the urine becomes alkaline and ropy, and deposits a precipitate when allowed to stand; and attacks of complete Retention (q. v.) occur with increasing frequency. But these symptoms are not in themselves sufficient to establish the presence of stricture. It is necessary to examine the urethral canal with a Catheter (q. v.) or Bougie (q. v.), to ascertain whether an organic obstruction exists, whether one or more strictures are present (as many as eight have been recorded, although four are rare; and one is the most common number), and their caliber. The treatment of organic stricture is too purely surgical to be discussed in these pages: it is sufficient to state that its object is twofold, viz, first, to restore the natural caliber of the canal, so far as this can be safely effected; and secondly, to maintain this patency, after it has been established.

Spasmodic stricture may occur from any of the following causes: the presence of organic stricture or of inflammation of the mucous membrane; from an acrid condition of the urine; from the administration of cantharides, turpentine, &c.; and from the voluntary retention of urine for too long a time. The treatment consists in the removal of the causes as far as possible, and the hot bath. The inhalation of chloroform sometimes gives immediate relief; and several cases are recorded in which, when the spasm occurred periodically, it was cured by quinine. Inflammatory or congestive stricture commonly arises when a recent purulent discharge from the urethra has been checked by external cold or wet. The patient complains of heat, fulness, and soreness in the perinæum; the passage of the urine is extremely painful, the stream being small, and ceasing before the bladder empties. The treatment is much the same as that for Retention of Urine (q. v.).

STRI'GAU or STRIEGAU, a town of Prussia, province of Silesia, and government of Breslau, is situated on Strigau Water, 32 miles west-south-west of Breslau. It has manufactures of woolens and linens. Pop. (1880) 11,470.

STRIKE, a term borrowed by geologists, from the German *streichen*, to extend, and adopted with the technical meaning it has in that language. It is applied to the direction of the outcrop of a stratum—the line which it makes when it appears on the surface of the earth. This line is always at right angles to the dip of the bed. The angle of dip and the direction of strike are determined by a clinometer and compass. A perfectly horizontal stratum can have neither dip nor strike.

STRIKES. See COMBINATION.

STRING-COURSE, a thin projecting course of stone or brickwork in a wall, generally ornamented with a moulding, and made to go round windows or other openings in the wall.

STRINGE'NDO, a term used in Music to denote a gradual acceleration in the time.

STRI'NGHALT is a peculiar catching up of the horse's limbs, usually of one or both hind limbs. It is most noticeable when the animal is first brought out of the stable, when he is excited, or made to turn suddenly round; it is a variety of chorea or St. Vitus's dance. Although a serious eyesore, it does not interfere with usefulness, and is quite incurable.

STRO'BILA. See TAPE-WORMS.

STRO'MBIDÆ, a family of gasteropodous molluscs, of the order *Pectinibranchiata*, nearly allied to *Buccinidæ* (Whelks, &c.) and *Muricidæ*. The shell has a canal, the external lip of which, as it attains maturity, becomes more or less dilated, and is marked with a sinus, whence the head issues when the animal comes out. The foot is narrow and small, but is employed in active leaping movements, during which the shell oscillates from side to side. The species are numerous, and are mostly inhabitants of tropical seas. Some of them are among the largest of molluscs. *Strombus gigas* is the largest known univalve. It is found in the West Indies, on

Fountain-shell (*Strombus gigas*).

reefs in shallow water, and is fished both for the table and on account of the shell. Great numbers of the shells are imported into Britain; 300,000 have been brought to Liverpool in a year. They are sometimes called Fountain-shell, from their occasional use as a garden ornament. Their chief use, however, is by cameo-makers, by whom they are valued for their solid and delicately tinted substance. A shell sometimes weighs four or five pounds. Pearls of a delicate pink color are sometimes found in this shell. The *Strombi* are sometimes called wing-shells, from the dilated margin of the lip.

STRO'MBOLI, one of the group of the Lipari Islands (q. v.), the most north-easterly of the group, is about 12 miles in circumference, circular in shape, and contains 2000 inhabitants. It is wholly of volcanic formation, and rises to the height of 3100 feet above sea-level. On its western side is a volcano of considerable activity. Sulphur and pumice-stone are gathered in large quantities, and among the chief agricultural products are cotton, wine, and excellent fruits.

STRO'MNESS. See ORKNEY ISLANDS.

STONGY'LIDÆ, a family of nematode worms, possessing the following common characters. The body is round, and sometimes very much elongated, and almost thread-like. The mouth is round, oval, or triangular, and situated at the extreme anterior end of the body. The tail of the male is commonly furnished with a bursa, usually emitting two spicules. The whole family is parasitic and contains a number of genera. Some of the S. are parasitic in man, some in mammals, birds, reptiles, &c.

STRO'NGYLUS (from the similar Greek word signifying *round*) is the term applied to a genus of the family *Strongylidæ* (q. v.) of nematode parasitic worms. The only true S. infesting man is the *S. bronchialis* of Cobbold, previously known as *Filaria hominis bronchialis*, *Hamularia compressa*, &c. The male usually measures rather more than half an inch, while the female is upwards of an inch in length. For the general and specific characters of this rare entozoon, the reader is referred to Cobbold's *Entozoa*, p. 357. The worm was originally discovered by Treutler in 1790, who found several individuals in the bronchial glands of an emaciated subject. In 1845 it was again found by Dr. Fortsitz at Klausenberg in Transylvania, in the lungs of a boy six years old. These are the only two cases recorded by Küchenmeister and Cobbold of its occurring in the human subject; but closely-allied species, *S. paradoxus* and *S. micrurus*, are occasionally found according to Cobbold, in the lungs and air-passages of the pig and the calf respectively, and Küchenmeister states that he has found a species in the lungs of the sheep.

Closely allied to S. is the genus *Eustrongylus* of Diesing and Cobbold, which contains the species *E. gigas*, more commonly known as the *Strongylus gigas* of Rudolphe, Cuvier, and others. This is the largest nematode worm at present known to infest man or any other animal; 'the male measuring from ten inches to a foot in length, and ¼th of an inch in breadth; whilst the female is said to attain a length of over three feet, its transverse diameter being fully half an inch; body cylindrical, and more or less tinged with redness; head obtuse, and furnished with a simple oval aperture surrounded by six chitinous nodules: mode of reproduction, probably viviparous; eggs broadly oval, measuring about $\frac{1}{350}$″ from pole to pole.'—*Op. cit.*, p. 358. This worm occurs, according to Bremser, in the kidneys and bladder, sometimes

Strongylus gigas.—From Cobbold's *Entozoa*.

in the abdominal cavity and the omentum, more rarely in the lungs and liver of 'martens, dogs, wolves, seals, otters, oxen, and horses.' Fortunately, it is very rare in man, and, according to Cobbold, weasels are the animals in which it is most commonly found. The accompanying figure shows one of these worms coiled up within the pelvic cavity of the kidney of the coati, a species of monkey. The symptoms to which it must give rise must be much the same as those arising from abscess and degeneration of one of the kidneys, or from renal calculi. The diagnosis in a suspected case could only be established by the detection of the eggs or embryos in the urine.

STRO'NSAY, one of the Orkney Islands, lies 15 miles north-east from the town of Kirkwall. It is 7¾ miles long, and 6 miles in extreme breadth. Pop. (1871) 1267; (1881) 1274.

STRONTIA. See STRONTIUM.

STRO'NTIUM (symb. Sr, equiv. 43·8—new system, 87·6—sp. gr. 2·54) is a ductile and malleable metal, somewhat harder than lead, and of a pale yellow color. When heated in the air, it burns with a crimson flame, and becomes converted into its oxide, strontia. It is unaffected by the action of dry air, but it decomposes water at an ordinary temperature, hydrogen being explosively developed; and it burns in chlorine gas, and in the vapor of iodine, bromine, and sulphur. It dissolves in dilute nitric acid, but the strong acid has scarcely any effect on it. This metal does not occur in the native state, but exists as a carbonate in the mineral *Strontianite* (so called from its being first found near Strontian, in Argyleshire), and as a sulphate in the mineral known as *Celestine* (so called from its delicate blue tint). It is obtained by the voltaic decomposition of the chloride of strontium. This metal bears to barium the same close relation that sodium bears to potassium; and the compounds of S. resemble those of barium not only in their composition but in their properties.

The oxide of S., commonly known as STRONTIA, is obtained in the same way, and resembles in almost all respects the corresponding oxide of barium, except that it is inert when taken into the system, while baryta is poisonous. When a small quantity of water is poured upon it, it slakes, giving out heat.

The salts of strontia resemble those of baryta in their general characters, and in their being precipitated from their solutions by sulphuric acid and the soluble sulphates; but they differ from them in not being thrown down by silico-fluoric acid or hyposulphite of soda, and in their communicating to the flame of the spirit-lamp and to burning substances generally, a brilliant purple-red color. The salts of strontia occur only in the mineral kingdom, and are never found as normal ingredients of organic bodies. *Carbonate of Strontia* (SrO,CO_2) occurs native both in a massive and crystalline form, and may be obtained artificially as a white powder by precipitating a soluble salt of S. with carbonate of soda. *Sulphate of Strontia* occurs native in *Celestine*, a mineral which is found in beautiful rhombic prisms in Sicily. *Nitrate of Strontia* (SrO,NO_5) separates from a hot concentrated solution in large colorless transparent anhydrous octahedral crystals, which dissolve freely in water. By the addition of nitric acid, it is precipitated from its aqueous solution. This salt is insoluble in alcohol; but when finely powdered, and mixed with it, it communicates to the alcoholic flame a beautiful red or crimson color. In consequence of this property, it is employed by the makers of fireworks. A mixture of 40 parts of nitrate of strontia with 10 of chlorate of potash, 13 of sulphur, and 4 of sulphide of antimony, deflagrates with a magnificent red color, and constitutes what is popularly known as *Red Bengal Fire;* but the mixture is dangerous both to prepare and to preserve, having more than once been the occasion of frightful accidents to the manufacturers from its becoming ignited spontaneously.

The most important of the haloid salts of S. is the *Chloride* (SrCl), which may be obtained in crystals containing six equivalents of water. The water is expelled at a moderate heat, leaving the chloride anhydrous. The chloride is the only salt from which the metal has hitherto been obtained.

Regarding the history of this metal, it may be observed that strontia was discovered as an independent substance almost simultaneously by Hope and Klaproth in 1793. In 1807, Davy obtained barium and strontium from their oxides, but not in a pure state; and it was not till 1855 that Bunsen and Matthiessen succeeded in procuring perfectly pure specimens of the metal.

STRO'PHULUS. See RED GUM.

STROUD, a parliamentary borough and market-town of Gloucestershire, nine miles south-south-east of the city of Gloucester, stands in a beautiful and extensive valley, at the confluence of the Frome and Slade, which unite to form the Stroudwater or Frome. It is the center of the woollen manufactures of Gloucestershire, and contains a number of woollen and silk mills. The water of the Frome is peculiarly adapted for use in dyeing scarlet and other grain colors; and on this account, cloth-factories and dyeworks have been built along its banks for the distance of 20 miles. The borough of S. forms part of the great west of England cloth districts. Pop. of parliamentary borough, which sends two members to the House of Commons (1871), 38,610; (1881) 45,703.

STRUENSEE, JOHANN FRIEDRICH, COUNT OF, a man who, in last century, attracted the attention and excited the sympathy of the whole of Europe, by his elevation and downfall at the Danish court. S. was born 5th August 1737, at Halle on the Salle, where his father, Adam Struensee, the author of the old Halle Hymn-book, was pastor of the Ulrichskirche. Young S. studied medicine, and when scarcely 19 years old passed as Doctor. Early alienated from positive Christianity, he zealously embraced the philosophy which had then arisen in France, and became a disciple of Helvetius and Voltaire. When his father removed to Altona, he accompanied him, and was soon afterwards appointed traveling physician to the young king, Christian VII. of Denmark; and on their return from a tour, physician in ordinary. At first, the young queen, Caroline Matilda, sister of George III. of England, looked upon him with mistrust; and it was not till 1770, when S. successfully managed the inoculation of the two-year old crown-prince, afterwards King Frederick VI., that she came round to him, intrusted him with the education of the prince, and by degrees made him the confidant of her unhappy position. S. removed the estrangement between the royal pair, which was the work of the favorite Holck, and, in consequence, rose still higher in favor with both. He was appointed Reader to the king, and Private Secretary to the queen. Since the revolution of 1660, Denmark had been under the domination of the nobility, who, as a council of state, governed the country. S. saw the disadvantages of this government of the nobles, and formed the ambitious resolve to come forward in this land of his adoption as an enlightened reformer after the model of Frederick II. To begin with, he effected the downfall of the favorite Holck, in whose stead his friend Brandt was appointed Royal Companion and Director of the Court Amusements. In order to gain the love of the people, S. proclaimed the freedom of the press. The council was dissolved, and a proclamation issued to the effect that the royal power in all its purity, as it had been handed down from olden times, was to be re-established. These measures amounted in reality to a revolution, and to a declaration of war against the aristocracy.

The queen and S., in whose hands the whole power now was, chose new ministers, and excluded the feeble Christian entirely from the management of affairs. In July 1771, S. received the title of Cabinet Minister, along with unlimited power. He brought several men from Germany, whom he appointed to different offices. This introduction of strangers caused great dissatisfaction among the people. In opposition to the politics of his predecessors, S. endeavored to free Denmark from Russian in-

fluence, and to find a natural ally in Sweden. The changes which he undertook in the internal affairs were directed to the advancement of the prosperity of the country, of civil liberty, and enlightenment. He put the finances in order, reduced the expenditure, loosened the fetters in which industry and trade had been bound, encouraged education, mitigated the penal laws, and brought order into the administration. An act passed in 1771, to a certain extent abolished serfage. All these reforms, which are in operation in the Danish dominions at the present day, were excellent; but the haste and want of statesmanlike skill with which they were carried out, made them appear as the acts of the most vexatious tyranny. S. committed a great mistake, too, in recklessly obtruding his philosophy of enlightenment in the face of the strict orthodox clergy and the pious prejudices of the people.

S. had scarcely been in power a year when the symptoms of reaction appeared in all quarters. The queen gave birth to a daughter in 1771, which, in the condition of the king, gave rise to most scandalous reports. The British ambassador, Lord Keith, who saw the catastrophe approaching, proposed to S., by the advice of George III., to take refuge in England; but S. declined doing so. At the head of the hostile party was Christian VII.'s stepmother, Juliana Maria, Princess of Braunschweig-Wolfenbüttel, who was impatient of the domination of the queen and Struensee. A bold stroke was to precipitate S. and ruin the queen, and the night when a court ball was to take place was fixed upon for carrying out the plot. The conspirators assembled at the king's stepmother's, and by a secret door entered the bedroom of the king, and obliged him to make out 15 warrants of arrest, among others for Struensee. Christain was prevailed upon, but with much difficulty, to write out orders to arrest and convey his consort the queen to Kronenburg. S. and the queen were then taken prisoners, and the former was treated with extreme harshness, put in chains, and brought to the citadel. He was accused of an assault on the person of the king; of the intention to compel Christian to abdicate the throne; of criminal intercourse with the queen; of using a fatal system in the education of the crown-prince; and of the usurpation and abuse of supreme power. Not one of these points could be legally proved. In a second examination, however, S., with tears, confessed to having had improper intercourse with the queen; but some of his contemporaries affirm that he made the confession under threat of torture. On this important confession, a second commission was sent to the queen at Kronenburg, from whom, however, not the slightest confession of guilt could be extorted.

When one of the commissioners at last remarked that if she made S. guilty of falsehood, he would be put to a disgraceful death for slandering majesty, the queen seized a pen, and began to sign a paper which contained the confession of her guilt. She had not finished when she sunk in a swoon in her chair; and it is said that some one put the pen in her hand, and guiding it, finished the name, 'Caroline Matilda.' S. was found guilty of a great and capital crime, and was sentenced to a cruel death. It was wished by some to proceed further against the queen; but the commissioners were satisfied by the simple separation of the royal pair, especially as the British ambassador threatened the appearance of a British fleet. After the king had confirmed the sentence, not without being urged by the Russian ambassador, it was carried into execution on the 28th April 1772, amid the rejoicings of the multitude. In the prospect of death, S. is said to have returned to the Christian faith. There is no doubt that he did not deserve his fate, but that he fell a sacrifice to the party of the nobles. The execution of his friend Brandt, which took place at the same time, was a still clearer case of legal murder, as he never took any part in the affairs of government. S.'s brother would have shared the same fate, had not Frederick II. claimed him in a menacing manner as a Prussian subject. Queen Caroline Matilda left Denmark in May 1772, and died of grief in 1775, in the castle of Celle in Hanover.

See works on S. by Höst, Falkenskjöld, Münter, Jenssen-Tusch (1864), and Schiern (1871); and the tragedies by Beer and Laube.

STRUGGLE FOR EXISTENCE. See DARWINIAN THEORY.

STRUTS, straining pieces of timber in a roof, used to strengthen the principal Trusses (q. v.).

STRUVE, FRIEDRICH-GEORG-WILHELM, a celebrated astronomer, was born at Altona, April 15, 1793, educated at the university of Dorpat (Russia), and appointed to a post in the observatory of that place in 1813. He became Director of the Dorpat Observatory in 1817, and continued with the utmost assiduity his observations and researches respecting double and multiple stars, adding immensely to our knowledge of these systems, and earning for himself the reputation of being one of the most skilful of practical astronomers. The instrument with which he observed was a Fraunhofer's (q. v.) refractor, of 10 inches aperture, and 13½ feet focal length; and with this telescope, in gleaning from the depths of space the materials for his three important works on double stars (1822 and 1828, 1837 and 1840, 1852), he examined no fewer than 120,000 of these twinkling luminaries. His investigations have led him to the conclusion, that the number of true double stars is much larger than was previously supposed (see STARS). S. also executed a number of important geodetic operations, such as the triangulation of Livonia, in 1816—1819, and the measurement of an arc of the meridian in the Baltic Provinces, in 1822—1827; which was subsequently (1828—1856) extended by him, in conjunction with Hansteen (q. v.) and Selander, to the North Cape; and by General Tenner southwards to Ismail in Turkey. This latter undertaking, the most extensive trigonometrical operation ever performed, when completed, gave the length of a meridian arc of 20°, and enabled geometers to determine with increased accuracy the exact form of the earth. Meanwhile, S. had been appointed, in 1839, director of the best organized observatory in the world, that of Pulkova (q. v.), and also chosen *correspondant* in the astronomical section of the Academy of Sciences of Paris. He died at St. Petersburg, 23d November 1864.—His son, OTTO-WILHELM STRUVE, also an eminent astronomer, was born at Dorpat, May 7, 1819, was educated under his father's direction, became his chief assistant at Pulkova, and the Director of the observatory after his death. He has made numerous astronomical discoveries, among which are more than 500 new double stars, and (1847) a satellite of Uranus, and has written numerous important papers, the most noticeable of which set forth his researches on the inner or dusky ring and on the variation in breadth of the bright rings of Saturn, and on the periodic motions of double stars.

STRY'CHNIA, or STRY'CHNINE. See NUX VOMICA.

STRY'CHNOS, a genus of trees of the natural order *Loganiaceæ*, having a five-lobed calyx, a tubular funnel-shaped or salver-shaped corolla, with a five-partite limb, five stamens, a filiform style, numerous ovules, and a one-celled berry, with a leathery rind, many-seeded, or, by abortion, one-seeded, the seeds discoidal and compressed. To this genus belongs the *S. nux vomica*, a tree of middling size, with ovate stalked leaves, a native of India, the fruit of which is produced in great abundance, and is about the size of a small orange; the seeds are the *Nux Vomica* of commerce, and yield *Strychnine*. The bark partakes of the poisonous quality of the seeds. The wood of the tree is very hard and durable. The Clearing-nut (q. v.) and St. Ignatius' (q. v.) Bean are produced by species of this genus, to which also belongs the tree (*S. toxifera*) which produces the Woorali or Curare (q. v.) poison of South America. Another species is the UPAS TIEUTÉ (*S. Tieute*) of Java, a large climbing shrub, the bark of which is etxremely poisonous, containing a very large quantity of strychnine. The wood of a species found in the north of India (*S. colubrina*), which is also a climber, is an imaginary cure for snake-bites. The bark of *S. pseudo-quina*, a Brazilian species, is used as a substitute for cinchona.

STRYPE, REV. JOHN, a voluminous ecclesiastical historian, was born in London in 1643. He studied at Cambridge, entered the church, and held for many years, with other smaller livings, the rectory of Low Leyton, in Essex. He died at Hackney in 1737, having reached the great age of 94. His works fill thirteen large folio volumes. The most important are—*Memorials of Archbishop Cranmer* (1694); *Life of Sir Thomas Smith, Secretary of State to Edward VI. and Elizabeth* (1698); Lives of *Bishop Aylmer* (1701), *Sir John Cheke* (1705), *Archbishop Grindal* (1710), *Archbishop Parker* (1711), and *Archbishop Whitgift* (1718); *Annals of the Reformation* (vol. i. 1709, vol. ii. 1723, vol. iii. 1728, and vol. iv. 1731); *Ecclesiastical Memorials*, relating to religion and the Church of England under Henry VIII., Edward VI., and Queen Mary, in 3 vols. folio, published in 1721. This is his best work, forming, with Burnet's more readable *History of the Reformation*, a consecutive and full account of the reformed Anglican Church. S. also published an enlarged edition of Stow's *Survey of London*, with several sermons and pamphlets. As a writer, he is heavy, but honest and plodding, and he was a faithful transcriber of the ancient papers he published, which, he says, were all copied with his own hand.

STUART, CHARLES EDWARD LEWIS CASIMIR, often called the younger Pretender, the eldest son of James Francis Edward, Prince of Wales, known as the elder Pretender, or Chevalier St. George (see STEWART, FAMILY OF), and his wife Clementina Sobieski, grand-daughter of the celebrated Polish monarch, John Sobieski. He was born at Rome, on the 31st December 1720, and bore among the Jacobites the title of Prince of Wales. He served under Don Carlos in Spain, and in his youth is described as having been handsome, affable, and engaging in manners. In 1743, 28 years after his father's unsuccessful attempt to regain the crown, a scheme was contrived in France, with the support of the Jacobites in England, by which Charles Edward was to recover the throne of Great Britain for his family. The first contrived project was to land an army in Kent, where were many ad-

herents of the exiled House; and troops to the number of 15,000 were assembled, and transports provided at Boulogne, Dunkirk, and Calais to carry them to England. But the squadron which was to have convoyed the transports fled before the British fleet under Sir John Norris; a storm destroyed the transports, and most of the troops were drowned. Charles, however, only awaited a favorable opportunity to make a fresh attempt. In July 1745, when George II. was in Hanover, and Scotland almost without military, he sailed from Nantes, in company with the Marquis of Tullibardine, and a few other devoted followers, and landed in the bay of Lochnanuagh, whence he proceeded to Kinlochmoidart, where the Highland clans attached to his cause were summoned to rise. Ten days later, Charles's standard was set up at Glenfinnan; and he marched southwards at the head of a large body of hardy mountaineers. Government offered a reward of £30,000 for the apprehension of the Pretender's son, who retaliated by offering a like reward for the apprehension of the Elector of Hanover. At Perth, the insurgents were joined by the Duke of Perth and Lord Strathallan, with a numerous retinue of followers; and on their approach, Edinburgh surrendered without resistance, the castle, which was in possession of the king's troops, still holding out. Charles took up his residence at Holyrood Palace, where he proclaimed his father king of Great Britain, and himself regent.

Meanwhile, Sir John Cope, the commander-in-chief of the king's troops in Scotland, having collected some reinforcements in the north, came from Aberdeen to Dunbar by sea, and encamped at Prestonpans. He was there unexpectedly attacked by the Highlanders, and ignominiously routed, leaving baggage, cannon, and camp equipage on the field. Contrary to the advice of his council, Charles, who could not bear opposition, resolved to advance into England, though his force hardly exceeded 6500 men. Carlisle surrendered at his approach, and he proceeded unmolested as far as Derby. In the meantime, three English armies, each larger than his own, were preparing to meet him. Being unable to raise any recruits in England, he found it necessary to retreat into Scotland, where he hoped to meet a reinforcement under Lord John Drummond. On their way north, the Highlanders were pursued by the Duke of Cumberland, whom they defeated near Penrith. Finding that Edinburgh was now in possession of the king's troops, Charles, joined by Lord John Drummond and Lord Strathallan, made his way to Stirling. That town surrendered to him, and he laid siege to the castle. General Hawley, in endeavoring to raise the siege, was utterly routed by Lord George Murray, at the head of the Macdonalds of Keppoch. But the advance of the Duke of Cumberland obliged the rebels to retreat further north, and for a time they carried on a desultory war with the king's troops in the neighborhood of Inverness. On 16th April 1746, the Duke of Cumberland encountered Charles's army on Culloden Moor, and opened a heavy cannonade on them. The Highlanders at first rushed boldly forwards; but on the advance of the royal infantry, they gave way; the battle soon became a rout, and the fugitives were pursued and slaughtered by the dragoons, who gave no quarter, and spread carnage and desolation over the country. The rebels lost that day at least 1000 men of the bravest and most devoted to the cause. Charles escaped to the Hebrides, hunted by the king's troops; disguised in female attire, he was conveyed to Skye in an open boat by Flora Macdonald, daughter of Macdonald of Milton. For months he wandered in concealment among the mountains of Skye and the mainland, where he had many hairbreadth escapes; and though his secret was known to hundreds of the poorest of the people, no one was tempted by the £30,000 reward to betray him. He eventually escaped to France, and no further attempts were made to reinstate the exiled family.

Charles Edward remained in France till the peace of Aix-la-Chapelle (1748). It was made a condition of that treaty that France should abandon the cause of the Stuarts; and Charles, refusing to quit France voluntarily, was conducted with a guard out of the kingdom, and retired to Rome.

He married, on 17th April 1772, Louisa Maximiliana de Stolberg-Guedern, daughter of Gustavus Adolphus, Prince of Stolberg-Guedern. The union did not prove a happy one, and the princess withdrew herself from him. See ALBANY, COUNTESS OF. In the latter years of his life, the prince was addicted to intoxication. When his claims ceased to be supported by any foreign power, he dropped the title of Prince of Wales, and assumed that of Count of Albany. He died at Rome, 31st January 1788, and was buried at Frascati. There was no issue of his marriage, but he left a natural daughter, on whom he bestowed the title of Duchess of Albany, and to whom he bequeathed considerable property.

Two brothers, generally known as John Sobieski Stuart and Charles Edward Stuart, endeavored, some years ago, to persuade the world that they were legitimate grandsons of Charles Edward. In point of fact, they were sons of Captain Thomas Allen, R.N., and grandsons of Admiral John Carter Allen, who died in 1800. Their story, as set forth, with some slight mystifications, in a work called *Tales of the Century, or Sketches of the Romance of History between the years* 1746 *and* 1846, was to the effect that their father, in place of being Admiral Allen's son, was a son of Prince Charles and the Princess Louisa, whose birth was kept secret, from fear of the Hanoverian family, and who was intrusted to Admiral Allen, and passed off by him for his own son. The life of Charles S. is detailed in *History of the Rebellion*, 1745—46, by R. Chambers.

STUART, GILBERT CHARLES, American painter, was born at Narraganset, Rhode Island, in 1756. In his boyhood, he went to Edinburgh with a Scotch painter named Alexander, with whom he studied his art; but his master dying, he worked his passage home, and began to paint portraits at Newport. In 1778, he made his way to London, where he led for two years a wild Bohemian life; but his talent was recognized by his countryman, Benjamin West, President of the Royal Academy, who took him into his family, and whose full-length portrait he painted for the National Gallery. In 1781, he opened his studio in London, and painted the portraits of his Majesty George III., H.R.H. the Prince of Wales, the Duke of Northumberland, Sir Joshua Reynolds, John Kemble, Colonel Barré, and many other celebrated characters. He also made a professional visit to Dublin, and in Paris painted a portrait of Louis XVI. In 1793, in the fulness of his powers and fame, he returned to America, and painted portraits of Washington, Jefferson, and many of the distinguished men of the period, and commenced a portrait of John Quincy Adams, which at his death was finished by Sully. He died at Boston, July 1828.

STUART, MOSES, American divine and author, was born at Wilton, Connecticut, March 26, 1780, and educated at Yale, where he remained for some time as a tutor. He began the study of law, but abandoned it for theology, was ordained as pastor of a Congregational church at New Haven in 1806; and in 1809, was appointed Professor of Sacred Literature at the Theological School at Andover, a position he filled till 1848. During this period, in addition to his professorial duties, he wrote a *Grammar of the Hebrew Language*, without points; *Letters to the Rev. W. E. Channing; Hebrew Grammar*, with points (based on Gesenius); *Commentaries on the Epistle to the Hebrews*, and *the Epistle to the Romans;* on the Books of Ecclesiates, *Proverbs, Daniel*, and the *Apocalypse; Hebrew Chrestomathy; Essay on the Liquor Traffic; Essay on Christian Baptism; Hints on the Prophecies; Conscience and the Constitution*—manifesting in all acuteness, vigor, and versatility. He died at Andover, Massachusetts, January 4, 1852.

STU'CCO, a composition used for the finer parts of plasterwork, such as cornices, enrichments, &c. Gypsum (q. v.), or Plaster of Paris, is used for this purpose. A coarser kind of stucco is also used for making floors, and for plastering the exterior of buildings.

STUFFING, in Cookery, means force-meat used for filling the bodies of small animals, such as poultry, or for stuffing openings made for the purpose in large joints. It usually consists of breadcrumbs, savory herbs and other seasonings, minced very fine, and made into a paste.

STUHLWEI'SSENBURG (Hung. *székes Fejérvár*, Slav. *Bielihrad* or *Bialigrad*, Lat. *Alba Regalis* or *Alba Regia*), a royal free town of Hungary, and seat of a bishop, lies in a swampy plain in the neighborhood of the marshes of *Sár-Rét*, 16 miles north-east of Lake Balaton. The principal buildings are the splendid cathedral of the Virgin Mary, the church of St. John, and the bishop's palace. It has several Catholic schools, a military academy, and a theater. The inhabitants manufacture cotton cloths, flannels, leather, silk, and knives ('Stuhlweissenburg clasp-knives'), and extract soda from the swamps, which are, moreover, rich in fish, crabs, tortoises and water-fowl. Pop. (1880) 25,612. S. is built on the site of the Roman *Floriana*, and from 1027 to 1527, was the place where the kings of Hungary were crowned and buried, 14 of whom repose here. In later times, it suffered much from the ravages of war, and was for some years in the hands of the Turks.

STUPA. See TOPE.

STURDY, or the GID, affects sheep, and occasionally cattle, and is caused by the presence within the brain of a hydatid, reaching sometimes the size of a hazel-nut, and floating in a watery fluid enclosed in a membranous sac. This hydatid, when given to dogs, is known to produce tape-worms, and conversely itself originates from the ova of the tape-worm ejected on the pastures by dogs, rabbits, or even by sheep themselves. In the state of ova, or in some of its earlier minuter transitional forms, the hydatid embryo is picked up along with the grass, passes into the blood, and is thence laid down in the soft loose textures of the brain. It is most common in low damp pastures, and amongst sheep from six to twenty months old. The animal cannot properly seek its food, loses condition, staggers when moved, turns stupidly around almost in one spot, and usually towards the side on which the hydatid lies. The parasite and its sac may generally be safely removed by placing the sheep, with its feet tied,

on a table or bench, searching for the softened portion of the skull, which generally overlies the hydatid, laying back a flap of skin, and introducing the trochar and canula, and when the sac is deep-seated, cautiously withdrawing it with the help of a small syringe. Protected by a leather cap and simple water dressings, the wound speedily heals.

STU'RGEON (*Accipenser*), a Linnæan genus of cartilaginous fishes, now forming the family *Sturionidæ*, and placed by Müller in the order of *Ganoids*, distinguished by the Ganoid (q. v.) scales or bony shields which form the external covering. The gills are free, as in the osseous fishes. The vertebral column is soft; and there are no evident sutures in the skull. Reproduction is by roe, as in osseous fishes. The form of sturgeons is elongated and angular; the plates are arranged in regular rows; the head is cuirassed; the snout long and conical; the mouth is on the under surface of the head, tubular, protractile, and without teeth. The upper lobe of the tail is much larger than the under. The dorsal and anal fins are opposite to one another, behind the ventrals. The air-bladder is very large, and communicates with the gullet by a large hole. The species of S. are numerous, and inhabit both the sea and fresh-water, ascending deep muddy rivers at certain seasons, and temporarily inhabiting lakes. Numerous species are found in the northern parts of the world, although there are none in the Arctic Ocean, or the rivers which flow into it, but the south of Siberia and North America particularly abound in them. They are plentiful in the Caspian and Black Seas, and in the rivers connected with them, where the S. fishery is of great importance, supplying the inhabitants of large districts with their chief article of subsistence, and producing great quantities of Caviare (q. v.), or preserved S. roe, and of isinglass (see GELATINE), for sale. The COMMON S. (*A. sturio*) is sometimes caught

Sturgeon (*Accipenser sturio*).

in the mouths of British rivers, most frequently in salmon-nets; and is a large fish, six or eight feet in length, with five rows of flattened plates; the muzzle long and pointed. Another species (*A. latirostris*), with broader muzzle, also visits the British coasts, but they are not popularly distinguished.

The S. is more abundant on the northern coasts of Europe. It is also found in the more southern parts, and was in very high repute for the table among the Greeks and Romans. At their banquets, it was introduced with particular ceremonies. In England, when caught in the Thames, within the jurisdiction of the Lord Mayor of London, it is a *royal* fish, reserved for the sovereign. Its flesh is white, delicate and firm. It is used both fresh, generally stewed, and pickled or salted.—The largest species of S. is the BIELAGA, or HUSO (*A. huso*), of the Black and Caspian Seas, and their rivers. It attains the length of 20 or 25 feet, and has been known to weigh nearly 3000 lbs. It enters the rivers in winter, while they are still covered with ice. Great part of the caviare of commerce is made from it, and much isinglass, which is merely the air bladder washed, cut into strips, and dried. The STERLET (*A. Ruthenus*) is a comparatively small species, only about three feet in length, found in the same regions, and particularly esteemed for the delicacy of its flesh, and of the caviare obtained from it. There are several other European and Asiatic species; and some of the North American rivers and lakes abound at certain seasons in species of S. which are peculiar to them.—Sturgeons spawn in fresh water, but the young are seldom seen there, and are supposed to descend very early to the sea.

STU'TTGART, the royal residence and metropolis of Würtemberg, is beautifully situated in a widening of the Nesenbach valley, the hills forming a semicircle of eminences clothed with vineyards, orchards, and gardens. The basin in which S. nestles is 897 feet above the sea-level, and enjoys a mild and healthy climate.

Except the very oldest part of the city, the streets are broad, and the buildings handsome. The Schloss, or palace, is a fine modern building. The royal park and gardens extend from the north-east side of the palace for two miles in the direction of Canstatt, have an area of 560 acres, are adorned by fine groups of trees, and intersected by shady avenues, in which all classes may freely walk. The cathedral, built in the 15th c., was gifted by the king, in 1852, with several beautiful painted windows. Other principal buildings are the Royal Theater, public library, Mint, Museum of Art, Polytechnic School, erected in 1860—1865, the post-office, the new synagogue, several new churches and schools, and the Palace of Justice. The new railway station is one of the finest in Europe. The royal library contains 400,000 volumes, 3600 MSS., 9000 Bibles in 80 languages, and 2400 specimens of early printing. S. has many benevolent institutions and societies. There is direct railway communication with the leading cities of Germany and Switzerland. Pop. (1871) 91,623; of whom 78,624 were Protestants, 10,708 Catholics, and 1817 Jews; in 1880, 117,303. Since 1866, and especially since the Franco-Prussian war, trade has increased in a remarkable degree. The principal industries are the manufacture of cotton and half-wool fabrics, iron and tin work, gold and silver articles, chemicals, tobacco, beer-brewing, &c. The export of S. manufactures to North America alone, averaged in late years 4,000,000 to 5,000,000 thalers. S. has a high position in the book-trade, and is the place of meeting of the Booksellers' Union of Southern Germany. S. was the birthplace of Hegel; here, also, Schiller's youth was spent. The name of the city occurs for the first time in 1229. It was besieged by King Rudolph of Hapsburg, 1286—1287, and appears then to have been a place of strength. Between 1634—1638, nearly 9000 people died of the plague; and during the wars of Louis XIV., S. was thrice taken; and again in 1796, 1800, and 1801.

STYE, or STY, is the popular name for a minute boil occurring at the edge of the eyelid, and known to surgeons under the term *hordeolum*. It begins as a small, red, tense swelling, accompanied with considerable itching, and a feeling of stiffness. As the inflammation goes on, the lid may become so swollen as to keep the eye closed. In a few days, matter forms, a white point appears at the apex of the swelling; and when the cuticle gives way, pus and a small slough of connective tissue escape, after which there is a general remission of the symptoms, and the eyelid soon resumes its natural state.

This common affection is chiefly confined to scrofulous and delicate children, but it is sometimes observed in persons of more advanced age. The best local treatment consists in the application of warm-water dressings with lint and oiled silk; and if any hardness remains after the discharge of the matter, dilute nitrate of mercury ointment may be applied. The stye should never be rubbed (notwithstanding the common prejudice in favor of rubbing it with a gold ring), nor, in general, is it necessary to puncture it. To prevent the recurrence of these little boils, attention should be paid to the diet, which should be abundant and nourishing, to the state of the bowels, and to the general health; and tonics may usually be prescribed with advantage. The old form of the word was *stian*.—See Holland's *Plinie*, book xxviii. ch. xi.

STYLE, OLD AND NEW. See CALENDAR.

STYLI'TÉS, See PILLAR SAINTS.

STY'LOBATE, the substructure of a temple beneath the columns. It is sometimes continuous all round the peristyle in the form of three high steps; sometimes it resembles a continuous pedestal along each side, with flights of steps at either end.

STY'PTICS (Gr. *styptikos*, astringent) are agents employed in Surgery for the purpose of checking the flow of blood by application to the bleeding orifice or surface. See BLEEDING.

STY'RIA (Ger. *Steiermark*), a duchy forming one of the German crown-lands of Austria, is bounded on the end by Upper and Lower Austria, E. by Hungary and Croatia, S. and W. by Carniola, Carinthia, and Salzburg. Its area is 8671 English sq. m., and pop. (1880) 1,213,197, who are partly of German and partly of Slavic origin. S. is a mountainous country, being traversed in the west and center by branches of the Noric Alps, which spread out into numerous ramifications; while the southern portion, between the Drave and the Save, is occupied by branches of the Carnic Alps. The climate of S., like that of most mountainous countries, is variable, but is generally raw and cold in the northern and more mountainous portion, and mild in the south. But in spite of its physical character, agriculture is so zealously prosecuted, that $\frac{1}{4}$ths of the country are under cultivation, producing rye, wheat, oats, and maize. Vines are largely cultivated in various parts, and orchards are numerous. The chief wealth of the country, however, lies in its mineral products, which include, besides immense quantities of iron, lead, copper, gold, silver, marble, limestone, and slate, with abundance of salt and coal. The chief industries are thus necessarily in connection with the production of iron and steel, and their manufacture into articles of such excellent quality as to be in great demand in other countries. There are also manufactures of brass and lead articles, earthenware, paper, tobacco, glass, white lead, copper hammers, and of cotton, linen, cloth, &c. S. was anciently divided between Noricum and Pannonia, and

has generally followed the fortunes of the two provinces of Upper and Lower Austria.

STYX (Gr. *stug-*, to hate, abhor), a waterfall in Greece, near the town of Nonacris, in the north-east of Arcadia, descends perpendicularly over lofty and precipitous rocks, and forms a small torrent, which falls into the Crathis. The scenery around it is weird and desolate, so that the Greeks regarded the S. with superstitious awe, the water being supposed to be poisonous, and to break every vessel into which it was put, except those made of the hoof of a horse or an ass. It was reported that Alexander the Great had been poisoned by it. It is now called *ta Mauraneria* (the Black Waters), and also *ta Drakoneria* (the Terrible Waters), the belief in its poisonous qualities still surviving.—In Mythology, the S. was a river of Hades, round which it flowed seven times, and over which Charon (q. v.) conveyed the shades of the departed. As a goddess, S. was the daughter of Oceanus and Tethys, dwelling in a grotto at the entrance of Hades. She was the confirmer of the most solemn oaths of the gods.

SUA'BIA (Ger. *Schwaben*), SWABIA, or SUEVIA, an ancient duchy in the south-west of Germany, so named from a horde of Suevi, who spread over it in the 5th c., and amalgamated with the Alemanni, its previous inhabitants. It existed as a great duchy of the Frank Empire till the 8th c., when Alsace and Rhætia were separated from it, and the remainder, retaining its name of S., was thenceforth governed by *nuntii camerœ*, or royal delegates, one of whom having in 915 usurped the title of Duke of Alemannia, was condemned by the German Diet, and decapitated in 917.

S. at this time was bounded on the W. and S. by the Rhine, on the E. by the Lech (which separated it from Bavaria) and Franconia, N. by the palatinate of the Rhine and Franconia; and contained about 13,000 English square miles. In 918, however, S. was acknowledged as a ducal fief of the Empire; and after changing hands several times, was (1080) bestowed upon Count Frederick of Hohenstaufen (q. v.), the founder of the illustrious House of this name, also known as the House of Suabia. Under the rule of this prince and his successors, S. became the most rich, civilized, and powerful country of Germany, and the ducal court was the resort of the Minnesingers (q. v.); but the wars of the Guelphs and Ghibellines, and the quarrel with the French respecting Naples, put an end to the dynasty in 1268. The ducal vassals in S. rendered themselves almost independent, and professed to acknowledge no lord but the emperor. During these dissensions arose the lordships of Wurtemberg and Baden, with numerous lesser states, holding direct of the crown, and opposed to them the cities, which strove also for an equal independence, and at last, in reward of important service, obtained in 1347 great additional privileges. A number of them united to make common cause against the neighboring feudal lords in 1376 (known as the *First Suabian League*); an opposite league was formed between Würtemberg, Baden, and 17 towns in 1405, called the League of Marbach; and both took part in the war of Swiss independence, the former in support of the Swiss, the latter of the Austrians. At last, the towns, which had been rapidly increasing in wealth and power, decided at Ulm, in 1449, to form a standing army, and a permanent military commission, for the forcible preservation, if necessary, of peace and order; and the Count of Würtemberg, the most powerful of the opposite party, having joined them, was appointed military chief of the league, which ultimately grew up into the *Great Suabian League*, and exercised both administrative and judicial authority over the whole country, effectively repressing feudal quarrels.

In 1512, S. became one of the ten circles into which Germany was now divided, received its complete organization in 1563, and retained it almost without change till the dissolution of the Empire in 1806. But during this period, the wars of the towns with Würtemberg, the Peasants' War, of which S. was one of the foci, the Thirty Years' War, and those between France and the Empire, destroyed the democratic constitution of the towns, and with it their energy, and then their prosperity disappeared, leaving now no relic which could suggest their former great political importance.

SUA'KIN, a seaport belonging to Turkey, on a small rocky island in the Red Sea, off the west coast of Africa, but near the shore, in lat. about 19° 10′ N. It has a good harbor, and a considerable trade, especially in gums; and it is a station for pilgrims passing to and from Africa. Pop. estimated at 8000.

SUARES, FRANCISCO, the most celebrated of the modern scholastic and polemical divines of the Roman Catholic Church, was born at Granada in 1548. His early studies were singularly unpromising; and it is remarkable, in the history of a man afterwards so eminent, that it was not without great difficulty, and after repeated trials, that he obtained admission into the Society of the Jesuits. His later career, however, was brilliant, quite in proportion to the dulness of his first beginnings; and he taught philosophy and theology with remarkable success, first at Alcala, and afterwards at Salamanca, Rome, and Coimbra.

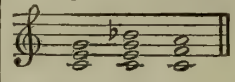
The accounts given of his habits of application to study are almost beyond belief. He is said to have habitually devoted seventeen hours a day to study. Of his power of memory, the marvels related are scarcely less prodigious. He is said to have been able to repeat at will any portion of the whole 23 folio volumes of his own works, even to the quotations from the Fathers and other theological writers with which they abound. S. may truly be described as the ablest and greatest of the modern scholastics; but in his works scholasticism appears in its best form; for although they abound in discussions uninteresting, and indeed unintelligible, to persons unacquainted with scholastic terminology, yet they may also be truly said on each subject to exhaust the whole of the learning, ancient and modern, which existed relating to that subject at the date of their publication. On the philosophy of the ancients S. is especially copious and accurate; and of most of the modern German philosophy we may find the germ in the pages which he devotes to the account of the opinions of the ancients.

In the scholastic controversies on Grace and Free Will, S. was strongly opposed to the Thomistic doctrine; but he also rejected the opposite system of Molina. See MOLINISM. The scheme of reconciling the freedom of the will with the efficacy of grace, and of saving at the same time the doctrine of 'special election,' devised by S., is called *Congruism*, and is explained under the head MOLINA. The works of S. are entirely theological, or ascetic, and were printed in 23 volumes folio at Lyon, Mainz, and Venice. An edition in 28 volumes 4to was completed at Paris in 1861. His treatise *De Legibus* is much esteemed, and has been reprinted in England. S. died at Lisbon in 1617.—See Des Champs, *Vie de Suares* (4to, Perpignan, 1671).

SU'BAHDAR was, under the Mogul government, the title of a governor of a province. It now designates a native officer, holding a rank equivalent to that of captain under the European officers.

SUBA'LTERN, in the Army, or rather in a regiment, is a company officer below the rank of captain; i. e., a lieutenant or sub-lieutenant.

SUBDO'MINANT, in Music, the fifth below the tonic; the note whose dominant is the tonic. Thus F is the subdominant of C, and C of G. One of the keys most nearly related to any key is its subdominant; and the easiest of all modulations is that from a key to its subdominant, which is effected by adding the dominant seventh to the common chord, and the resolution of this chord is the common chord of the subdominant; e. g., in modulating from the key of C to the key of its subdominant F, we have



See DOMINANT.

SUBIA'CO (anc. *Sublaqueum*), a city of the province of Rome, on a hill by the Teverone, 30 miles from Rome. S. possesses a fine cathedral, and many monuments of antiquity. There was a famous Benedictine monastery in S., and here in the 15th century, one of the earliest printing-presses in Italy was established. Pop. 7000.

SUBJECT. See OBJECT.

SUB-KINGDOMS, ANIMAL, a term applied to the great primary divisions of the animal world. The sub-kingdoms are also named 'morphological types,' and this latter term serves to indicate their constitution more definitely than the name 'sub-kingdom.' As an example of the manner in which a 'sub-kingdom' of animals is constituted, we may select that of the *Arthropoda*, a group of animals containing crustaceans, spiders, insects, and centipedes. These, united by Cuvier with the segmented worms to form the *Annulosa* or ARTICULATA (q. v.), are now accorded separate rank. A lobster may be selected as a typical example of this group. In the detailed examination of this animal, we may note that the jointed nature of the tail is perceptible in the fore part of the body, notwithstanding that the latter region consists apparently of a single piece. A further examination of the lobster's body would reveal the fact that each joint and its appendages—the latter being 'paired'—agrees in essential or fundamental structure with every other joint of the body. The investigation of the plan of structure of the lobster's frame would show a very typical arrangement of parts. The *heart* lies dorsally, or on the back. The *digestive system* occupies a median position; and the *nervous system* lies ventrally, or on the floor of the body. The nerve-axis of the lobster further consists, typically, of a double chain of nervous masses (or *ganglia*) united by nervous cords, and from which branches proceed to the various parts of the body. The ideas we may gain regarding the *general type of structure* of the lobster's body, or plan on which that body is built up, may be thus summarized: (1) The body is jointed; (2) the joints and their appendages are fundamentally similar or homologous; (3) the heart lies dorsally, the nervous system ventrally, whilst the digestive system occupies the median position; (4) the append-

ages are in pairs. Now, if we examine the body of any insect, we shall find it to essentially resemble that of the lobster in the general arrangement of its parts.

The body of a spider or a scorpion exhibits a similar disposition of organs to that of the lobster, and shows a fundamentally similar structure beneath variations in appearance and form; and a centipede's body would be found to be also constructed on the lobster-type. The barnacles, water-fleas, crabs, and a whole host of animals more or less nearly allied to the lobster, and belonging to the lobster's class (that of the *Crustacea*), exhibit a near relationship with the typical animal; whilst worms generally (leeches, earth-worms, &c.) would present a fundamental similarity in their characters to those described as existing in the lobster. We thus discover uniformity of type beneath variations in form and appearance, and it is exactly this uniformity or broad structural likeness between apparently different animals which enables us to group them together to form 'sub-kingdoms' or 'types.' A sub-kingdom or type of animals may therefore be defined as consisting of a *number of animals whose bodies are constructed on the same fundamental plan.* Lobsters, crabs, barnacles, &c., insects, spiders, scorpions, and centipedes thus form the 'sub-kingdom' Arthropoda, on account of their agreement in fundamental structure, and in the essential characters just described as being typically exhibited by the lobster. The animal world is thus divided into five or six sub-kingdoms. Between some of these groups recent research—altogether unfavorable to the construction of defined sub-kingdoms or types—has demonstrated connecting links to exist. For a newer and more approved classification, see ZOOLOGY; but one long recognized was as follows:

I. PROTOZOA—Ex.: Sponges, infusoria, amœbæ, and other animalcular forms.
II. CŒLENTERATA—Ex.: Sea-anemones, corals, zoophytes, jelly-fishes, &c.
III. ECHINOZOA—Ex.: Sea-urchins, star-fishes, crinoids, sea-cucumbers, tape-worms, flukes, &c.
IV. ANNULOSA—Ex.: Worms, insects, centipedes, spiders, crustacea.
V. MOLLUSCA—Ex.: Sea-mats, sea-squirts, lamp-shells, shell-fish, cuttle-fishes.
VI. VERTEBRATA—Ex.: Fishes, amphibia, reptiles, birds, mammals.

SUBLAPSA'RIAN, (Lat. *sub-lapsum*, after the Fall), the name given to one section of the school of divines, who maintain the doctrine of absolute decrees of Election and Reprobation. It is possible to conceive God making such a decree in two different ways, either on the hypothesis of His foresight of the fall of Adam, and thus of original sin, or independently of such foresight on his part, and without any reference to such foresight, and entirely out of His own free will and determination. The Sublapsarian system supposes the former; and thus refers the eternal election or reprobation of men by God to His foreseeing that all men would fall in Adam, and thus would deserve eternal reprobation. Out of the entire mass of mankind thus fallen, He freely pre-elects some to life, and equally freely pre-dooms others to death. This distinction is not confined to the Calvinistic schools; it is also found among the Roman Catholics. See SUPRALAPSARIAN.

SUB-LIEUTE'NANT is the junior combatant commissioned officer in the royal navy. When a midshipman has served six years, and can pass in seamanship and certain other subjects, he becomes a sub-lieutenant, and is eligible for promotion to lieutenant, on opportunity occurring. The pay of a sub-lieutenant is £91, 5*s.* a year, and the half-pay, £45, 12*s.* 6*d.* An officer usually serves but a short time in this rank; and, if not promoted earlier, he must retire at 40 years of age. Until within a few years, the sub-lieutenant was called a Mate (q. v.). The establishment is in process of reduction to 250 as a fixed number. In the army, cornets and ensigns are now sub-lieutenants.

SUBLIMA'TION is a chemical process similar to distillation, but differing from it in the nature of the substances to which it is applied. While in distillation, *liquids* are converted by the agency of heat into vapor, which is condensed in the liquid form usually by the cooling action of water; in sublimation, *solid* bodies are reduced by heat to the state of vapor, which reassumes the solid form on cooling. Sublimation is usually conducted in a single vessel of glass or iron, the product being deposited in the upper part of it in a solid state, while the impure residue remains at the bottom; but in the case of sulphur, the vapor is condensed on the walls of a large chamber. Iodine affords a good example of sublimation. On gently heating the lower part of a Florence flask containing a little of this substance, a purple vapor rises, which almost immediately condenses in small brilliant dark purple crystals in the upper parts of the flask, while any impurity that may be present remains at the bottom. Amongst the substances obtained by this process, and employed in the Pharmacopœia, are arsenious acids, benzoic acid, corrosive sublimate, and sublimed sulphur.

SUBLI'ME. Objects indicating great power, vast Expanse, or lofty Elevation, excite in the beholder a feeling of pleasurable elation; and the name 'sublime' is applied both to the objects and to the feeling.

The precise quality in things that arouses this mode of pleasurable excitement, has been variously assigned. According to Burke, *terror* is, in all cases whatsoever, either more openly or more latently the ruling principle, or, at all events, one of the chief sources of Sublimity: Blair suggested that *mighty power or force* is the cause; Payne Knight ascribed it to *mental energy;* Kaimes considers it due to *height or elevation;* Dugald Stewart, in an elaborate essay, affirms that *elevation* is the leading characteristic, and that expanse and power are sublime by suggesting or implying great height; Sir W. Hamilton says that Sublimity requires *magnitude* as its condition, and exists in three forms—Space, Time, and Power.

The feeling itself has also been described variously. If this could be fixed, we should have a key to the objective quality. Longinus characterized it, in reference to literary composition, as 'filling the reader with a glorying, and sense of inward greatness.' Some would call it a 'sense of security' in circumstances of terror or danger. Hamilton describes it as 'a mingled feeling of pleasure and pain—pleasure in the consciousness of the strong energy, pain in the consciousness that this energy is vain.' The connection with the sentiment of Power is generally admitted; but as the comparison of the object with self suggests our own littleness at the same time, there may be a doubt as to whether the emotion is due to the Power, to the Littleness, or to the combination of both.

Referring to the generic sentiment of Power, which is evidently at the foundation, we find that the feeling of superior might in ourselves is cheering, elating, stimulating; and that the sense of littleness or inferiority is a depressing and enfeebling state of mind, a state of pure pain, redeemable in certain circumstances by other feelings, as when our inferiority is only in the comparison with an object of love or veneration; or when it is the condition of some compensating superiority—'the courtier stoops to rise.' The presumption, therefore, is that the elation of the Sublime is connected with the notion of Power. It may be felt although the power is not actually possessed, but imagined, borrowed, or conceived, through a sort of sympathy with the *appearances* of great power or might. If this account of the Feeling be correct, Power must be a principal quality in its Objects; and if with this we combine voluminous sensation (and the corresponding ideas, vastness of expanse and greatness of time), we shall probably be able to explain the Sublime in all its forms.

SUBMARI'NE FORESTS occur at several places around the shores of Britain and Ireland. They consist of beds of impure peat, containing the stools of trees which occupy the sites on which they grew; but by change of level, the ancient forest surfaces are now covered by the tide even at low water. No kind of tree has been found in these forests which does not exist at the present day in the country, and the underwood and herbaceous plants, so far as determined, agree specifically with those found now in similar localities. Submarine forests belong to the Recent or Quaternary period, and occur above the Boulder Clay.

SUBMARINE NAVIGATION. When the Diving-bell (q. v.) had shown that air for respiration can be supplied to persons placed in adequately arranged vessels under water, ingenious men began to speculate on the possibility of navigating closed ships or boats in similarly exceptional circumstances. Cornelius Drebell made a vessel to be rowed under water in the time of James I. In 1774, an inventor named Day lost his life during an experimental descent in Plymouth Sound, in a vessel of about 50 tons burden. Mr. Bushnell, of Connecticut, in 1775, and Robert Fulton, about 1796, contrived submarine vessels, intended to be used in warfare. The vessel patented in 1859 by Mr. Delaney of Chicago, was egg-shaped in transverse section, and diminished nearly to a point at each end. It had two iron tanks in the interior; one had air forced into it by an air pump; the second contained water. The engineer of the boat, by pumping water into or out of the second tank, through the action of the air in the first, could raise or lower the boat to different depths in the water.

SUBO'RDINARY, or SUBO'RDINATE ORDINARY, in Heraldry, a name given to a certain class of charges mostly formed of straight or curved lines. Heralds vary a little in their enumeration, but the following are generally held to come within this category: the Bordure, the Orle, the Tressure, the Flanche, the Pile, the Pall, the Quarter, the Canton, the Gyron, the Fret, the Inescutcheon, the Lozenge, the Fusil, and the Mascle. See these heads; also ORDINARIES.

SUBORNA'TION OF PERJURY is the offence of procuring another to take such a false oath as constitutes Perjury (q. v.) in that other. It is a misdemeanor, punishable anciently by death; afterwards banishment, or cutting out of the tongue; then forfeiture of goods; and latterly, as at present, by fine and imprisonment.

SUBPŒ'NA, in English Law practice, means the writ or process by which the attendance of a witness in a court of justice is compelled. It is a writ in the Queen's name, commanding him to lay aside his business and all excuses, and attend at the time and place indicated, under a penalty of £100. If the witness is required to produce a document, the writ is called a *subpœna duces tecum*. If the witness do not attend, and has not a good legal excuse, such as dangerous illness, he may be sued in an action of damages, or committed to prison.

SUB RO'SA, 'under the rose'—i. e., between ourselves, or in secrecy. It was customary among the ancient Germans, on occasions of festivity, to suspend a rose from the ceiling above the table, as a symbol that whatever was said during the feast by those present would be afterwards forgotten, or at least be kept as a secret among themselves.

SU'BSIDIES, a term in Politics, used in two different senses: 1. It is applied in English political history to taxes levied not immediately on property, but on persons, in respect of their reputed estates in lands or goods; or customs imposed on any of the staple commodities in addition to the *costuma magna et antiqua*. Thus, 30,000 sacks of wool were granted to Edward III. in 1340, in aid of the war with France. Subsidies were granted on various occasions to James I. and Charles II. 2. The same word is used to denote money paid by one state to another, in order to procure a limited succor of auxiliary troops, ships of war, or provisions. In the time of the war with the revolutionists of France and Napoleon I., Great Britain furnished subsidies to foreign powers to a large extent, in order to engage them to resist the progress of the French. In questions regarding subsidies, it is held that the state furnishing the succor does not thereby become the enemy of the opposite belligerent: it may remain neutral in all respects, except as regards the auxiliary forces supplied. Such, for example, was long the attitude maintained by the Confederate Cantons of Switzerland: while granting troops to the various European powers, they were in the habit, at the same time, of preserving a rigorous neutrality. The service of Swiss regiments abroad is no longer sanctioned. The federal constitution of Switzerland, of 12th September 1848, prohibited the conclusion of military capitulations; and on 30th July 1859, a proclamation was issued by the Federal Council, forbidding any Swiss subjects from taking service under a foreign power, without the authorization of the council.

SUBSTANCE, a word connected with certain discussions in Logic and Metaphysics. Substance is correlative with Quality or Attribute. Every substance must have attributes, and every attribute must be the attribute of some substance. The substance gold has the attributes weight, color, &c. But as every power or property of a thing, every way that the thing affects us, may be called an attribute or quality, if all the attributes are counted off, there is nothing left; and the question then arises: What is the *substance?* To avoid this seeming inconsistency, it was assumed that everything whatsoever possesses, besides its attributes, an unknown substratum that they rest upon, or inhere in—a mystical and inscrutable bond, that holds the attributes together, without being itself an attribute. This gratuitous assumption of what is, after all, a nonentity, was repudiated by Locke and others, who found a meaning for substance without departing from the knowable. Every object has some *essential* or *fundamental* quality, which being present, it preserves its identity; and which being removed, it is no longer the same object, but another. Thus, the substance of Body or Matter is not the remnant after all the qualities are subtracted; it is the two fundamental and inerasable qualities, Extension and Resistance. Size, shape, color, heat, odor, &c., may all be varied; but so long as Extension and Resistance, in any degree, are found, we have a piece of matter. On the same view, the substance of Mind is whatever we regard as its fundamental essence, or distinguishing marks. We may adopt Feeling, or Volition, or Intellect, or require a share of all three, according to our mode of defining the mind. It would, then, be a mere confusion of language to talk of Feeling, Volition, and Intellect as *inhering* in mind; they *are* mind, and there is nothing besides.

Notwithstanding the obviousness of this explanation, the employment of the words Substance and Attribute has led to such an inveterate demand for something that shall underlie all attributes—a substance of body and a substance of mind—distinct from anything meant by the names, that many philosophers have considered it necessary to preserve the phantom as a thing of belief, if not of knowledge. The doctrine of an unknowable substance in the abstract very early allied itself with the popular theory of the Perception of a material world (see PERCEPTION), and the same arguments are good, for or against both. Other names for expressing the same contrast are *noumenon* and *phenomenon*. The Phenomenon is what shows itself to our senses, or is conceived by our intelligence—the qualities of extension and resistance in body; and of feeling, &c., in mind. The Noumenon is something apart and beyond, something inconceivable and unknowable, but which, say some, we are instinctively led to believe in. Thus, in the great question above alluded to—the belief of an independent material world—the phenomenal manifestations are inextricably involved with our mental powers of conceiving, and would vary, if these were to vary; consequently, they cannot be the absolute, independent, self-existent reality; which drives one school of philosophy upon the expedient of believing in such a reality, although it must be for ever incomprehensible to us.

SU'BSTITUTE, MILITARY. In nations where conscription is resorted to for the supply of soldiers for the army, the lot often falls on those unwilling to serve in person. In such a case, the state sometimes agrees to accept the services of a substitute who is of equally good physique. Unless the levy be very extensive, or the term of military service very long, substitutes are readily found among military men who have already served their prescribed period. Of course, the substitute must be paid for the risk he runs. His price depends, like all other saleable articles, on the demand and supply. Happily, in Great Britain, few of those now living have ever known when substitutes were necessary. It is, however, to be remembered that the act for a militia ballot hangs continually over us, and is only suspended by a special act of parliament from year to year.

SUBSTITU'TION is one of the three principal methods employed in examining the chemical composition of organic bodies, and in tracing their relation to other compounds; the two other methods being those of *oxidation* and of *reduction*. Although the term is restricted to organic chemistry, the ordinary method of preparing insoluble inorganic compounds by double decomposition is in reality a case of substitution of one base or one acid for another. If, for instance, solutions of nitrate of lime and sulphate of soda are mixed together, the resulting compounds are sulphate of lime and nitrate of soda, in which the lime is substituted for the soda, and the soda for the lime. In some cases, an element may be replaced (or, more correctly, displaced) by a compound group; thus, cyanogen, C_2N, may take the place of oxygen, as, for example, in the reaction that ensues between hydrocyanic acid and red oxide of mercury, when cyanide of mercury and water are formed, as shown in the equation: $H(C_2N) + HgO = Hg(C_2N) + HO$.

Similarly, the groups NO_4, SO_2, and NH_2 may often be substituted for hydrogen. In various organic bodies, one or more atoms of hydrogen may be displaced by one or more atoms of chlorine, a fact which was originally observed by Gay-Lussac in noticing the action of chlorine on wax. The new product thus formed is almost always analogous in its nature to the compound from which it is produced; thus, according as the substance acted on by the chlorine is an acid or a base, the resulting product is an acid or a base, and the number of atoms is always the same in the original substance and the product. The following examples will elucidate the above remarks: If acetic acid, $C_4H_4O_4$, be exposed to the action of chlorine, we obtain, according to the duration and modifications of the action, the two compounds, monochloracetic acid, $C_4H_3ClO_4$, and trichloracetic acid, $C_4HCl_3O_4$, in the former of which, one atom, and in the latter, three atoms of hydrogen, are displaced by a corresponding number of atoms of chlorine. Hydrochloric ether, C_4H_5Cl, may be made to yield the following succession of compounds, in which a gradually increasing amount of the hydrogen is displaced by chlorine, until, in the final result, the hydrogen has altogether disappeared. The consecutive compounds thus resulting from hydrochloric ether, C_4H_5Cl, are (1) chlorinated ether, $C_4(H_4Cl)Cl$; (2) dichlorinated ether, $C_4(H_3Cl_2)Cl$; (3) trichlorinated ether, $C_4(H_2Cl_3)Cl$; (4) tetrachlorinated ether, $C_4(HCl_4)Cl$; and (5) sesquichloride of carbon, $C_4(Cl_5)Cl$. 'The chlorine,' says Professor Miller, 'appears to have taken the place of hydrogen in the group without disturbing the relative position of the other elements which enter into its formation; just as a brick in an edifice may be conceived to admit of being removed, whilst its place is supplied by a block of wood or of stone, without altering the form or symmetry of the building.' Substitutions of bromine and iodine for hydrogen may be effected in the same way as has been shown to occur in the case of chlorine.

The study of the artificial formation of organic bases has led to the discovery of many remarkable instances of substitution products. If, for example, bromide of ethyl, C_4H_5Br, is heated in a sealed tube with a solution of ammonia in alcohol, hydrobromate of ethylia (or ethylamine) is formed, and on distilling this vapor with hydrate of potash, one of the products is a new base, ethylia, C_4H_7N, which may be regarded as ammonia, NH_3, in which one atom of hydrogen has been displaced by one atom of ethyl, C_4H_5.

By a similar proceeding, we may successively displace the second and the third atoms of the hydrogen in the ammonia; and we thus obtain two more complex bases, diethylia, $C_8H_{11}N$, and triethylia, $C_{12}H_{15}N$.

SUBTRA'CTION, one of the four fundamental processes of Arithmetic, is the diminution of a quantity by the removal of a certain portion of it. It is consequently the reverse of *Addition*, and determines how much of any quantity remains after a certain quantity has been taken from it. In cases where the digits of the number to be substracted are greater than the corresponding ones of the number to be diminished, two methods of operation may be adopted.

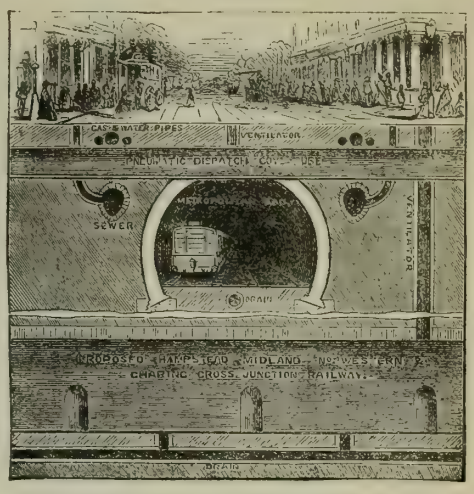
(1)	(2)	(3)
7324	7 (13) (12) 4	6 (12) (12) 4
1842	(2) (9) 4 2	1 8 4 2
5482	5 4 8 2	5 4 8 2

For example, in substracting 1842 from 7324, the numbers are written as in form (1). The method of operation usually followed is to make an addition mentally to the upper figure when necessary, and then compensate for this by an equivalent addition to the next under figure, as represented in form (2). Thus, 10 'tens' are added to 2 'tens,' to enable 4 'tens' to be subtracted, and this addition is compensated for by an equal increase of the under line by 1 'hundred,' through the change of 8 'hundreds' into 9 'hundreds.' The more simple and directly intelligible plan, shown in form (3), is to borrow a unit of the next higher degree in the upper line, care being taken to remember, in the partial subtraction immediately succeeding, that the upper digit must be considered as less by unity than it appears.

SUBWAYS. The system of engineering *beneath* the public streets has not by any means yet reached its full development. Subways for foot-passengers are occasionally constructed in connection with railway termini: one such connects the Bishopsgate Street station of the Metropolitan Railway with the Liverpool Street station of the Great Eastern; another connects two Victoria stations at Pimlico, belonging to different lines and companies. The *Tower Subway* is a remarkable instance of a passage under the Thames for foot-passengers. The Metropolitan or Underground Railway, opened in 1863, was the first example of its kind; the passengers going down stairs from the side-pavements to stations underneath the carriage-way. The pneumatic propulsion of mail-bags (see PNEUMATIC DISPATCH) has given rise to projects for a similar mode of propelling railway trains beneath streets and roads. One such, the Waterloo and Whitehall Railway, was commenced about 1865, to pass under the Thames; want of funds led to its abandonment after shafts had been sunk. The term *subways* is usually applied, not to such tunneled passages for traveling, but to roomy archways that will contain sewer-pipes, water-pipes, and gas-pipes. It has been long considered a defective system that whenever such pipes need repair, the surface of the street has to be broken up to get at them, thereby causing great expense and great interruption to traffic. When the Metropolitan Board of Works commenced their series of improvements, they resolved on the trial of subways for this useful purpose. They began with a new street, extending from Covent Garden Market to St. Martin's Lane, opened in 1861. Underneath the carriage-way of this street, there is a subway, a central arched passage or tunnel 12 feet wide by 6½ feet high; with arched side-openings for house service-pipes, connected with the cellarage of the several dwellings.

In this subway are water-pipes, gas-pipes, and electro-telegraphic wires, all easy of access by side entrances to the subway, of sufficient size to admit workmen, pipes, &c. In this instance, the main sewer is not in the subway itself, but underneath it, provided with man-holes, gullies, ventilating shafts, &c. A second example is afforded by Southwark Street, lately formed from Blackfriars Road to the southern foot of London Bridge. Underneath this street extends a subway, excellently planned for the purposes above mentioned. Two street lamp-posts, of unusually elegant design, one at each end of the street, act as ventilating shafts for the subway; and there are other ventilators along the route, besides side entrances for workmen. A curious proof has been furnished, however, of the anomalies which so frequently mar our public works. In 1865, a gas company broke up the roadway, and broke through the well-built crown of the arch of the subway, to get at their gas-pipes for purposes of repair or adjustment. It was found, on investigation, that no one had power to prevent them. The act empowered the Metropolitan Board of Works to make a subway for the use of gas companies, water companies, &c.; the gas company, on the other hand, were empowered by *their* act to break up the public roadways to get at their pipes; the Board could not compel the company to adopt the new plan, because the powers were only permissive, not obligatory. The water companies and gas companies fear incurring additional expense; and there is known to be a difference of opinion among engineers concerning the danger from leakage and explosion when the two sets of pipes are enclosed in the same archway.

The subway system, after overcoming these and other difficulties, has made a great advance within a recent period. Queen Victoria Street, and several other new streets, have been provided with subways similar to that under Southwark Street. The Victoria or Northern Thames Embankment presents some fine examples of subway engineering. Between the masonry of the river-wall and the former line of high-water, there are no less than



Singular Project in Subway Engineering.
(From *Illustrated London News*.)

three tunnels or arched passages under the surface of the ground parallel to the course of the river. One is the Metropolitan District Railway; another is the Low-level Sewer of the Great Main Drainage System; while a third is a subway to contain gas and water pipes, telegraph wires, &c. The most extraordinary plan, perhaps, ever seriously proposed in subway engineering is connected with the spot where Tottenham Court Road, Euston Road, and Hampstead Road join. The Metropolitan Railway is here flanked on either side by sewers; above it, but below the level of the street, are several gas and water pipes, drains, and ventilating shafts; while crossing immediately over the Metropolitan Railway, at right angles, is the tube of the (still abortive, 1880) Pneumatic Dispatch (q. v.). Beneath all this is shown in the woodcut the section of another tunnel, intended to join the Midland and North-western Railways with the South-eastern. Civil engineers and contractors are ready to grapple with the difficulties of this extraordinary work whenever financial circumstances are favorable.

SUCCE'SSION is a legal term used in Scotland, but not used technically in England, where the same subject is spoken of under the name of Next of Kin (q. v.), and Descent; see also INTESTACY, STATUTES OF DISTRIBUTIONS, EXECUTORS, ADMINISTRATOR. In Scotland, the term is used to denote the taking of property by one party in place of another. Where the devolution takes place in consequence of a conveyance from the proprietor, the acquirer is termed a singular successor, as the conveyance is the single title under which he acquires. Where, however, the person dies intestate, his heir succeeds to the whole of the heritage, and is called the universal successor. Where no will or disposition by the owner is executed, the law makes a disposition for him, and distributes the property according to certain rules of relationship by blood. 1. In the case of heritable succession, Primogeniture (q. v.) is the rule, the eldest son and his issue taking the property; and after that stock is exhausted, the next eldest son; and so on. When males fail, then the succession opens to the daughters, who take not in order of seniority, but all together, and are called Heirs-portioners (q. v.). When descendants fail, then the succession goes to collaterals; thus, brothers and sisters succeed first—the brothers according to a certain priority, and, failing them, the sisters all together as heirs-portioners. When the descendants and collaterals are exhausted, the succession then goes to ascendants (the mother, however, being entirely excluded), the father first, and then uncles and aunts, &c. In heritable succession, the right of representation exists, i. e., when an heir is dead, his children represent him, and take that share which, if alive, he would have taken. Brothers and sisters consanguinean, i. e., by the same father, but not by the same mother, succeed after brothers and sisters german (i. e., by the same father and mother), before the remoter line of the full blood.

The English law of descent or succession differs considerably from the above. See INTESTACY, and Paterson's *Comp. of Eng-*

lish and Scotch Law (2d ed.), s. 751, *et seq.*—2. As to succession in movables, or to the personal property of the intestate, see KIN, NEXT OF. There are taxes called succession duties, which are payable to the revenue on all property, real and personal, acquired by succession. The duty payable on lineal issue or lineal ancestors is 1 per cent.; by brothers and sisters and their descendants, 3 per cent.; and so on, the duty increasing as the relationship is more distant. The husband or wife of the proprietor is exempted from the duty.

SUCCESSION ACTS. From a comparatively early period in English history, parliament occasionally exercised the power of limiting or modifying the hereditary succession to the throne. The first instance of such interference occurred in the reign of Henry IV., who possessed himself of the crown, to the prejudice of the descendants of Lionel, Duke of Clarence, second son of Edward III. Act 7 Henry IV. c. 2 confirmed the title of that monarch, and declared Prince Henry heir-apparent of England and France, with remainders to Henry IV.'s other children. Parliamentary interposition was subsequently exercised in the case of Henry VII. and in regard to the immediate successors of Henry VIII. The respective rights of James I., Charles I., and Charles II. were acknowledged by parliament; and in the case of Charles II. the crown was held to have devolved on him immediately on the death of his father.

The revolution of 1688, was founded on the so-called abdication of the government by James II. See ABDICATION. The Convention bestowed the crown on William and Mary for life, and regulated the claims of Anne. On the impending extinction of the Protestant descendants of Charles I., the crown was settled by 12 and 13 Will. III. c. 2, in the event of the death of William and Anne without issue, on the next Protestant line, according to the regular order of succession—viz., the descendants of the Electress Sophia of Hanover, granddaughter of James I.; and it was at the same time enacted, that whoever should hereafter come to possession of the crown, should join the communion of the Church of England as by law established. This is the latest parliamentary limitation of the crown; but the right of parliament to limit the succession has been secured by 6 Anne, c. 7, which attaches the penalties of treason to the 'maliciously, advisedly, and directly' maintaining, by writing or printing, that the king and parliament cannot make laws to bind the succession to the crown, and the penalties of a *Præmunire* (q. v.) to maintaining the same doctrine by preaching, teaching, or advised speaking.

SUCCESSION WARS were of frequent occurrence in Europe, between the middle of the 17th and the middle of the 18th centuries on the occasion of the failure of a sovereign house. The most important of these wars was that of the Orleans succession to the Palatinate (1686—1697), closed by the peace of Ryswick; of the Spanish succession (1700—1713); of the Polish succession (1733—1738), closed by the peace of Vienna; of the Austrian succession (1740—1748); and of the Bavarian succession (1777—1779), called, in ridicule, the Potato-war. Of these, the second and fourth were by far the most important, and a brief notice of their course and conclusion is subjoined.

SUCCESSION, WAR OF THE SPANISH, arose on the death, without issue or collateral male heirs, of Charles II., king of Spain, 3d November 1700. The nearest natural heir to the throne was of the royal line of France, Charles's elder sister having married Louis XIV.; but to prevent any possible union of the two crowns, a solemn renunciation had been exacted both from Louis and his queen, for themselves *and their heirs;* and this renunciation having been ratified by the king and Cortes of Spain, was made as binding as legal forms could make it. Failing the Bourbons, the next heirs were the descendants of the younger sister of Charles, who had married the Emperor Leopold I., and from whom no renunciation had been exacted; and the only issue being a daughter, who had married the Elector of Bavaria, and borne a son, Joseph-Ferdinand, this prince was during his lifetime regarded both by Charles II. and the Spanish people as the rightful heir. But dying in 1699 without issue, the question of succession was reopened, Louis XIV., failing his wife's rights, claiming for himself, as the son of Philip IV.'s elder sister (being, however, again legally barred here by another solemn renunciation); while the Emperor Leopold, maintaining with justice that the Bourbons were by these two renunciations wholly deprived of all their rights of heirship, claimed the throne as the son of Philip IV.'s younger sister. The other powers of Europe, especially Britain, Holland, and Germany, warmly interested themselves in the matter, as a question of policy, and with good reason; for not only was the crown of Spain a valuable prize in itself, carrying with it the sovereignty of the Netherlands, the Milanese, Naples and Sicily, and immense possessions in America, but its union with France or Austria would of a certainty endanger the independence of every other sovereignty in Europe.

Both claimants bade for the support of the maritime powers, the one by renouncing his claims in favor of his second grandson, Philip of Anjou, the other by putting forward his second son, Charles, as his substitute, while both solemnly promised never to undertake the union of the two crowns. The Austrian party at first preponderated in Spain; but Louis, by able and unscrupulous policy, succeeded in undermining the Austrian influence at Madrid, and in having Philip declared the heir (October 2, 1700). On the death of King Charles, a month after, Philip appeared in Spain, and was well received by all classes, and at once recognized as monarch, an example gradually and unwillingly followed by all the European powers excepting the emperor; for at that time the dread of Louis XIV.'s power pressed like an incubus on the nations of Europe. However, the French monarch, by various ill-advised acts, chiefly by his support of the elder Pretender (the son of James II.), whom he recognized as sovereign of Britain, and by occupation of the Netherlands and menacing treatment of Holland, stirred up such general resentment, that William III. was enabled to revive the *Grand Alliance*, and his successor, Anne, to join with Holland and Austria in declaring war against France and the 'Spanish usurper,' 15th May 1702.

Hostilities at once commenced; a combined British-Dutch-German army under Marlborough attacked the French in Belgium, and captured one by one their fortresses on the Maes, while the Reichs army (Germany having declared for Austria), under the Markgraf of Baden, crossed the Rhine, and took Landau. Austria herself had, however, commenced the contest in the previous year, by sending into Italy Prince Eugene (q. v) of Savoy-Carignan, at the head of a veteran army of 32,000 men, who did a good deal of hard fighting, with no adequate result. Meanwhile, the Elector of Bavaria raised an army and declared for France, and a French army under Villars marched to join him. Both were kept in check by the Markgraf for some time; but, in the summer of 1703, Villars burst through the Black Forest, and joined the elector, with the view of penetrating through Bavaria into Austria, but his obstinate ally, the elector, was determined to invade the Tyrol instead, and join Vendome in Northern Italy—a scheme which ended most disastrously; and Villars returned in disgust to France. In the Low Countries, Marlborough employed himself in gradually depriving the French of their strongholds: in Italy, the Austrians were driven from point to point, till nothing remained to them but a few districts on the Po; they were, however, relieved towards the close of the year by the defection from France of the Duke of Savoy, who joined the grand alliance 25th October 1703, an event which compelled Vendome to return to Piedmont. The first great blow was struck in the following year, when the combined Austrian-German-British army, under Marlborough, totally defeated the French and the elector at Blenheim (q. v.), driving the débris of their forces almost to the foot of the Vosges. After this, the French never obtained a permanent footing in Germany. The campaigns of Marlborough in Germany, and of Eugene in Italy, in 1705, were successful but not very important.

The year 1706 was another great epoch in this protracted contest; the British and Dutch having freed the valley of the Maes, had forced the French into South Brabant, and Marlborough having, by a stratagem, caused them to march towards Namur, suddenly attacked them at Ramillies (q. v.), and, after a brief combat, put them completely to rout with great slaughter, the elector and Vileroy, the joint commanders, narrowly escaping capture. Louis hastily reinforced his army, and recalled Vendome from Italy to take the command, a step which, however necessary, cleared the way for Eugene who completely out-generalled his opponent Marsin, and after a memorable march of 34 days, appeared before Turin, and united with the Duke of Savoy. The battle of Turin, in which the gallant Marsin was slain, was one of the most obstinate of the whole war, but its result was as decisive, and from this period the French power in Northern Italy was shattered; and the following year saw the country completely cleared of both French and Spaniards. From 1706 the war in Germany was purely defensive, and no battle worthy of notice was fought. In Italy also the contest on the whole languished, though the Austrian arms were for the most part successful, Mantua and Naples (1708) being subdued, and the pope compelled to preserve neutrality by dread of another sack of Rome. But since the commencement of 1704, another theater of war had been established by the landing of the Archduke Charles at Lisbon with 8000 British and 6000 Dutch troops, who were joined by the Portuguese (their king having acceded to the alliance against France), and invaded Spain from the west; but nothing of consequence was established till a landing had been effected by the Earl of Peterborough (q. v.), with a small body of troops in Catalonia. Then attacked both from the west and east, the Bourbon forces were beaten and driven across the Pyrenees, and it was only after the departure of Peterborough that Berwick (q. v.) made head against his antagonists. By his victory at Almanza (25th April 1707), he recovered the whole of Spain except Catalonia.

In 1710 Berwick finally left Spain; and the Carlists under Stanhope and Starhemberg again got the upper hand, repossess-

ing themselves of the east of Spain, and of Madrid (28th of September). But the arrival of Vendome speedily changed the face of affairs. Stanhope was defeated and captured (9th December) at Brihuega, and Starhemberg was forced to retreat on the following day. The war was thenceforth confined to Catalonia, and was distinguished by no noteworthy incidents. The most important part of the struggle had been meanwhile taking place in the Netherlands, where Marlborough (1707) drew up in concert with Eugene a secret plan of operations which effected a division of the Moselle army under the elector and Berwick from that of the north under Vendome; whereupon the British and Germans swiftly uniting fell upon Vendome's army at Oudenarde (q. v.) (1708), and before Berwick could come up to its aid, inflicted upon it a severe defeat. The capture of Lille, Ghent, and Bruges necessarily followed. France now began to show symptoms of exhaustion, and made overtures of peace, but these being chiefly illusory, were rejected; and the emperor having largely reinforced Eugene, the allies took the field with 110,000 men, while the French, equal in strength, were now directed by Villars, the most enterprising and fortunate of their generals; but his star, which had hitherto been constantly in the ascendant, fell before that of Marlborough at Malplaquet (q. v.) (September 1709). After some further campaigning, besieging, and negotiating, the opportune death of the emperor (April 17, 1711) rescued France from the brink of destruction; for Britain became lukewarm in support of a cause which would effect the reunion of Austria and Spain; and the Tories having come into power, private preliminaries of peace were signed between Britain and France, 8th October, 1711. Eugene, however, continued the war, aided by Holland, and captured Quesnoy; but the defeat and capture of the Earl of Albemarle and the British contingent at Denain (July 1712) so weakened his force, that he was compelled to give way; and in the following spring the Dutch joined the British as parties to the peace of Utrecht (q. v.). The Emperor Charles was also forced to conclude a treaty of peace at Baden, 7th September, 1714, which ended the struggle, leaving Philip in possession of the Spanish throne (see UTRECHT, PEACE OF); while Austria obtained the Spanish Netherlands and the Milanese.

SUCCESSION, WAR OF THE AUSTRIAN. The death of the Emperor Charles VI. (20th October 1740), by which the male line of the House of Hapsburg became extinct, was the signal for a general uprising of the powers of Europe, some to prey on the Austrian possessions, and others to aid the eldest daughter and heir of the deceased emperor. The probability of such a contingency had long been foreseen by Charles VI., for as early as 1713 he had published a *Pragmatic Sanction* (q. v.), stipulating that, in default of male heirs, the whole of his dominions should descend undivided to his eldest daughter, Maria Theresa (q. v.); and it was almost his sole aim, during his subsequent reign, to gain the consent of all parties having proximate claims to any of the Austrian domains, and of the principal powers of Europe, to this arrangement. The Elector of Bavaria, Charles-Albert, alone refused to resign his pretensions. On the death of her father, Maria Theresa intimated her accession to the various European powers, and from all of them, except France and Bavaria, received assurances of good-will and support; but notwithstanding, two months did not elapse till Frederick II. of Prussia, without a declaration of war, invaded Silesia. The Austrian treasury was at this time exhausted, and the army much disorganized; so that little or no effective resistance could be made to the Prussians; while the state of alarm into which this sudden attack had thrown the court of Vienna was increased by doubts as to the intentions of France. These doubts were soon resolved by the latter, in the spring of 1741, forming a confederacy of all the claimants to the Austrian dominions—the electors of Bavaria and Saxony, sons-in-law of the Emperor Joseph I.; Philip V. of Spain; Charles-Emmanuel of Sardinia, who claimed the Milanese; and Frederick II. of Prussia, who *now* demanded almost the whole of Silesia.

On the other hand, Britain granted Maria Theresa an annual subsidy of £300,000; the Dutch were willing to aid her when opportunity offered; and Hungary gallantly responded to her pathetic appeal by sending in thousands her motley population, Magyars, Croats, Slavs, and Tolpatches, to fight in defence of their heroic queen. Meantime the Bavarians, in conjunction with the French under Belleisle, overran the greater part of Bohemia This invasion compelled the queen to buy off her most formidable opponent, Prussia, by the surrender of Silesia and Glatz; and then, while Prince Charles of Lorraine kept the French at bay in Bohemia, Khevenhuller, the most enterprising of the Austrian generals, advanced up the valley of the Danube, captured 12,000 French in Lintz, overran Bavaria, and on the very day of the elector's coronation as the Emperor Charles VII., took Munich his capital (12th February 1742). But this great success alarmed Frederick II. for the security of his new possessions, and abruptly breaking the treaty, he poured his forces into Bohemia and Upper Austria, and gained the battle of Chotusitz (17th May). The same year witnessed increased activity on the part of Britain (the Walpole administration being now in power) and Holland on behalf of Austria; the expulsion of the French and Bavarians from Bohemia; the severance of the king of Sardinia from the coalition against Austria, produced by the bribe of some districts of the Milanese, which, however, he did not obtain till some time afterwards; the enforcement of neutrality upon Naples by the threatening attitude of a British fleet off the capital; and, on the other hand, the recovery of Bavaria by the elector.

In May 1743, Bavaria again fell into the hands of Prince Charles and Khevenhuller; Count Saxe was driven with great loss from the Palatinate; the 'Emperor' Charles-Albert and the Swedes, disgusted at their ill-success in the war, retired from the contest, so that France and Spain now remained the sole representatives of the once mighty coalition. In 1744, France and Britain, which had hitherto engaged in the conflict only as allies, declared war on each other; and the latter proceeded to destroy piecemeal the French and Spanish shipping on the high seas, and to attack their colonial possessions. For this, however, the successes of Saxe in the Netherlands were a compensation. However, the great successes of Austria on the Rhine, and the ill-concealed ambitious projects of Maria Theresa, again alarmed Frederick II. for Silesia; and he resolved on another attempt to rivet his hold on the much-coveted province before it was too late. Accordingly, he concluded at Frankfurt (May 13, 1744), a secret convention with France, the emperor, the elector-palatine, and the king of Sweden. Bursting into Bohemia with his usual celerity, Frederick II. forced the Austrians at once to return from Alsace, thus enabling the elector to recapture Bavaria; but before Prince Charles had time to reach Bohemia, a fresh levy of 44,000 men, which had been raised by the chivalrous and patriotic Hungarians, joined by 6000 Saxons, had reached the Prussians, and by cutting off their supplies, and capturing their stragglers and foraging parties, compelled them to evacuate the kingdom with considerable loss. In Italy, the Spaniards, who were now joined by the Neapolitans, were defeated repeatedly, and compelled to retreat down the peninsula; and the king of Sardinia succeeded in preventing the French from effecting a permanent lodgment in North-west Italy. In January 1745, the emperor-elector died, and his son, Maximilian-Joseph, profiting from his father's misfortunes, declined to take part in the contest, or to allow himself to be nominated emperor, and made peace with Austria.

Frederick II., displeased with the meddling and overbearing conduct of France with respect to the approaching imperial election, also sought to come to terms with Austria, by the mediation of Britain, and the peace of Dresden (25th December 1745) finally withdrew Prussia from the conflict. In Flanders, the fortunes of Austria also declined; and after the victory of Fontenoy (11th May 1745) she could not prevent Saxe from capturing the chief Belgian fortresses in succession. In Italy, also, fortune declared for the coalition; for the Spanish-Neapolitan army, now reinforced by the Genoese and Modenese—70,000 men in all—defied all opposition, overran the whole of Lombardy and much of the Sardinian territories, driving the king under the walls of his capital. Similar reverses befell the allies in Flanders during the campaign of 1746; but these were more than counterbalanced by the great successes obtained in Italy, where all the lost fortresses of Lombardy, Parma, and Guastalla, were recaptured, the coalition army totally routed in a great battle near Placentia (June 16), and Genoa overrun and occupied. Another of fortune's favors to Austria was the death of Philip V. of Spain (July 9), which, by depriving that archplotter, his queen, of the supreme power, considerably diminished the zeal of the Spanish court in the prosecution of the war. In 1747, the Dutch, who had hitherto escaped the ravages of war, were made practically acquainted with them by Saxe, who, having completely subdued the Austrian Netherlands, invaded and overran Dutch Flanders, routed the unfortunate Duke of Cumberland at Laffeldt (2d July), while his celebrated chief of engineers, Count Lowendal, after a two months' siege, took Bergen-op-Zoom, Cohorn's masterpiece, a fortress believed by the Dutch to be impregnable.

At the commencement of 1748, Britain, France, and Holland sought to bring about a peace, and agreed among themselves to certain preliminaries, which were submitted to Austria and Sardinia; but as one of them was the surrender of Parma and Placentia to Don Philip of Spain, the former refused her consent; and her two allies, disgusted at her disregard of the sacrifices they had made on her behalf, at once signed the preliminaries (30th April), and Austria sullenly followed suit on May 18. Much discussion followed, but on the 18th October 1748, the treaty of Aix-la-Chapelle (q. v.) put an end to this most disastrous war, which left the Hapsburgs in possession of their hereditary dominions, with the exception of Silesia and some of their Italian provinces. See AIX-LA-CHAPELLE.

SUCCI'NIC ACID ($C_8H_4O_6.2HO$) derives its name from its having been originally found in amber (Lat. *succinum*), and is one

of the group of dibasic acids of the oxalic acid series, whose general formula is $C_{2n}H_{2n-4}O_4.2HO$. Succinic acid occurs as a natural constituent not only in amber, but also in the resins of many of the pine tribe, in the leaves of the lettuce and wormwood; and, in the animal kingdom, it has been detected in the fluids of hydatid cysts and hydrocele, in the parenchymatous juices of the thymus gland of the calf, and of the pancreas and thyroid gland of the ox.

One of the most important points in connection with succinic acid is its convertibility into tartaric acid, while tartaric acid may in its turn be reconverted into succinic acid.

SU'CCULENT PLANTS are those plants remarkable for the thick and fleshy or succulent character of their stems and leaves. This character prevails in the natural orders *Cactaceæ*, *Mesembryaceæ*, and *Crassulaceæ*, but frequently appears also in genera of other natural orders, as in aloes and some other *Liliaceæ*. It consists in a peculiar development of cellular tissue. Succulent plants are remarkable for the small number of Stomata (q. v.) on the green surface. They are generally found in dry climates, often as almost the only vegetation of the most arid places; although some of them occur in situations where moisture is often abundant; their peculiar structure, however, being apparently intended to adapt them for enduring occasional droughts. Thus, there are not only succulent plants in the Sahara and other deserts, but in Britain, and some of them form a conspicuous feature of the flora of the mountains of Europe—as species of *Sedum*, *Rhodiola rosea*, &c.—where they are found in situations sometimes abounding in moisture, but occasionally parched—on bare rocks, steep slopes with scanty soil, and the like. By the want of stomata and the store of moisture in their own cellular tissue, they are adapted for the endurance of long droughts. Yet they live in great part by nourishment derived from the atmosphere, rather than from the soil; a fact which may easily be proved by suspending a specimen of the Common Yellow Stonecrop (*Sedum acre*) by means of a string, when it will be found to flourish for a considerable time, and sometimes to preserve its vitality as long as those planted in the ground. In dry tropical countries, succulent plants perform in part the same office which lichens and mosses do in colder regions, in preparing the first mould for future vegetation.

SUCHET, Louis-Gabriel, Duke of Albufera, and Marshal of France, was descended from an honorable family, and born at Lyon, 2d March 1770. He volunteered as a private into the cavalry of the Lyon national guard in 1792, and subsequently became attached to the army of Italy. His rare intelligence and brilliant valor, displayed at Lodi, Rivoli, Castiglione, Arcola, and in numerous battles of less note, laid the foundation of his military reputation, and in 1798 he became general of brigade. The able manner in which he, with a force not one-sixth of that of the Austrians, kept Melas in check (1800), preventing the invasion of the south of France, and ultimately capturing 15,000 prisoners, is one of the most brilliant military feats on record. S. also took a distinguished part in the campaigns against Austria (1805) and Prussia (1806), and was subsequently (April 1809) appointed generalissimo of the French army in Aragon, where, for the first time, he appears as holding an independent command. The part of Spain committed to his charge, though inhabited by a people distinguished by their obstinacy and patriotism above all others in Spain, was completely subdued, more, however, through his just and able administration, and the strict discipline which he maintained, than by military talent. The latter quality he was only called upon to exercise against Spanish troops, which he had little difficulty in annihilating. In the first few days of 1812, he conquered Valencia, and obtained in addition to his dignity of Marshal (8th July 1811) that of Duke of Albufera, and the grant of a magnificent domain. The five campaigns which he made in the Peninsula are considered perfect models of the kind of service he had to perform—viz., to rivet the chains of a foreign domination on the necks of a patriotic and high-spirited people. The details have been well given by him in his *Mémoires sur ses Campagnes en Espagne* (Paris, 1829, 1834, 2 vols. with atlas). But the misfortunes of the other French armies in Spain compelled S. gradually to relinquish all his conquests. He was created a peer by Louis XVIII., but took service under his old master after his return from Elba, and was charged with the defence of the south-west frontier.

Deprived of his peerage at the second restoration, he did not return to court till 1819, when it was restored, and he soon rose high in royal favor. He died at the château of Saint-Joseph, near Marseille, 3d January 1826. Napoleon's high opinion of S.'s military talents is recorded by O'Meara and Las Casas, and according to his classification, S. ranked second, Massena being first. —His son and successor in the dukedom of Albufera was a member of the Corps Legislatif, and a supporter of the Napoleonist policy under the Emperor Napoleon III.

SUCKING FISH, a name sometimes given to the Remora (q. v.), and to fishes of the family Discoboli (q. v.), which have a sucker formed by the union of the ventral fins, and are capable of attaching themselves by it to stones or other substances. The best known of the British species, and the only one which is of any value as an article of food, is the Lumpsucker (q. v.). Several other species occur on the British coasts, to which the name SUCKER is generally given, as the CORNISH SUCKER (*Lepidogaster Cornubiensis*), and the UNCTUOUS SUCKER or Sea-snail (*Liparis vulgaris*). They are small fishes, destitute of scales.

SUCKLING, Sir John, one of the brilliant cavalier poets of the court of Charles I., was born at Whitton, in Middlesex, and baptized February 10, 1608—1609. His father, also a knight, held office as a secretary of state, and comptroller of the household, but died in 1627, when the poet was in his 18th year. The latter inherited large estates; and having completed his education at Trinity College, Cambridge, he went abroad, and served for some time in Germany under Gustavus Adolphus. He returned about 1632, and was soon distinguished for his wit, gallantry, and lavish expenditure. To aid the king against the Scots, he raised a troop of 100 horsemen, whom he clad in a rich and gaudy uniform of white and red, with plumes of red feathers in their caps. This loyal corps is said to have cost the poet about £12.000. They rode north; but no sooner had the cavalry come within sight of the Scots army at Dunse, than they turned and fled without aiming a blow! This disgrace gave occasion to numerous lampoons, and to a clever though coarse ballad against S.'s gay horsemen; but in reality they behaved no worse than the rest of the English army. Their loyal commander next joined in a scheme to rescue Strafford from the Tower, and this being discovered, he fled for safety to the continent. He died, while yet in the flower of his life and genius, in 1641 or 1642. Various accounts are given of the circumstances attending his death, but the most painful of these, viz., that he poisoned himself in Paris, is confirmed by family tradition. See the Memoir by the Rev. Alfred Suckling (1836), prefixed to a volume of *Selections from the Works of Sir John Suckling*. He had probably run through his fortune, and dreaded want, as well as despaired of the success of the royal arms.

The works of S. consist of four plays, now utterly forgotten, a prose treatise entitled *An Account of Religion by Reason;* a collection of *Letters*, written in a stiff, artificial style; and a series of miscellaneous poems, beginning with *A Session of the Poets*, published in 1637, which is original in style, and happily descriptive of the author's contemporaries. But the fame of S. rests on his songs and ballads, which are inimitable for their ease, gaiety, and pure poetic diction. His ballad of *The Wedding* is still unsurpassed, and one simile in his description of the bride—

> Her feet beneath her petticoat,
> Like little mice, stole in and out,
> As if they feared the light—

has had the honor of being copied by Herrick and Congreve.

SUCRE. See CHUQUISACA.

SUCTO'RIA, an order of insects, containing only those forming the Linnæan genus *Pulex*. See FLEA.

SUDA'MINA, or MILIARY ERUPTION, is one of the diseases of the skin belonging to the class *vesiculæ*, or *vesicles*. The former name is derived from the fact, that the disorder is always accompanied with profuse sweating; while the latter has reference to the size of the vesicles, which do not exceed those of a millet-seed. The vesicles are most abundant on the neck and trunk, and are sometimes, but not always, attended with itching. They almost always occur in association with febrile disorders, which, however, do not seem in any way modified by these occurrences. The only known condition that favors their production is copious and prolonged sweating. They sometimes appear in health during the summer heat, when strong exercise has induced copious sweating. Pathologically, this disease is of so little importance that it is unnecessary to notice its treatment. It is, however, sometimes useful as a sign in diagnosis, especially in typhus and typhoid fevers.

SUDA'N, or SOUDAN, a vast tract of Central Africa, bounded on the N. by the Sahara; on the W. by Senegambia; on the S. by Upper Guinea, and on the E. by the Nile provinces of Egypt. (The term is sometimes used in a wider sense for the belt south of the Sahara, extending from the Atlantic to the foot of the Abyssinian highlands; including Senegambia as Western S., and Darfur, Sennaar, &c., as Egyptian S.). The Niger (q. v.) waters the western regions. The climate of the west and middle districts resembles that of Senegambia and Guinea; that of Eastern S. is still imperfectly known. Agriculture is pursued with considerable skill; cotton, tobacco, and indigo are abundantly grown; and wheat, rice, maize, Guinea-corn, and millet are among the ordinary crops. Gold-dust, which abounds in the rivers; iron, made from iron-stone, which prevails in all parts of the country; and ivory and feathers, are the principal exports. Of the numerous states into which the country is divided, the following are the chief: Bambara, Masina, Gando, Sókoto, Bornu, Bagirmi, Waday, and

Dar-fur (now annexed to Egypt). Area estimated at 2,250,000 sq. m.; pop. 10 to 80 millions. S. is the peculiar home of the negro race.—S. is also the name of a province of Egypt, which is a continuation eastward of the preceding. It includes Kordofan, Nubia proper, Sennaar, &c., with a pop. of about 10,000,000.

SU'DBURY, a municipal borough of Suffolk, 16 m. S. of Bury St. Edmunds, on the left bank of the Stour, across which a bridge connects the town with the suburb of Ballingdon in Essex. The silk and bunting manufactures are the most important branches of industry. There are also brick works, in which the white clay used is notable for its purity. Malting is carried on. S. was one of the first towns into which the woollen manufacture was introduced by the Flemings. Pop. (1871) 6908; (1881) 6584.

SUDDEN DEATH may be induced by natural or by violent causes, and the detection of the true cause is obviously of very great importance, since the acquittal or conviction of a suspected person may depend upon it. Sudden death may occur naturally from syncope (fainting or swooning), from asphyxia (literally pulselessness), or, more correctly, apnæa (privation of breath), or from coma (insensibility). Syncope, or sudden cessation of the heart's action, may occur, as Dr. C. J. B. Williams points out in his *Principles of Medicine*, in two ways. (1.) By the heart losing its irritability (or becoming paralyzed), so that it ceases to contract; and (2) By its being affected with tonic spasm, in which it remains rigidly contracted, losing its usual alternation of relaxation. Sudden death from asphyxia, or, more correctly, from apnæa, occurs when, from any cause, the entrance of air into the lungs is prevented. It is not so often witnessed as a result of disease as of accident. It is sometimes caused by a spasmodic closure of the chink of the glottis (see LARYNX). Sudden death from coma is liable to occur in apoplexy and injuries of the head.

In all cases of sudden death, there is a strong tendency on the part of the public to suspect poisoning. It is very hard to make them understand that persons may die a natural death suddenly as well as slowly; or conversely, that death may really take place slowly and yet be the result of poison. 'One of the means,' says Dr. Taylor, 'recommended for distinguishing narcotic poisoning from apoplexy or disease of the heart, is the difference in the rapidity with which death takes place. Thus, apoplexy or disease of the heart may prove fatal either instantly or within an hour. The only poisons likely to operate with such fatal rapidity are prussic acid or nicotina. Poisoning by opium is commonly protracted for five or six hours. This poison has never been known to destroy life instantaneously or within a few minutes. Thus, then, it may happen that death will occur with such rapidity as to render it impossible, under the circumstances, to attribute it to narcotic poison.'—*Op. cit.*, p. 145.

In its relations to medicine and medical jurisprudence, the subject of this article has been fully discussed by Herrick and Popp, *Der Plötzliche Tod aus inneren Ursachen*, 1848.

SU'DETENGEBI'RGE, the most important mountain-range of Germany, dividing Prussian Silesia and Lausitz from Bohemia and Moravia, and connecting the Carpathians with the mountains of Franconia. It does not form a continuous chain except in the middle, where it is known under the names of Riesengebirge (q. v.) and Isergebirge; the ends, both towards the north-west and south-east, broadening out into great rugged hilly plateaux, with broken chains and isolated peaks. The S. are composed chiefly of granite, gneiss, mica-schist, and porphyry, with superimposed beds of basalt and coal, and are clothed with pines to a height of between 2000 and 3000 feet. They are rich in minerals, especially in the metals, iron, lead, copper, zinc, tin, cobalt, with some silver and gold. Schneekoppe (Snow-Peak) in the Riesengebirge, about 5000 feet high, is the culminating point in the whole range.—The name S. is applied in a narrower sense to the south-east portion of the range, separating Silesia from Moravia.

S'UDRA is the name of the fourth caste of the Hindus. See CASTE.

SUE, MARIE-JOSEPH-EUGENE, a well-known French novelist, was born at Paris, 10th December 1804. His father, Jean-Joseph Sue, was one of the household physicians of Napoleon and he educated his son for his own profession. At the age of twenty the young man became an army surgeon. In this capacity he served in the French expedition to Spain, under the Duke of Angoulême in 1823. Subsequently he transferred himself to the navy; and in 1828, was present at the battle of Navarino. In 1829 his father died, leaving him a handsome fortune, on the acquisition of which he ceased to practice his profession.

After coquetting a little with art, he betook himself seriously to literature, and very soon, in the department of fiction, he achieved a considerable popularity. His earlier efforts were sea-stories, somewhat after the manner of Cooper, or romances in imitation of Scott; and though in both fields he displayed talent, his true power was scarcely as yet developed. Something of it may, however, be traced in his *Mathilde, ou les Mémoires d'une Jeune Femme* published in 1841; but it was first decisively made manifest in the famous *Mystères de Paris*, which began to appear the year after in the columns of the *Journal des Débats*. The furor of excitement occasioned by this work and its successor, *Le Juif Errant*, which appeared in the *Constitutionnel*, not only in France but elsewhere, has seldom, perhaps, been exceeded; and for both the writer received large sums of money. In 1846, his *Martin, l'Enfant Trouvé* was issued; in 1847—1848 appeared *Les Sept Péchées Capitaux*; and in 1852, he published *Les Mystères du Peuple*, his last work of any importance. Throughout Sue's later works there runs a vein of socialism; and at the revolution of 1848 he allied himself with the extremest sect of the Republicans. On 28th April 1850 he was elected deputy to the Legislative Assembly for the department of the Seine, and was assiduous in his duties as such till the *coup d'état* of December 1852, by which he was driven into exile. He retired to Savoy; and at Annecy he died 3d July 1857.

In the writings of Sue great power is displayed; but it is rather of the unhealthy kind, and depends for much of its effect on vicious sources of interest. His books are read once with a fever-heat of curiosity, and scarcely bear reperusal.

SUE'CA, a town of Spain, in Valencia, and 23 miles south of the city of that name, on the Jucar, about 4 miles from the Mediterranean. Brick and tile works are in operation, and there are several flour and rice mills. Pop. 13,500.

SU'ET is a variety of solid fatty tissue, which accumulates in considerably quantity about the kidneys, and omentum of several domestic animals, especially the ox and sheep. Beef suet is extensively used in cookery, while purified mutton suet under the name of *Sevum Præparatum* occurs in the Pharmacopœia, and is obtained by melting and straining the internal abdominal fat. It consists of a mixture of the ordinary animal fats, with a great preponderance of the most solid of them; viz., stearin, which constitutes about three-fourths of the whole. The pure suet of the Pharmacopœia is 'white, soft, smooth, almost scentless; and is fusible at 103°.' It is used as an ingredient in cerates, plasters, and ointments. Ordinary melted suet is frequently employed in the same manner as lard, to preserve potted meats or fish and similar articles from the action of the air.

SUETO'NIUS, CAIUS TRANQUILLUS, son of Suetonius Lenis, a tribune of the 13th legion under Otho, was born probably a few years after the death of Nero. He is known to us chiefly as a Roman historian and miscellaneous writer, for his merits as which he is highly praised by the Younger Pliny. He was also, it is supposed, a teacher of grammar and rhetoric, and a composer of exercises in pleading; nay, from a letter of Pliny's to him, it may be gathered that he sometimes pleaded causes in person. Pliny procured him the dignity of military tribune, which, by S.'s desire, he got transferred to another. Though childless, S. was, through the same friendly agency, presented by Trajan with the *jus trium liberorum*, which, in that reign, was only to be had by great interest. He was afterwards secretary of the Emperor Adrian, whose favor he had secured. The date of his death is unknown. All his works (among which, as we learn from Suidas, there were several on topics usually treated by grammarians) have been lost, except his *Lives of the Cæsars*, his *Lives of Eminent Grammarians*, and (in part only) his *Lives of Eminent Rhetoricians*. It is by the first of these works that he is most favorably known, replete as it is with information about the Twelve Cæsars, from C. Julius to Domitian, which is to be had nowhere else, and abounding with anecdotes which, while they too often prove the profligacy of his heroes, testify to the impartiality of their chronicler. From a period long before the renaissance to the present, these 'Lives' have always been favorite reading, and have found numerous editors, the best of whom is still Burmann (Amsterdam, 1736), and numerous translators into nearly every European language.

SUE'VI, first mentioned by Cæsar, in whose history (*De Bello Gallico*) the name is employed as the collective designation of a great number of Germanic peoples. They occupied a district of indefinite extent on the eastern side of the Rhine, and may have been the same tribes as those subsequently known as Chatti, Longobardi, &c. Cæsar states that their territory comprised 100 cantons, and was densely wooded, that they had towns (*oppida*), but no strongholds, and that every year a part of the population left their homes to seek employment in war. The S. of whom Tacitus speaks (*Germania*, 38, &c.) seem to have dwelt north and east of the S. of Cæsar, extending as far as the Elbe and the Baltic, which Tacitus calls the 'Suevic Sea.' The peoples united under the rule of Marobodnus, the Marcomannic chief, were Suevic, and hence the Marcomanni and Quadi, who figure in the reigns of Marcus Aurelius and Aurelian, are often called Suevi. After the name had fallen into disuse as a collective designation, it reappeared (second half of the 3d c., *Amm. Marc.*, &c.) as the name of a people occupying the same territory as the S. of Cæsar, who appear, however, to have been a mixed race made up of ad-

venturers from different parts of Germany, and who probably took the name of S. after possessing themselves of the country. We find them in alliance with the Burgundians, Alemanni, Alani, Vandals, &c. They are among the most notable of the barbaric peoples that broke up the Roman Empire in the north-west and west. Bursting through the passes of the Pyrenees (409 A.D.), they, along with the Vandals, overran and wasted Spain q. v.). Those who remained at home in Germany seem to have spread during the 5th c. east to the Neckar and the Rauhe Alps, and south as far as Switzerland. The medieval Swabians were their direct descendants.

SU'EZ, until recently, a small, ill-built, wretched-looking town on an angle of land near the northern extremity of the Gulf of Suez, 76 miles east of Cairo, with which it is connected by railway. The pop. was officially returned, in 1872, as 13,498. It is walled on all sides but that towards the sea, has an indifferent harbor, but a tolerably good quay. S. of late has been greatly improved. English and French houses, offices, and warehouses have been erected in every direction, and the bazaars are assuming a respectable appearance. These bazaars are provided with clarified butter from Sinai, with fowls, grain, and vegetables from the Egyptian province of Sharkijeh, and with wood, dates, and cotton. Rain falls but seldom, sometimes not once in three years. All around stretches a burning waste of sands. S. owes its modern prosperity to the establishment of what is known as the *Overland Route* (q. v.) to India, in consequence of which a large portion of the traffic between England (and other European countries) and the East passes through the place; and to the opening of the Suez Canal in 1869. For a long time previous to the establishment of the overland route, S. had been in a state of complete decay, although, at a yet earlier period—previous, in fact, to the discovery of the sea-route to India by the Cape of Good Hope—it was a flourishing emporium of the products of East and West. A salt manufactory was recently established here by the Egyptian government, and from May to July 1875, six thousand tons of salt were sent to India.

The GULF OF SUEZ is the western and larger of the two branches into which the Red Sea divides towards its northern extremity, and washes on the west the coasts of Egypt, on the east those of the Sinaitic peninsula. Extreme length, 200 miles; average breadth, about 20 miles. The shores are sometimes low, barren, and sandy wastes, sometimes bold and rocky headlands.

The ISTHMUS OF SUEZ is a neck of land 72 miles in width at its narrowest part, extending from the Gulf of Suez on the south to the Mediterranean on the north, and connecting the continents of Asia and Africa. It embraces within its limits (according to the commonly received opinion) the fertile Goshen (q. v.) of antiquity; but it is now a wretched uninhabitable waste, consisting of mingled sand and sandstone, interrupted here and there with salt swamps or lakes, but almost entirely destitute of fresh water. The main interest that attached to this region, in recent times, was, whether or not—since Egypt was on the great highway to India and China—it was practicable to cut a ship-canal through the Isthmus. We shall here briefly indicate the main steps that were taken to have this important question solved in a satisfactory manner.

It is certain that, in ancient times, a canal connecting (indirectly) the two seas did exist. At what period it was constructed is not so certain. Herodotus ascribes its projection and partial execution to Pharaoh Necho (about 600 years B.C.); Aristotle, Strabo, and Pliny less felicitously fix on the half-mythical Sesostris as its originator. The honor of its completion is assigned by some to Darius, king of Persia, by others to the Ptolemies. It began at about a mile and a half from Suez, and was carried in a north-westerly direction, through a remarkable series of natural depressions, to Bubastis, on the Pelusiac or eastern branch of the Nile. Its entire length was 92 miles (of which upwards of 60 were cut by human labor), its width from 108 to 165 feet, and its depth 15 (Pliny says 30) feet. How long it continued to be used, we cannot tell; but at length it became choked up with sand, was restored by Trajan early in the 2d c. A.D., but again became unusable from the same cause, and so remained till the conquest of Egypt by Amrou, the Arab general of the calif Omar, who caused it to be reopened, and named it the 'Canal of the Prince of the Faithful,' under which designation it continued to be employed for upwards of a century, but was finally blocked up by the unconquerable sands, 767 A.D. In this condition it has ever since remained. The attention of Europe was first turned to it in modern times during the invasion of Egypt by Bonaparte, who caused the isthmus to be surveyed by a body of engineers, who arrived at the opinion that the level of the Mediterranean is 30 feet below that of the Red Sea at S., an opinion which a subsequent survey proved to be erroneous.

From this time, the question continued to be agitated at intervals, especially by the French, and various plans were proposed, but nothing definite was arrived at till 1847, when France, England, and Austria sent out a commission to measure accurately the levels of the two seas. The commissioners, M. Talabot, Mr. Robert Stephenson, and Signor Nigrelli, ascertained that, instead of a difference of 30 feet, the two seas have *exactly the same mean level.* The only noticeable difference was, that there is a tide of 6½ feet at the one end and 1½ foot at the other. Another examination leading to similar results was made in 1853. Mr. Stephenson expressed himself very strongly against the feasibility of a canal, that is to say, a canal of such dimensions as would suit the requirements of modern commerce, and planned, instead, a railway from Cairo to S., which was opened (1858), and which now conveys overland all our Indian and Australian mails. The French, however, were not satisfied with Mr. Stephenson's conclusions, and M. Talabot, on his return to Europe, published in the *Revue des Deux Mondes* a plan for connecting the two seas by way of Alexandria and S. (or rather a point 6 miles below S.), for a description of which we have not space. In 1854, a new experimenter appeared in the person of M. de Lesseps, a member of the French diplomatic service in Egypt, who (1856) obtained from the pasha the 'concession,' i. e., the exclusive privilege of forming a ship-canal from Tyneh (near the ruins of ancient Pelusium) to Suez. The peculiarity of M. de Lesseps's plan lay in this, that, instead of following an oblique course, and uniting his canal with the Nile, as the ancients had done, and as all the modern engineers had thought of doing, he proposed to cut a canal right through the isthmus in a straight line to Suez.

This canal was to have a minimum width at the surface of 262 feet, and at the bottom of 144 feet, with a depth of 22½ feet; and

Map showing Suez Canal.

at each end there was to be sluice-lock formed, 330 feet long by 70 wide. By taking advantage of the tides at S., it was hoped that an additional depth of 3 or 4 feet might be obtained. But the colossal feature of M. de Lesseps's plan was the artificial harbors which he proposed to execute at the two ends. That at the Mediterrean end was to be carried out 5 miles; that at S., 3 miles. The English looked with aversion on M. de Lesseps's scheme; but in 1855, a new European commission was appointed, which reported that M. de Lesseps's scheme, somewhat modified, *was practicable.* The result of the report was the formation of a joint stock company, with a subscribed capital of £8,000,000 (afterwards increased) in which Saïd, the Pasha of Egypt, took a large number of shares, and made large concessions of land; and the work was accordingly begun. The canal was to be dredged through Lake Menzaleh, which runs far into the land directly towards S., to be connected with Lake Temsah, the Bitter Lake, and other marshy swamps, and so with Suez. Only a third of the way required to

be excavated through the sands and rocks of the desert. Work was begun in the end of 1860. In April, 1865, the works, at the request of M. de Lesseps, were visited by another scientific commission, who reported favorably of the scheme.

The canal was formally opened in November 1869.

The hostility of the British nation to the canal faded away with its successful completion and the advantages which it afforded to British commerce; and in 1875, the British government purchased, for £4,000,000, the Khedive of Egypt's shares in the canal, which amounted to 176,602 out of 400,000. These shares give no returns to their owner till 1894, the Khedive having alienated the dividends till that period in favor of the company. The fears expressed at the opening of the canal, that the trade of the East would be diverted from Great Britain as a center, were soon found by statistics to be groundless. In fact, the great proportion of the shipping that passes through the canal—usually about four-fifths of the whole—is English. Thus, in 1882, 3198 ships, of 7,122,156 tons, passed through; of these, 2565 ships, of 5,795,598 tons, were British. The revenue grew from £915,839 in 1873, to £2,421,835 in 1883. The clear profit in the latter year amounted to more than half of the gross income: less than half sufficing to cover the expenditure. The heavy dues (ten shillings a ton) and the enormous profit created much dissatisfaction amongst British shipowners; as well as the fact, that while M. de Lesseps commanded 21 votes at the Board of Management, Britain has only 3 votes. Accordingly, the scheme of a second canal, diverging more or less widely from the route of the present canal, was ventilated. A project negotiated between M. de Lesseps and the British government in 1883, gave so large concessions in favor of M. de Lesseps and the existing company, that it was highly unpopular in Britain, and had to be withdrawn. Plans for widening the old canal, and for providing large basins, in which ships going opposite ways may pass one another, were in progress in 1883.

SUEZ CANAL. In the above article on this subject, the nature of the scheme has been briefly described, and illustrated by a small map; and the progress of the works noticed down to the year 1865. In this place, some of the features will receive a little further explanation. The canal is 100 miles long, 25 of this length being through lakes.

The Port Said Entrance.—Port Said or Saïd, a town now containing 10,000 inhabitants, had no existence in 1860. It became the dépôt of the Company, the metropolis of vast bodies of laborers and other persons employed on the works of the canal. As the Mediterranean Sea is very shallow near this point, an artificial deep channel had to be made, bounded east and west by piers stretching far out into the sea. Stone for these piers was, in the first instance, brought from a long distance; but afterwards artificial stone was made on the spot, consisting of two parts of sand and one part of hydraulic lime ground into a paste, and poured into wooden boxes or moulds. When the mixture solidified, the mould-boards were removed, and the solid blocks of artificial stone were left from three to six months in the open air to dry and harden. The blocks contain 10 cubic mètres each, weigh 20 tons, and were made at a contract price of 42 francs per *mètre cube*. The western pier has a length of 7000 feet, and the eastern of 6000 feet: they are 4600 feet apart at the shore, but gradually approach towards each other, so that their outer ends are only 2300 feet apart. The western pier is continued in an arc of 1100 yards extent, so as, with the eastern pier, to shelter the harbor from all winds. Within this outer harbor is an inner port, 870 yards by 500, which is kept at a uniform depth of 30 feet, by means of steam-dredging. The lighthouse, with its electric light, is 180 feet high.

From Port Said to Temsah Lake.—From Port Said, the canal crosses about 20 miles of Menzaleh Lake, a salt-water shallow, closely resembling the lagoons of Venice, having from 1 to 10 feet depth of water. The canal through this lagoon is 112 yards wide at the surface, 26 yards at the bottom, and 26 feet deep. An artificial bank rises 15 feet on each side of this channel. Beyond Menzaleh Lake, heavier works begin. The distance thence to Abu Ballah Lake is 11 miles, with a height of ground above the level of the sea varying from 15 to 30 feet. Crossing the last-named lake, there is another land distance of 11 miles to Temsah Lake, cutting through ground to a depth varying from 30 to 70 or 80 feet; and then 3 miles further across this little lake itself. At El Guisr, or Girsch, occurs the deepest cutting in the whole line, no less that 85 feet below the surface; at the water-level it is 112 yards wide, at the summit-level 173 yards, from which the vastness of the gap may be estimated. Ismailia (pop. 5000) on Temsah Lake, is regarded as the central point of the canal. While the canal was being made, it grew up rapidly from an Arab village to a French town, with the houses of engineers and managers, hotels, shops, cafés, a theater, and a central railway-station, from which railways stretch to Alexandria and Suez.

The Fresh-water Canal.—This extends from the Nile Temsah Lake, and was constructed purposely to supply with water the population accumulating at various points on the line of the canal; but it is also used by small sailing-vessels. This fresh-water or 'sweet-water' canal comprises three portions or sections: (1) from the Nile east or north-east to Ismailia, on Temsah Lake; (2) from Ismailia, nearly south to Suez, on the western side of the great ship or maritime canal; (3) from Ismailia nearly north to Port Said, also on the west side of the ship canal. The first and second of these sections are really canals, large enough to accommodate small steamer and barge traffic; but the third section consists simply of a large iron pipe, through which the water is conveyed to the several stations. Plugs are inserted in the pipe wherever needed, to allow water to be drawn off for everyday wants.

From Temsah Lake to Suez.—The route crosses Temsah Lake to Toussoum and the Serapeum cutting, through a plateau 46 feet above the sea, where the waters were let in by the Prince and Princess of Wales, February 28, 1869. There is a space of 8 miles from Temsah Lake to the commencement of the Bitter Lakes, which had to be dug to a depth varying from 30 to 62 feet, according to the undulations of the surface. In these deep cuttings, owing to the great width of the canal, the quantity of sand to be dug out (for it is nearly all sand, though sometimes agglomerated with clay) was enormous, requiring the constant labor of a large number of powerful dredging machines and elevators. In passing through the Bitter Lakes, there was more embanking than excavating to be done, seeing that the bottom of this region is only two or three yards above the intended bottom of the great canal. From the southern end of the Bitter Lakes to Suez, a distance of about 13 miles, there is another series of heavy cuttings through the stony plateau of Chalouf, varying from 30 to 56 feet in depth. Where cutting is thus difficult, the surface width is reduced considerably from the regular width of 327 feet. The canal is intended throughout to be 72 feet wide at the bottom, and 26 feet deep.

On November 16, 1869, the S. C. was opened in form, with a procession of English and foreign steamers, in presence of the Khedive, the Empress of the French, the Emperor of Austria, the Crown-Prince of Prussia, and others. On November 27, the *Brazilian* went through; a ship of 1809 tons, 380 feet long, 30 feet broad, and drawing from 17½ to 20½ feet of water. Since then the canal has continued in successful operation, and passages have been made almost daily, chiefly by British vessels. The cost of construction of the canal was said to have reached, in December 1869, the total of £11,627,000. In 1870, 491 ships, of 436,618 tons, passed through; and in 1874, 1264 ships, of 2,424,000 tons. About 70 per cent. of the shipping and tonnage belongs to Great Britain. The great advantage of the canal is, of course, the shortening of the distance between Europe and India. From London or Hamburg to Bombay is by the Cape about 11,220 miles, but by Suez only 6332—that is, the voyage is shortened by 24 days. From Marseille or Genoa there is a saving of 30 days; from Triest, of 37. The rate at which steamers are allowed to pass through, is from 5 to 6 knots an hour. The canal charges are, 10 francs per ton, and 10 francs per head for passengers. The receipts for 1873 amounted to 22,755,862 francs, or £911,032; for 1875 (when 1494 ships passed through), to £1,155,185; for 1876 (1457 ships passed), £1,245,750. In 1880, 2011 ships passed.

SUFFOCA'TION. See ASPHYXIA and RESPIRATION.

SU'FFOLK, a maritime county of England, bounded on the N. by Norfolk, and on the S. by Essex. Area, 947,681 acres; pop. (1861) 337,070; (1871) 348,475; (1881) 356,863. The surface is for the most part flat, falling away into marshes on the north-west and north-east borders. The coast-line, which is low and marshy, or lined with cliffs of shingle or gravel and red loam, is about 50 miles in length, and is, on the whole, regular, being unbroken by any considerable indentation, and comprising no headland worthy of notice except Lowestoft Ness, the most easterly point in Great Britain. The tributaries of the Waveney, which separates S. from Norfolk on the north, and those of the Stour which forms the boundary-line on the south, together with the river Lark, an affluent of the Great Ouse, and the Gipping, which, after it begins to broaden into an estuary, is called the Orwell, are the chief streams. The climate is cold in spring, but is drier than that of the western counties. The soil is of various kinds, some of which are very productive. 770,000 acres are under cultivation, and the most improved system of agriculture has been introduced, together with the best and newest agricultural implements. A polled breed of cattle, of which the cows are deservedly held in high esteem, is peculiar to the county. The S. pigs are a famous and most profitable breed. There are in the county about 430,000 head of sheep, chiefly Southdowns and crosses of this breed. The ordinary crops are raised. The county sends four members to parliament. Capital, Bury St. Edmunds.

SU'FFRAGAN (Lat. *suffraganeus*, from *suffragium*, a suffrage or vote), the name given to a bishop in a province, in his relation of dependence or subordination to the archbishop, or rather met-

ropolitan, of the province. See METROPOLITAN. In some continental churches, the name is applied to coadjutor-bishops appointed—as in the case of prince-bishops in the German Empire—to assist the bishop in his own diocese.

SU'FFRAGE (Lat. *suffragium*, derivation uncertain), a right to vote, and more particularly the right possessed by the citizen of a state where representative government exists, to vote for a member of the legislative body.

The idea that the universal enjoyment of political suffrage is a right by natural law, is grounded on the fiction, that the obligations of municipal law arise out of a social contract express or implied. In opposition to this notion, it is argued that the true purpose for which government exists is the general welfare of the nation; and it is the duty of the state to consider whether the suffrage may be more beneficially exercised by the many or the few. Infants, minors, idiots, and insane persons have everywhere been excluded from the suffrage, on the ground that sound judgment is necessary for its exercise. Persons convicted of crimes have been excluded, as a security to society; and also almost universally women, for reasons based on their relation to society and to the opposite sex. Like considerations of expediency, it is argued, are a ground for withholding the suffrage from those whose circumstances and station in life render it unlikely that they should form a sound judgment on political questions. It is the intelligence and enlightenment of the country that an elective legislature should represent; and in any large extension of the suffrage, there is obviously a risk of the intelligence of a constituency being swamped by its mere numerical majority. A widely extended suffrage has, however, been advocated as a valuable means of educating the people to self-dependence; and several philosophical politicians of the present day, who are favorable to a large extension of the electoral qualification, propose to obviate what they regard as its otherwise inevitable evils, by graduating the suffrage, so as to give each individual elector a number of votes corresponding as much as possible to his property, education, or social position. Schemes for this end, differing in detail, have been proposed by Mr. J. Stuart Mill, in his *Considerations on Representative Government* (1861); and by Professor Lorimer in his *Political Progress not necessarily Democratic* (1857), and *Constitutionalism of the Future* (1865). See REFORM, REPRESENTATION, BALLOT.

SU'FISM (from *sufi* or *sofi*, the Greek *sophos*, a sage; erroneously also derived from Arab. *sof* or *suf*, wool, and thus designating an individual who wears nothing but woollen garments) designates a certain mystic system of philosophical theology within Islam. Its devotees form a kind of ecclesiastical order somewhat similar to that of the Fakirs (q. v.), or dervishes, but they are mostly of a far superior stamp; and some of the greatest Persian poets, philosophers, historians, and even kings belonged to their ranks. They assume four principal degrees of human perfection or sanctity. The first or lowest is that of the Shariat—i. e., of the strict obedience to all the ritual laws of Mohammedanism, such as prayer, fasting, pilgrimage, almsgiving, ablutions, &c., and the ethical precepts of honesty, love of truth, and the like. The second degree (Tarikat) is not attainable by all, but only by those higher minds that, while strictly adhering to the outward or ceremonial injunctions of religion, rise to an inward perception of the mental power and virtue necessary for the nearer approach to the divinity, the necessity of, and the yearning for, which they feel. The third (Hakikal = truth) is the degree of those who, by continuous contemplation and inner devotion, have risen to the true perception of the nature of the visible and the invisible—who, in fact, have recognized the Godhead, and through this knowledge of it have succeeded in establishing an ecstatic relation to it. This state is finally sublimated into that highest and last degree (Maarifal), in which man communicates directly with the Deity. Practically, the great mass of the people take the lowest degree; the second stage is reached by the 'Murides,' who do not fulfil the behests of the ceremonial law because they are behests, but because they are good in themselves, knowing that virtue is good; and because it leads to truth, they adhere to it for its own sake. They give alms because the sight of poverty grieves them; their ablutions are as much due to their desire of physical purity as to that of obeying a religious injunction.

The third stage is that of the Naibs, to whom all this spiritualizing of faith applies in a still more eminent degree. And the highest stage of attainable perfection is that of the Murshid, whose words are God's words, pure and simple, because he is in direct and constant communion with God. He is the 'Sun of faith,' by whose reflected light shine the Naibs, its 'moons.' All Sufistic poetry and parlance is to be taken allegorically and symbolically. They represent the highest things by human emblems and human passions; and religion being with them identical with love, erotic terminology is chiefly used to illustrate the relation of man to God. Thus the beloved one's curls indicate the mysteries of the Deity; sensuous pleasures, and chiefly intoxication, indicate the highest degree of divine love as ecstatic contemplation; while the wine-house, of which constant mention is made, merely indicates the state in consequence of which our human qualities merge in or are exalted into those of the Deity. Founded in the 9th c. by Kafi-Mullah, this peculiar mysticism has principally struck root in Persia, and chiefly among men of genius, e. g., Hafiz (q. v.). Recently, it has been revived, with slight modifications, by Shamil the renowned and once formidable antagonist of the Russians, who undertook to enlist even the common soldiers, if not in the ranks of the initiated—for Sufism, in its real meaning, is very exclusive—at least of its votaries; and the very lowest among them even had a sentence given him indicative of his forming part of the sect and of the gradations that form its main characteristic. In conclusion, it may be observed that Sufism mixes up all religions and all their prophets indiscriminately in one class; and the words idolatry, unbelief, licentiousness, and the like are generally used in their reverse sense by its votaries. Their principal religious writer is Jalaleddin Rumi.

SUGAR (Lat. and Gr. *sacchar-*, Sans. *sarkara*, Pers. *schakar*, Arab. *sokkar* or *assokkar*, Sp. *azucar*, It. *zucchero*, Fr. *sucre*, Ger. *zucker*) is a general term applied by chemists to a number of neutral carbo-hydrates, possessing a more or less sweet taste, for the most part crystallizable, and produced by the vital processes going on in certain plants and animals. They are divisible into two groups, the first embracing such sugars as are capable of undergoing fermentation, and of being resolved, under the action of yeast, either directly or indirectly into alcohol and carbonic acid gas; and the second including those sugars which are not capable of being broken up by fermentation into the above-named products. The first group contains cane-sugar or sucrose, fructose or inverted sugar, trehalose, mycose, melezitose, melitose, grape-sugar or Glucose (q. v.), and milk-sugar or lactose; while the second group includes inosite or inosin, sorbite or sorbin, and scyllite or scyllin.

Cane-sugar or *sucrose* ($C_{12}H_{11}O_{11}$), the ordinary sugar of commerce, is by far the most important of this class of compounds; and in so far as its sweetening properties are concerned, it exceeds grape-sugar in the ratio of 5 to 2, and milk-sugar in a still higher ratio. It has a specific gravity of 1·6. It dissolves in about one-third of its own weight of cold water, producing a thick viscid syrup, and in all proportions in hot water; it is slightly soluble in absolute alcohol, but spirit of wine of specific gravity 0·830 dissolves about one-fourth of its weight. By the spontaneous evaporation of its watery solution, it is deposited in four-sided rhomboidal prisms. Common loaf-sugar and sugar-candy are two well-known forms of crystallized sugar; the former consisting of a mass of small transparent crystals, and owing its dazzling whiteness to the numerous reflections and refractions which the rays of light undergo within the interior from the numberless crystals of which it is composed; while the brown color which the latter usually possesses is due to the coloring matter not having been removed from the syrup previous to crystallization.

The crystals of sugar-candy are larger than those of loaf-sugar, in consequence of the slower evaporation in the former case. When crystals of sugar—as, for example, two pieces of loaf-sugar—are rubbed together in the dark, a pale phosphorescent light is evolved. If a solution of sugar be boiled for a long time, it acquires an acid reaction, and loses its power of crystallizing—a change which is attended by the assimilation of additional water, and the formation of the uncrystallizable inverted sugar, which will be presently described. If the boiling be further prolonged, the inverted sugar ($C_{12}H_{12}O_{12}$) assimilates more water, and is converted into grape-sugar ($C_{12}H_{12}O_{12} + 2Aq$), while a little formic acid and ulmin (a brown, nearly insoluble substance belonging to the *humus* group) are produced. The crystallization of sugar is also prevented by the addition of a little oxalic, citric, malic, or any of the stronger acids to its solution; and in order to check the bad effects of an acid, a small quantity of lime is usually added to the cane-juice before it is heated.

The action of different degrees of heat on sugar has been carefully studied. At about 320°, sucrose fuses, and on cooling, forms the transparent amber-colored solid known as *barley-sugar*, which, if kept for a long time, assumes a crystalline state, and becomes opaque. If the application of heat be continued until about 400°, the sugar loses two atoms of water, and *caramel*, which is described in the article GLUCOSE, is formed, and at a still higher temperature, the changes which sucrose undergoes are identical with those suffered by glucose. Sugar dissolves many metallic oxides when its solution is boiled with them—as, for example, freshly precipitated oxide of lead, lime, and baryta, and its presence prevents the precipitation of alkalies of various metallic oxides from their salts—the oxides of copper and of iron being thus retained in solution. Many metallic oxides are partially or entirely reduced when boiled with sugar; thus, chromic

acid is reduced to sesquioxide of chromium, salts of the red oxide of mercury are converted into those of the suboxide, and salts of gold give a precipitate of the reduced metal. It does not reduce alkaline solutions of oxide of copper to the suboxide (Trommer's test) unless with the aid of heat, which converts it into glucose. Under the action of certain oxidizing agents, it may be converted into propionic, formic, and acetic acids. Sucrose is not *directly* capable of undergoing fermentation; but in the presence of a ferment (yeast, for example) it is converted into glucose, and in that form it readily undergoes vinous, lactic, and butyric fermentation. Its action on polarized light is described below.

This variety of sugar is chiefly obtained from the juice of the sugar-cane, but it is also abundantly present in the juices of certain species of maple and of beet-root, all of which yield this substance as a commercial product; it is also contained in Sugar-grass (*Sarghum saccharatum*), whose juice yields 13 per cent. of sugar; in carrots and turnips, in the pumpkin, the chestnut, the young shoots of maize, in the flowering buds of the Cocos palm, and in a large number of tropical fruits. Its use as an article of diet has been already mentioned under DIET. Several articles of food contain some form of sugar in considerable quantity. In peas, there are 2 per cent. of sugar; in rye-meal and wheaten bread, about 3½ per cent.; in cows' milk, 4½ per cent.; in goats' milk and in barley-meal, 5½ per cent.; in human milk, in asses's milk, ripe gooseberries, and ripe pears, about 6 per cent; in oatmeal, about 8 per cent; in wheaten flour, from 4 to 8 per cent.; in beet-root, from 5 to 10 per cent; in ripe peaches, 16½ per cent.; in ripe cherries, 18 per cent; and in dried figs upwards of 60 per cent. Although sugar is commonly regarded as a luxury, it is in reality a very valuable article of food (as, indeed, might be inferred from its presence in milk, and in both the yelk and white of eggs), since it is very rapidly digested, and supplies heat-forming or respiratory food to the system. 'When, however,' says Dr. E. Smith, 'it is compared with wheaten flour, it is a very dear food, since three or four times more carbon will be obtained for 1*d.* in flour, besides nitrogen, none of which is found in sugar. It has also been proved by Messrs. Lawes and Gilbert that even its fattening properties—that is to say, its power to form fat in the system, when it is supplied in excess of the quantity which the daily wants of the body require to produce heat—are not greater than those of starch as found in the cheapest grain.'—*Practical Dietary*, 1863, p. 63.

In consequence of sugar being a fat-forming substance, it should be taken very sparingly in cases of excessive obesity. There are certain forms of dyspepsia in which sugar should be avoided, as exciting increased gastric uneasiness; and in diabetes, all articles of food containing or (like starch) yielding sugar, should be rigidly prohibited. Although prone to fermentation when in a dilute state, in its concentrated form sugar possesses great antiseptic power, and is extensively employed to preserve both vegetable and animal substances from decay. The sugar naturally existing in some fruits is often sufficient to insure their preservation in a dry state, while in other cases it is added, as in preserves and jellies. A mixture of salt and sugar applied to meat, fish, &c., preserves more of the natural flavor than mere salting does. Sugar converted into caramel is much used by cooks and confectioners as a coloring matter.

Closely allied in their chemical characters to sucrose are the following comparatively rare forms of sugar: (1) *Trehalose* ($C_{12}H_{11}O_{11} + 2Aq$), so called from *Trehala*, or Turkish Manna (the product of a coleopterous insect, *Larinus nidificans*), from which this variety of sugar is extracted, differs from sucrose in the following points—it crystallizes in brilliant rectangular octahedra; contains water of crystallization; fuses at 212°, and loses its water of crystallization; is very soluble in hot alcohol; possesses about three times as great a rotatory power on polarized light; and when heated to 356° does not undergo further change. (2) *Mycose*, obtained from ergot of rye, possesses the same composition as trehalose, from which it mainly differs in crystallizing in rhombic prisms, and in exhibiting a somewhat weaker rotatory power. (3) *Melezitose* ($C_{12}H_{11}O_{11}$), obtained from larch manna, differs from cane-sugar in its less sweet taste, and in exhibiting a less powerful rotatory action. (4) *Melitose* ($C_{12}H_{12}O_{12} + 2Aq$), the chief ingredient in the Australian manna yielded by the *Eucalyptus* tree, crystallizes in acicular prisms, is feebly sweet, undergoes fermentation with yeast, but yields only half as much alcohol and carbonic acid as would be obtained from an equal weight of glucose, one half of this sugar being converted into an unfermentable syrupy body, known as *Eucalyn* ($C_{12}H_{12}O_{12}$).

More important than any of the above varieties, and differing from cane-sugar in a distinctive physical property, is the substance formerly known as *Fruit Sugar*, but now often described as *Inverted Cane-sugar*. The objection to the former name is, that the sugar contained in many ripe acidulous fruits, and formerly regarded as a distinct variety, is merely a mixture of cane-sugar, with more or less of the *Inverted Sugar* ($C_{12}H_{12}O_{12}$), which has already been noticed as resulting from the action of prolonged boiling, or of a little acid on cane-sugar. The same change occurs in many ripening fruits, in consequence of the presence of a peculiar albuminous ferment. Inverted sugar is not crystallizable, is soluble in dilute alcohol, and produces *left*-handed rotation; hence its name. By chemical means, it is convertible into grape-sugar, a change which sometimes occurs spontaneously, as is seen in the gradual crystallization of the sugar in dried fruits.

Grape-sugar, constituting the hard granular sweet masses occurring in old dried fruits, such as rasins, figs, &c., has already been described in the article GLUCOSE, or GLYCOSE, under which names it is commonly known to chemists. It is also known as *Starch-sugar*, because it is readily obtained by the action of a dilute acid on a hot solution of starch, and is identical with the sugar occurring in the urine in diabetes.

Milk-sugar, known also as *Latine* and *Lactose* ($C_{20}H_{19}O_{19} + 5Aq$, or, according to some chemists, $C_{12}H_{11}O_{11} + Aq$), is a purely animal product. It exists in considerable quantities in the milk, especially of the herbivorous animals, and is one of the most important and essential ingredients in that secretion. It may be obtained on a large scale by separating the curd from the milk, and evaporating the whey till it is ready to crystallize; when, on the introduction of small pieces of wood, the crystals of sugar are deposited on them.

These crystals are four-sided prisms of a milk-white color, and so hard that they crunch between the teeth. This variety of sugar is only moderately sweet (*vide supra*), requires about six times its weight of cold water for its solution, but dissolves readily in boiling water, while it is insoluble in alcohol or ether. If it be gradually heated to 284°, two equivalents of water are expelled, whereas, if it be suddenly heated to about 400°, all five equivalents are given off. When pure, milk-sugar is insusceptible of fermentation; but when boiled with dilute acids, it is converted into a directly fermentable sugar, in many respects very similar to grape-sugar, and to which some chemists have given the name of *Lactose*, a term commonly applied to milk-sugar itself. On treating a moderately diluted acid solution of milk-sugar with yeast, this variety is first formed, and then yields carbonic acid and alcohol; if, however, decomposing matters, as, for example, casein in the act of disintegration, are present, it undergoes lactic and butyric fermentation; and hence we understand how milk after exposure for a time to the air becomes sour. The intoxicating character of the drink prepared by the Kalmucks and Tartars from sour mares' milk, is due to this indirect vinous fermentation of sugar of milk. Regarding the uses of this variety of sugar, it may be observed that it is probably the most important of the constituents of whey (which is milk deprived of the whole of its casein except a mere trace held in solution), and hence that it is the active ingredient in the *whey-cure*, which is so popular in Switzerland. (The whey in these cases is usually obtained from goats' milk). It is also the chief constituent of the globules used in homœopathy.

The second group of sugars, namely, those which are incapable either directly or indirectly of undergoing fermentation, are of less practical importance than cane-sugar, grape-sugar, or milk-sugar.

Inosin, or *Inosite* (derived from the Greek *is*, gen. *inos*, muscle), is represented by the formula $C_{12}H_{12}O_{12}+4Aq$. It occurs as a normal constituent in the juice of the heart, and of the involuntary or unstriped muscles, and has also been found in the tissues of the lungs, spleen, liver, kidneys, and brain, and in the urine in Bright's disease and diabetes. It has been recently shown that it is identical with the substance previously known as *Phaseo-mannite*, which is readily obtained from the unripe seeds of the common kidney-bean (*Phaseolus vulgaris*). It forms colorless efflorescent prisms, which lose four equivalents of water at about 210°. When mixed with decaying cheese and chalk, it becomes gradually converted into lactic and butyric acids. *Scyllite* is a saccharine matter closely resembling inosite, and occurring in various organs of several plagiostomous fishes, and especially in the kidneys of the rays and skate. It differs, however, from inosite in its crystalline form, and in its containing no water of crystallization. Its composition is unknown. *Sorbin*, or *Sorbite* ($C_{12}H_{12}O_{12}$), derives its name from its occurring in the juice of the berries of *Sorbus aucuparia*, the Service Tree, and may be obtained in colorless transparent rhombic octahedra. It reduces oxide of copper to the suboxide (Trommer's test), and is of a sweetish taste.

Closely allied to the sugars, but differing from them in their chemical composition (inasmuch as they do not contain hydrogen and oxygen in the proportions to form water), are *Mannite* ($C_{12}H_{14}O_{12}$), obtained from *Manna*, the inspissated juice of the *Fraxinus ornus*, but also occurring in celery, onions, asparagus shoots, *Laminaria saccharata* and other sea-weeds, certain fungi, the juice which exudes from apple and pear trees; *Dulcite* ($C_{12}H_{14}O_{12}$), the product of an unknown Madagascar tree; *Quercite* ($C_{12}H_{12}O_{10}$), obtained from acorns; and *Pinite* ($C_{12}H_{12}O_{10}$), from *Pinus lambertiana*, a tree growing in Australia and California. All these bodies are crystalline, and sweet to the taste.

Although chemists have hitherto looked upon the sugars as or-

ganic compounds, without any recognizable radical, and from their composition have termed them *carbo-hydrates*, 'the researches of Berthelot render it propable that the sugars as well as mannite, and the bodies allied to it, are polyatomic alcohols, like glycerine, for he has found that they possess the power of entering into combination with various acids, with elimination of water, in some cases yielding colligated acids analogous to the tannic, and in others furnishing neutral bodies closely allied to the fats.'—Miller's *Organic Chemistry*, 2d ed. p. 72.

Amongst the various chemical purposes to which the phenomenon of circular polarization may be applied, we may especially mention its use in determining the quantity of any kind of sugar in solution. While some sugars give a right-handed rotation, others give a left-handed rotation, and each sugar exerts a definite amount of rotatory power. The following are the rotatory powers of the chief varieties of sugar, equal weights of each being dissolved in an equal bulk of water, and the temperature being 56°:

Cane-sugar	$(C_{12}H_{11}O_{11})$,	right	73°·8
Trehalose	$(C_{12}H_{11}O_{11})$,	"	220°
Melezitose	$(C_{12}H_{11}O_{11})$,	"	94°·1
Mycose	$(C_{12}H_{11}O_{11})$,	"	193°
Inverted Sugar	$(C_{12}H_{12}O_{12})$,	left	28°
Grape-sugar	$(C_{12}H_{12}O_{12})$,	right	57°·4
Milk-sugar	$(C_{12}H_{12}O_{12})$,	"	56°·4
Sorbin	$(C_{12}H_{12}O_{12})$,	left	46° 9

This method has been applied to determine the amount of sugar in diabetic urine, to ascertain the quantity of sugar which remains in the unfermented state in wines, and to other similar purposes. As, however, the process is one of extreme delicacy, the method must be used with great caution.

On the production and manufacture of sugar, see *Sugar Growing and Refining*, by Lock, Wigner, and Harland (Spon. 1882); *Sugar Refining*, by Gill; *Sugar Analysis* by Tucker (Philadelphia, 1882).

Manufacture.—The manufacture of sugar from the sugar-cane and other sources is now one of the largest branches of human industry, but this great development is of comparatively recent date; and although there are evidences of its very high antiquity in India and China, sugar appears only to have been vaguely known to the Greeks and Romans. It is mentioned by Theophrastus as 'honey in reeds;' and Lucan has the following line, which indicates a knowledge of its existence, but merely as a curious fact:

'Quique bibunt tenera dulces ab arundine succos.'

Its introduction to Europe appears to have been one of the results of the Crusades. The sugar-cane was grown in Cyprus about the middle of the 12th c.; it was from thence, at a later time, transplanted to Madeira, and at the commencement of the 16th c., was carried from the latter island to the West Indies. Originally, in all probability, only the sweet recent juice was known; for apparently the art of boiling it down, and forming it into raw sugar, was an invention of the 15th c.; and it was not until the middle of the following century that a Venetian discovered the art of refining sugar, which soon became established in Germany. The first refinery of which any notice exists was one in Dresden, as early as 1597; but long previous to this the subject had attracted so much attention as to be discussed in learned treatises, one of which in particular, the *Saccharologia* of Sala, in the beginning of the 16th c., shows that the clarification of the syrup by defecation was then a matter of some importance. Still the manufacture of sugar in the countries to which it had been introduced made but slow progress, for its use was limited by its dearness to the wealthy. The material has now, however, become one of the commonest necessaries of life, and has largely conduced to the health of nations. Until 1747, sugar was supposed to be the product of the sugar-cane only, but in that year, Marggraf, a German chemist, demonstrated that it was a natural product of other vegetables, and especially of the beet-root; and half a century later, its manufacture from that source was first commenced in Silesia. A large portion of the sugar consumed on the continent is now obtained from this source. See BEET-ROOT SUGAR.

Since we have become better acquainted with the sources of our own supplies, we have learned that a large portion of the raw sugar of the East Indies received in British ports as cane-sugar is in reality made from the juice of several palms, especially that of *Arenga saccharifera*, and the wild date, *Phœnix sylvestris*. The juice is obtained from these plants by cutting off the male spadix when young, and from the cut portion there is for four or five months a continual flow. The liquid is at first clear, and is immediately boiled down to a thick syrup, which granulates on cooling, and constitutes, if not otherwise purified, the coarse brown sugar called jaggery, which is extensively consumed in India. More carefully prepared, it is sent to Europe with sugar made in the cane-plantations, and is only distinguished from it by well-skilled persons. If the juice is not immediately boiled, it becomes turbid, and passing into the vinous fermentation, forms the intoxicating drink called toddy.

In Canada and in the United States very much sugar is made by boiling the juice or sap of the Sugar Maple-tree (*Acer saccharinum*). The *Sorghum saccharatum*, or Sugar-grass (See DURRA), and the stalks of ordinary maize or Indian corn (*Zea*) yield sugar, which has lately been made so as fairly to rival the best crystallized cane sugar (see under SUGAR-CANE).

Beet-root sugar is manufactured from the fresh-dug roots, chiefly of the varieties we call Mangold-wurzel. The process (which, however, is constantly undergoing modifications) is briefly described in the article BEET-ROOT SUGAR. Beet-root yields from 7 to 8 per cent. of sugar, of which only 3 to 4 per cent. are of the best quality, called *Melis*, 2 to 3 per cent. of the second quality, called *Farin*, and the remainder molasses.

The manufacture of starch-sugar is described in the article GLUCOSE.

From the beginning of the 16th c., when the sugar-cane of India was introduced to the West Indies, sugar has been one of the most important products of those islands. Careful cultivation has produced many varieties of this useful plant, some of which are better adapted than others for particular localities. The original variety introduced into the West Indies is still cultivated under the name of the *Creole Cane;* but the favorite variety is the *Otaheite Cane*, which is the most luxuriant grower, and gives the largest yield of juice. It is the variety chiefly cultivated in Brazil, Demerara, and Venezuela, as well as the West Indies. In many parts of the East, another admirable variety is the *Batavian* or *Striped Cane;* it was originally raised in Java, and is the favorite with rum-distillers.

The extraction of juice from the sugar-cane is effected by simple pressure. In its native country, India, there are still in use in some districts machines of the rudest construction, which are probably the same which were used a thousand years since. The Chinapatam Sugar-mill (fig. 1) consists of a mortar made by cut-

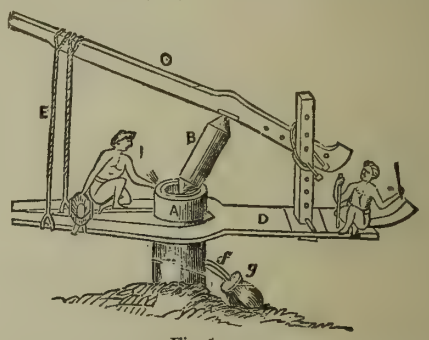


Fig. 1.

ting down some hard-wood tree to within 2 or 3 feet of the ground, and hollowing the top of the portion left standing in the ground into the form of a mortar, A. A small hole is then bored obliquely through from the bottom of the cavity to the outside, and a pipe, *f*, conveys the juice into a jar, *g*. B is a cylindrical piece of wood, sharpened at each end, to act as a pestle, which is kept in its place with sufficient pressure by the lever C and the ropes at E. Two men are required; one at I has a basket supplied with small lengths of freshly-cut cane, which he places, two or three at a time, in the mortar, and, when necessary, removes the crushed ones; the other man sits on the other end of the train, balancing it, and at the same time drives oxen which are attached to the end of the beam D, and keep the movable parts of the mill constantly turning round.

Notwithstanding the rudeness of this contrivance, very large quantities of sugar are made by it in India. A much better one, however, is the Chica Ballapura engine (fig. 2), which consists of

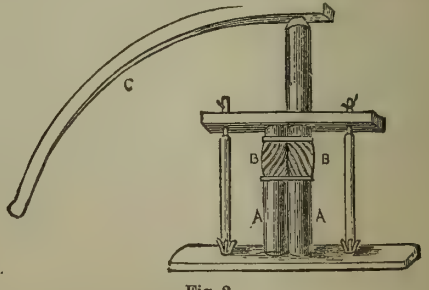
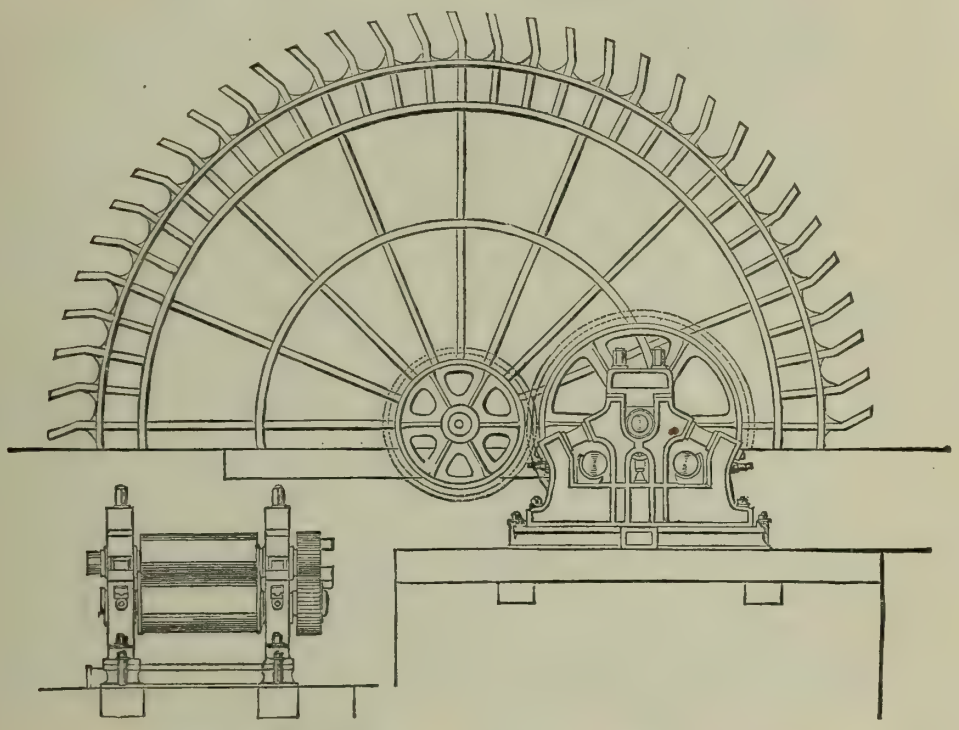


Fig. 2.

two upright rollers, A, A, the heads of which are formed into double spiral screws, B, B, which work in one another, so that

when an ox is yoked to the long curved lever, C, and goes round, one of the upright rollers, being connected with the lever, is made to revolve, and its screw carries the other one round, but in an opposite direction. The pieces of cane are fed in by hand between the rollers, and as the juice is squeezed out, it flows down into a small hollow below the frame made to receive it, whence a small trough carries it to an earthen pot. The frame of this mill is securely fixed with stakes driven deep into the ground. In all probability, this very ancient machine has been the origin of all the most modern ones, for they all consist of rollers placed either vertically or horizontally, between which the canes are made to pass.

The mills now in general use for squeezing the juice out of the sugar-canes are very powerful machines. Fig. 3 represents an end view of a cane-mill, with the iron water-wheel and gearing for drivingit, and fig. 4 represents a front view of the same mill.



FFig. 4.

Fig. 3.

Some idea of the strength of those mills will be formed from the fact, that one of the rollers weighs upwards of 5 tons. The axles are 12 inches in diameter, and notwithstanding that they are made of the best wrought iron, they are not secure against breakage. The manufacture of sugar has probably been carried to greater perfection in the islands of Java, Mauritius, and Cuba than in any other parts of the world. In Java especially, in consequence of the great extent of the plantations, the planters have been able to erect very complete establishments for the manufacture of sugar.

The following very condensed account of the process of making sugar in Java will give some idea of the operation.

The canes, freed from all loose leaves, are passed through between the rollers under the greatest possible pressure that can be brought to bear upon them. The rollers revolve only from two to four times per minute. From 100 lbs. of canes, 65 to 75 lbs. of cane-juice will be expressed. This juice, which is of a sweetish taste, and of the color of dirty water, passes direct from the mill to a small reservoir, where it usually receives a small dose of quicklime, and without delay runs off to large iron or copper vessels, heated either by a fire underneath or by steam-pipes in the liquid. As the temperature of the juice rises, a thick scum comes to the top, which is either removed by skimming, or the warm juice is drawn off from below the scum. The concentration of the juice is partly effected in a series of large open hemispherical iron pans about six to eight feet diameter, of which five or six are placed in a row, with a large fire under the one at the end. This one fire, which runs along under the whole row of pans, is found sufficient to make two or three of them nearest the fire boil violently, and in addition, it warms the juice in the pans furthest from the fire. As the juice first enters the pans furthest from the fire, it gets gradually heated, and the vegetable impurities rise in scum to the top, and are carefully removed. As the juice is ladled from one pan to the next, it boils with greater and greater vigor as it approaches nearer the fire, until in the pan immediately over the fire it seethes and foams with excessive violence; and this seems to be essential to the successful making of sugar. It is known that the presence of all those impurities which constitute the scum interferes with the crystallizing of the sugar; and the rapid ascent of bubbles of steam through the liquid in the pans carries all impurities dispersed through the body of the liquid to the top, where they can be removed with facility.

It is well known that great heat is very destructive to cane-juice; that is to say, it turns much of the crystallizable sugar into treacle or uncrystallizable sugar, but the gain arising from getting rid of much of the impurity in the cane-juice more than compensates for the destruction of part of the sugar. After the concentration has been carried to a given point, and all the scum has been got rid of, the application of a high heat, which would act with an increasingly destructive effect as the condensation becomes greater, is suspended, and the liquor, now of the color of turbid port wine, and of the consistency of oil, is drawn into the vacuum-pan, where the concentration is completed at the lowest possible temperature, generally about 150° F. The vacuum-pan shown in fig. 5, is in universal use in all European sugar-refineries

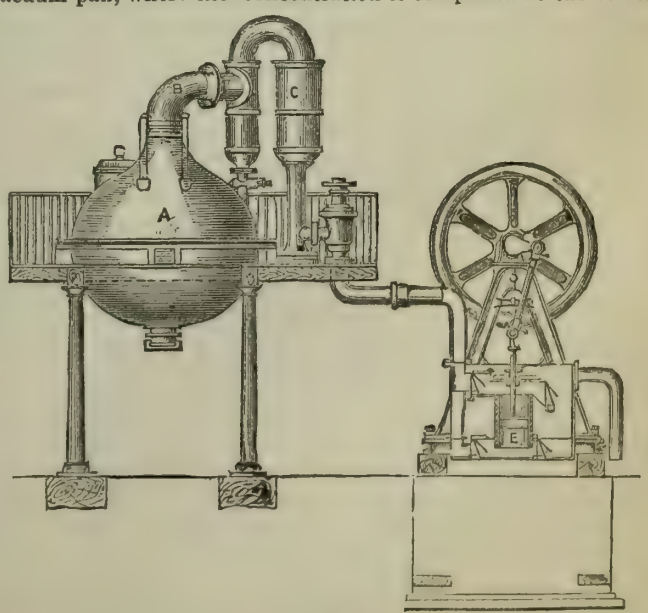


Fig. 5.

and in all well-provided sugar-plantations. It is generally made of copper, of a spherical form, and from six to nine feet in diameter. The bottom is double, leaving a space of an inch or two for the admission of steam between the two bottoms, and there is generally a long coiled copper pipe of three or four inches diameter above the inner bottom, so as to still further increase the amount of heating surface. This apparatus is made perfectly air and steam tight. Leading from its upper dome, A, there is a large pipe, B, communicating with a condenser, C, into which a rush of cold water is continually passing, so as to condense all the steam or vapor that arises from the liquid boiling in the vacuum-pan. The water which is constantly rushing into the condenser is as steadily withdrawn again by the pump at E. There is thus a constant vacuum in the pan, and, consequently, the liquid in it will boil at a much lower temperature than it would in an open pan or boiler. There is an extraordinary advantage in being able to effect the later stages of the concentration at a low temperature, for it is when the liquid becomes thick that the destructive results of a high temperature become most excessive.

As the concentration of the liquid in the vacuum-pan proceeds, crystals of sugar begin to form, and the skill of the sugar-boiler is shown by the uniformity of the crystals he produces. The boiling is commenced by filling in only about a third or fourth of the quantity the vacuum-pan will hold, and gradually adding more liquid as the crystals increase in size. The sugar-boiler is able to watch the changes going on in the vacuum-pan by means of small samples he withdraws from it by means of a suitable apparatus. The sugar-boiler holds those drops of thick fluid on his finger and thumb, between his eye and a strong light, and is thus able to detect those minute changes in its condition which show that it is time to add an additional quantity. By the time the vacuum-pan is full, the contents have thickened, by the formation of crystals of sugar, into a mass of the consistency of thick gruel; it is then allowed to descend into a vessel called the heater, where it is simply kept warm until it can be run out into the 'forms,' which, in the sugar-growing colonies, are generally conical earthen pots, holding from one to two cwts. of sugar. It is allowed to cool and complete its crystallization before the plugs, which close the bottom of the pots, are withdrawn. When this is done, from one-fourth to one-third of the contents of the form, which has remained in a fluid state, runs off into gutters leading to large tanks, from which it is again pumped up into the vacuum-pan, and reboiled, yielding a second quality of sugar. This reboiling of the drainings is repeated, with a continually decreasing result, both as to quantity and quality of the solid sugar obtained, and it is rarely carried beyond the fourth boiling. If the planter wishes to obtain Muscovada or unclayed sugar, the process is now complete, and the sugar is turned out of the forms, and packed for shipment. In some cases, the sugar is run direct from the vacuum-pans into casks or hogsheads, which replace the forms, holes being bored in the bottoms of the casks, to admit of the uncrystallized portion of the sugar draining out.

If *clayed* sugar is to be made, the forms are allowed to stand for a few days until all the treacle has drained out; and a quantity of thin mud, about the consisteny of good thick cream, is then poured over the sugar, to the depth of one or two inches. The water contained in this thin mud slowly steals down through the sugar, and mixing with the coatings of treacle still adhering to the outsides of the crystals of sugar, renders them less viscid, and facilitates their descent to the bottom of the form. The mud remains, at the end of a few days, in the form of a dry hard cake on the top of the sugar, and none mixes with the sugar.

The process of claying sugar is simply washing off a coating of black or yellow treacle from a crystal of sugar, which is always white. This operation is possible without dissolving the crystal of sugar, simply because the treacle has a greater affinity for water than the crystallized sugar has. Anything that would yield a very slow and steady supply of water to the sugar, would do as well as mud or clay. There is always some loss of crystallized sugar in the process of claying, and attempts have been made to use strong alcohol for washing off the coatings of treacle from the crystals; but although alcohol dissolves treacle very freely, and scarcely acts on the crystals at all, still it has not been found to answer commercially. Besides the cost of the process, there is a difficulty in getting rid of the smell of alcohol in the sugar.

The centrifugal machine of Messrs Manlove, Alliott, & Co., has been very extensively used for getting rid of the treacle. Its action depends on precisely the same principle as that called into play when a sailor twirls a mop to expel the water from it. The centrifugal machine is simply a drum of 3 or 4 feet diameter, and 12 to 18 inches high, revolving at a great velocity on a vertical axis. The sugar, either direct from the vacuum-pan, or after it has been allowed to cool, is put, still mixed with the treacle, into the Machine. As soon as the drum acquires a high velocity, its contents are forced by the centrifugal action against the drum, the cylindrical portion of which is made like a sieve, and admits of the escape of the treacle, but retains the crystals of sugar. Some idea of the efficiency of those machines may be formed when it is stated, that in a machine of three feet diameter, revolving at the usual speed of 1000 revolutions per minute, the tendency of the treacle to escape will be 514 times its own weight; that is to say, the treacle will have 514 times more force to fly off, than it has to drop off the crystal by the mere force of gravity.

Sugar-refining was unknown to the ancients, and even the refining previously referred to as having been established in Germany in the 16th c., consisted merely in clarifying the syrup and producing a sort of sugar-candy; but one improvement followed another, until the process may now be considered as almost perfect. The chief difficulties attending the operation arise from the circumstance that the material to be operated upon is ever varying in quality. Not only is there a difference between the produce of two different plantations, but even the manufacture of the same plantation shows differences of quality; these differences arising chiefly from the presence of foreign substances, which seriously interfere with the operations of the refiner. The attempt made to test the exact quality of solutions of raw sugar by means of polarized light (see above) have hitherto been attended with little success in practice. Sugar-refining, as practised in Britain, has three distinct objects—(1) the production of loaves of thoroughly refined sugar; (2) crushed sugar; and (3) white sugar in separate crystals. The last is of comparatively recent introduction. In some existing sugar-refineries, old fashions still prevail; but our description must be confined to the most recent methods.

Sugar-refining is carried on in this country on a great scale; London, Bristol, and Greenock being the principal seats of the trade. There is comparatively little raw sugar used in Great Britain. Nearly all the yellow and dark-colored sugar sold in the shops has passed through the hands of the refiners, and is simply inferior sugar, made out of the syrup which drains from the white loaf-sugar.

Sugar-refineries are built eight or nine stories high, and the raw sugar is first hoisted to the upper story, where it is dissolved in large tanks of hot water, care being taken to use as little water as possible for the purpose. A quantity of bullock's blood is stirred into the solution of sugar, and the heat being gradually raised, the albumen of the blood coagulates, and rises to the surface in the form of a thick light scum, bringing with it nearly all the mechanical impurities floating in the fluid. The liquor, still hot, is then passed into the bag-filters shown in fig. 6. Those filters are made of a very closely woven cotton cloth, capable of retaining the minutest mechanical impurity. In order to facilitate the passage of the liquor through the bags, they are suspended in a kind of iron closet, and surrounded by an atmosphere of steam to keep the liquor hot. From the bag-filters, the liquor, now freed from all mechanical impurities, but of a dark color, flows into a lofty cylindrical iron filter, of about 5 or 6 feet diameter and 20 or 30 feet high, filled with animal charcoal, that is, char-

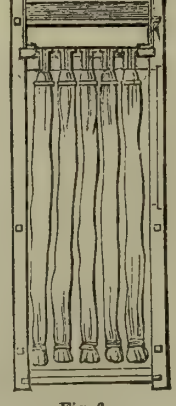


Fig. 6.

Fig. 7.

coal made of bones. This charcoal is reduced to coarse powder; and the dark offensive liquor is allowed to percolate very slowly through the mass. The result is, that it flows out at the bottom a perfectly transparent and pure solution of sugar. The charcoal can only be used for a few days at a time, becauses it gradually loses its purifying power; when the liquor begins to flow through it without being purified, it is taken out of the filter, and reburned, which completely revives its powers.

The liquor as it flows from the charcoal filter is a mixture of pure sugar and pure water, and perfectly transparent. The application of heat is the only mode of expelling the water, and this unfortunately blackens the sugar again. In order to get rid of the water with as little heat as possible, the colorless liquid is boiled in the vacuum-pan as in the early process of the manufacture (see fig. 5). The liquor boils in vacuo at about 150° F., and even this moderate heat has the effect of turning it quite

brown. When it has been sufficiently concentrated by boiling in the vacuum-pan, which takes from 1½ to 2½ hours, it is run into the sugar-loaf forms (fig. 7); which, after cooling, are carried to a room kept warm by means of steam-pipes. This warmth facilitates the flow of the treacle or syrup out at the aperture seen at the bottom of the form. To get rid of the coating of colored treacle which still hangs about the crystals of sugar, a small quantity of a saturated solution of pure white sugar is poured on the top of the form. This strong liquor is unable to dissolve any more sugar, but being more fluid than the sticky coatings of treacle or syrup adhering to the crystals, it mixes with the coatings, and makes them fluid enough to flow down to the bottom of the form, leaving the crystals clear of syrup or treacle, and consequently free of all color. This process of washing off the coloring matter from the crystals of sugar is the same in principle as the 'claying' used in the production of sugar. The loaves of sugar, after standing some time, to admit of all the liquor draining off, are wrapped in paper, and dried in stoves heated by steam. The liquor draining from the forms is reboiled in the vacuum-pan, and forms loaves of an inferior quality; and the liquor draining from the inferior loaves is again boiled into the yellow sugars known amongst sugar-refiners as bastards.

Crushed or Crashed Sugar is simply inferior loaves crushed while still soft and moist, and packed in hogsheads, instead of being left in the loaf form.

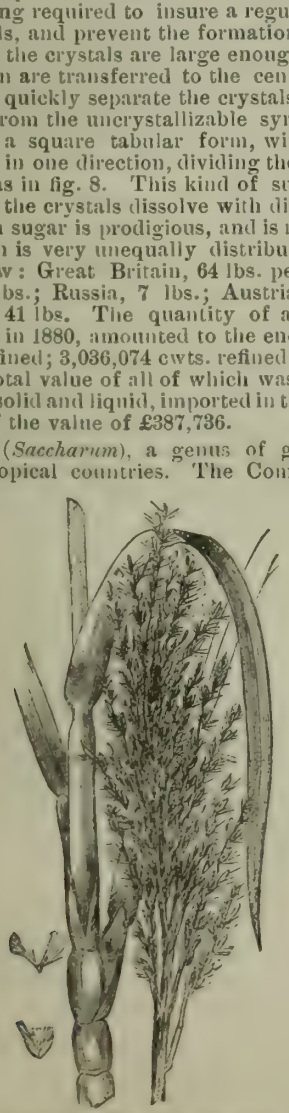
The syrup which drains from refined sugar is reboiled, and constitutes the *Golden Syrup* of the shops.

Crystal Sugar.—In making the sugar crystals, all the processes are carried on as in refining, until the syrup is clarified. Then it is boiled or concentrated in a vacuum-pan of larger size than ordinary, and the concentration is carried on until minute crystals appear. Fresh syrup is then added from time to time, great care and experience being required to insure a regular feeding of the first-formed crystals, and prevent the formation of a second crop. When the crystals are large enough, the contents of the pan are transferred to the centrifugal machines, which quickly separate the crystals in a perfectly dry state from the uncrystallizable syrup. The crystals are of a square tabular form, with a deep groove across in one direction, dividing the crystal into equal parts as in fig. 8. This kind of sugar is much liked for coffee, &c., but the crystals dissolve with difficulty.

Fig. 8.

The commerce in sugar is prodigious, and is rapidly increasing; but its consumption is very unequally distributed. The proportions are as follow: Great Britain, 64 lbs. per head; France, 4 lbs.; Belgium, 6 lbs.; Russia, 7 lbs.; Austria, 1½ lbs.; United States of America, 41 lbs. The quantity of all kinds imported into Great Britain, in 1880, amounted to the enormous sum of 17,001,613 cwts. unrefined; 3,036,074 cwts. refined; and 211,541 cwts. of molasses; the total value of all of which was £23,368,823. Besides, the glucose, solid and liquid, imported in that year, amounted to 405,760 cwts., of the value of £387,736.

SUGAR-CANE (*Saccharum*), a genus of grasses, natives of tropical and sub-tropical countries. The Common S. (*S. officinarum*) is originally a native of the East Indies, was brought to the south of Europe by the crusaders, and in the 15th and 16th centuries found its way into all the European colonies within the tropics. In Europe the cultivation of the S. has always been very limited, and is scarcely practised except in Sicily and Andalucia. In China, it extends to 30° N. lat., and in North America to 32°; in the southern hemisphere only to 22° S. lat. The plant is a perennial, with a creeping root, sending up a number of culms or stems generally 8—12 feet high, which have many joints, are of various colors, and about 1—2 inches thick. They are filled for about two-thirds of their length with a loose, sweet, juicy pith. The leaves are ribbon-shaped, and 4—5 feet long, with a strong whitish middle nerve. The flowers are in great diffuse pyramidal panicles of a yard in length.—The Violet-colored S. (*S. violaceum*) is particularly esteemed, and much cultivated in the West Indies.—The Chinese S. (*S. Sinense*), cultivated in China, has the stem in great part covered with the sheaths of the leaves. Cultivation has produced many varieties of these species; if, indeed, they are originally distinct species, and not themselves mere varieties.—The species of *Saccharum* are numerous; they contain much silica in the rind, and some of them are much employed in India for thatching and for making mats, as well as for screens and light fences. The Bengalese make their pens of the hollow stems of *S. semidecumbens* and *S. fuscum*.



Sugar-cane (*Saccharum officinarum*).

The S. is usually propagated by cuttings. For this purpose the top joints are used. The cuttings are planted in rows three or four feet apart, and at intervals of about two feet in the rows. The largest varieties, in rich moist soils, attain a height of 20 feet; but in dry poor soils, the height is sometimes scarcely more than 6 feet. The plant *tillers* like wheat, but not to the same degree. The cane-ground is kept clean by hand-hoeing, or by the plough. Hand-hoeing was formerly universal in the West Indies, but the plough is now very generally used where the nature of the ground permits. The best varieties are ready for cutting in about ten months from the time of planting, but other varieties require a longer period of growth, from 12 to 20 months. When the canes are fully ripe, they are cut a little above the ground, and tied in bundles to be conveyed to the mill. Fresh canes, called *rattoons*, spring from the root, so that the plantation does not require to be renewed for several years; but the canes of the first crop are the largest and a gradual decrease of size takes place. The ordinary practice on sugar estates is to renew a part of the plantation every year.

The name CHINESE SUGAR-CANE is sometimes given to the SHALOO or SUGAR-GRASS (*Sorghum saccharatum*), already noticed in the article DURRA. A still more important sugar-yielding grass is the ordinary maize or Indian corn. The sorghum became known in America in 1857, and has latterly been extensively cultivated for producing syrup. It has long been known that sugar could also be obtained from the stalks of maize; but neither sorghum sugar nor maize sugar could till lately be made so as to compete commercially with the produce of the sugar-cane. Recently, however, an American gentleman—Mr. Stewart of Murraysville, in Pennsylvania, has discovered a method of obtaining from both sorghum and maize crystallized sugar equal to the best kinds known. The processes are somewhat simpler than those in use for the sugar-cane, and are more economical than those employed in making beet-sugar. The quantity is also abundant. It has been calculated that, on an average, one acre of maize may yield 1800 pounds of sugar and 44 gallons of molasses; and that the yield of sugar from one acre of maize will give as good a profit as could be got from thirty acres of wheat. (See report of Mr. Drummond, British Secretary of Legation at Washington in 1878.) Two per cent. of the area now given to maize would serve to supply the enormous demand for imported sugar in the United States. It is therefore easy to see how great would be the effect produced in the sugar-trade of the world if the United States were to utilize for their own use, as they may now easily do, their own sugar supplies; still more if they should become a sugar-exporting country.

SUGAR-OF-LEAD, the common name for Acetate of Lead. See LEAD.

SUHL, a town of Prussia, province of Saxony, and government of Erfurt, is situated on a small stream, called the Lauter, in a romantic valley on the south-west side of the Thuringian Forest, 32 miles south-south-west of Erfurt. The name S., which in the Sorb-Wendish dialect means salt, is probably derived from the salt springs, formerly much worked. Mining is extensively carried on in the neighborhood, and has been so for centuries. The principal manufactures are iron and steel wares, chemical preparations, paper, and leather. S., celebrated in the days of chivalry as the 'Arsenal of Germany,' still maintains its ancient reputation as a manufactory of arms. Pop. (1880) 19,937. Its history is very interesting; see Werther's *Sieben Bücher der Chronik der Stadt Suhl* (1817).

SUHM, PETER FRIDERIK, a Danish historian, was born in Copenhagen, 18th October 1728, of an ancient and noble family, and was sent to the university of Copenhagen, where he gradu-

ated in law in 1748. A few years later, he went to Norway, for the sake of prosecuting his studies in philology and history, in conjunction with the learned historian Schöning, and did not return till 1765 to Copenhagen, where he continued to reside till his death in 1798. Among his numerous works on the early mythical and political history of Denmark we may instance the following: *Forsoeg til Forbedringer i den gamle danske og norske Historie* (1757); *Om de nordiske Folks ældste Oprindelse* (1770); *Om Odin og den hedenske Gudelære* (1771); *Critisk Historie af Danmark i den hedenske Tid*, i.—iv. Band (1774—1781); *Historie af Danmark*, 1*ste Tome* (1782). Besides numerous other historical essays, moral treatises, poetic compositions, contributions to the philosophical and literary periodicals of Germany, France, and Denmark, &c., he edited *Scriptores Rerum Danicarum Medii Ævi*, from vol. iv. to vol. vii. inclusive (Hafniæ, 1776—1792), and took upon himself the cost and supervision of the publication of many remains of old northern literature.

S. was an indefatigable collector of rare and curious books; and in 1796, in return for a pension from the government, he made over to the Royal Library of Copenhagen his valuable library of 100,000 volumes, to which he had previously allowed the public access. After the death of his only son, he devoted the greater part of his ample means to the purpose of having copies made of the more valuable MSS. in the collection, many of which were, moreover, printed at his sole charge; besides which, he founded scholarships, and afforded direct pecuniary assistance to many poor students and learned men. He died in 1798. S.'s collective writings were brought out by S. Poulsen, in 16 vols., between 1788—1799; and various editions of his lesser works have at different times appeared in Germany, as well as in Denmark, where he is justly regarded as one of the most learned and laborious and patriotic writers of his country.

SU'ICIDE (Lat. self-murder) is a heinous crime, by the law of the United Kingdom, though it was treated as venial by the Roman law, and was the subject of panegyric by Stoic philosophers. The law of England treats it as a felony, and hence there may be accessories to it, so that if A persuade B to kill himself, and B does so, A is guilty of murder. Suicide, or *felo de se* (q. v.), not only includes one who deliberately kills himself, but also one who in maliciously attempting to kill another is himself killed. If A, however, requests B to kill him, and B does so, A is not a *felo de se*, though B is a murderer. If A and B mutually agree to commit suicide together, and in the attempt one only dies, the other is guilty of murder. When it is said that a man was a suicide, this implies that he was in his senses, for otherwise he committed no crime; hence an insane person, unless when in a lucid interval, cannot commit the crime. The punishment inflicted on a suicide consisted, formerly, in an ignominous burial in the highway, with a stake driven through the body, and without Christian rites; also the legal consequence was forfeiture of the goods and chattels to the crown. The only consequences now are forfeiture of goods.

An act of 1824 permitted burial in churchyards without rites, between 9 and 12 P.M.; the Interments (Felo de se) Act of 1882 sanctioned burial at any hour, and with the usual rites. An attempt to commit suicide is not punishable like an attempt to murder a third party, nevertheless it is a misdemeanor. The consequences of suicide on the contract of life-assurance are generally guarded against by an express stipulation, that if the assured die by his own hand, the policy shall be void; and it has been held by the courts that the policy is forfeited, even though the party destroyed himself in a fit of frenzy or delirium.

There are, no doubt, even in modern times, some who hold the theoretical opinion that suicide is permissible in certain circumstances; but in regard to those who have actually committed or attempted the crime, there has almost always been detectable evidence of cerebral changes; or, at all events, of that irritation and excitement which initiate and accompany molecular disorganization of the nervous structure. In short, suicide, as a rule, is a symptom of some form of insanity, permanent or temporary, in which the emotions and passions are excited or perverted. Suicide is likewise a concomitant of certain bodily diseases; for example, of dilatation and fatty degeneration of the heart, of blood-degeneration, of affections of the intestinal mucous membrane, of the uterus, and of the brain and nervous matter; and it may be regarded as a frequent sequence of the melancholic, the morose, and hypochondriacle temperament. It has appeared as an epidemic; it has been observed as a hereditary tendency in certain families; and as a tendency more frequently exhibited by males than females; more frequently by the educated and affluent than by the industrial and ignorant classes; most frequently in large cities; and as directly engendered by luxury, political agitation, gambling, intemperance, and demoralization. It would appear, however, that indulgence and asceticism, riches and extreme poverty, claim nearly an equal number of victims. It has been calculated that twice as many artisans commit suicide as laborers.

In 1840, it was found that in every 10,000 of the population, 1·33 masons, carpenters, butchers; 7·43 tailors, shoemakers, bakers; 4·9 bankers, professionals; 2·0 of persons assured in Equitable Office; 7·8 dragoons; 6·7 servants and coachmen; 4·0 paupers, died by their own hand. Observation has shown that from 20 to 35 is the most influential age in inducing the suicidal tendency; and the age appears to determine, to a certain degree, the modes of death selected as well as the proclivity. As might be expected, the nature of the delusion, the accessibility of the means, imitation, the profession or pursuit of the individual, novelty, and notoriety, all influence the choice of the instrument or means of death. The theomaniac dies by crucifixion; the great majority by ropes, rivers, wells, razors, arsenic; the medical man by aconite, chloroform. Even sex is characterized by peculiar preferences. Females seek voluntary death according to the following order of the means—hanging or strangulation, abstinence, precipitation, drowning, cutting, poison; males, again, according to this order —cutting, shooting, hanging, poison, drowning. Race, climate, country, and the distinguishing polity of different societies to a certain extent affect the proportion of suicides to the population. In the kingdom of Sweden, there is calculated to be one suicide to every 92,375 inhabitants; in Saxony, 1 to 8446; in Russia, 1 to 34,246; in the United States, 1 to 15,000. In Paris, 1 suicide occurs in 2700; in St. Petersburg and London, 1 in 21,000 citizens. Middlesex, again, is the most prolific of all English counties; Chester least so: there being in the former, 10·5, in the latter, 7·2 to 100,000 people. In all England, the proportion is 7·4.—*Anatomy of Suicide*, Forbes Winslow; *Du Suicide*, Brièrre de Boismont; *Traité du Suicide*, Bertrand; *Suicide*, by Morselli (Lond. 1881); *Suicide: Studies on its Philosophy, its Causes and its Prevention*, by O'Dea (New York, 1882).

SU'IDÆ, a family of Mammalia, non-ruminant Artiodactyla (q. v.), having the feet generally four-toed, the hinder feet sometimes three-toed; the toes hoofed, the two front toes forming the principal part of the foot, the others smaller and scarcely touching the ground; the snout abruptly truncated, mobile, muscular, and sensitive, but not elongated into a proboscis; the tail short, or almost wanting; the incisor teeth variable in number, the lower ones all directed forwards, the canines projecting, and bent upwards; the stomach little divided. To this family belong hogs, wart-hogs, peccaries, &c.

SUIDAS, the name given to the compiler of a *Lexicon* some time during the Byzantine Empire. When he lived, or who he was, or whether he was even called S., no one can say; but it is customary to place him about the 10th or 11th century. The *Lexicon* bears unmistakable evidence of having gone through many hands; and though we can fix the date when several of the articles *must* have been written, it is impossible to ascertain whether they are the composition of the first compiler or of a later editor. The work is a sort of cyclopædia, giving an explanation of words, and notices of persons, places, &c., in alphabetical order. It is utterly destitute of literary or critical merit, but is valuable in the eyes of scholars on account of its numerous extracts from ancient Greek writers, grammarians, scholiasts, and lexicographers, whose writings in many cases have perished. The first edition appeared at Milan (1499); since then the best editions have been those of Küster (Camb. 3 vols. 1705), Gaisford (Oxf. 2 vols. 1834), Bernhardy (Halle, 2 vols. 1834), and J. Bekker (Berl. 1854).

SU'I JU'RIS, in the Roman law, the condition of a person not subject to the *Patria Potestas* (q. v.). The paterfamilias was the only member of a family who was *sui juris*, all the rest being *alieni juris*, including sons, unmarried daughters, the wife, and the wives and children of the sons of the paterfamilias. A daughter, on her marriage, passed into the family of her husband; but a son did not become *sui juris* by marriage. A son or unmarried daughter became *sui juris* on the death of the paterfamilias. In his father's lifetime, a son could only become *sui juris* by emancipation. The laws of the Twelve Tables declared that a son three times sold by his father should be freed from his power; and the ceremony of emancipation was of the nature of a fictitious sale gone through three times, in order to liberate the son from parental control. *Connubium* being the foundation of the *patria potestas*, a bastard was *sui juris*.

SUIR, a river of Ireland, rising in the north of the county of Tipperary, flows south through that county by the towns of Thurles and Cahir. Ten miles south of Cahir it bends eastward, forming the boundary of Tipperary and Waterford, and passing by Clonmel and Carrick. It then passes out of Tipperary, and meeting the Barrow at Passage, Waterford, falls into the sea in Waterford Haven, after a course of about 100 miles. It is navigable by barges as far as Clonmel.

SUIT IN CHANCERY was the process corresponding to an action in a court of law. The suit generally commenced with a bill, i. e., a petition to the Lord Chancellor, which set forth the grievance, with a prayer for redress. It was signed by counsel, and was served on the defendants, either personally or at the

dwelling-place. They had then to enter appearance, and put in either an answer or a demurrer, or a plea, which were the several defences to the suit, according to the nature of the subject-matter. Since 1876, all suits have been called actions, but the procedure is not much changed. An appeal lies from the Chancery division of the High Court to the Court of Appeal, and finally to the House of Lords.

SUL, Rio Grande do. See Rio Grande do Sul.

SULIMA'N MOUNTAINS, a mountain range upwards of 350 miles in length, running from north to south, and forming the boundary between Afghanistan and the Punjab. In lat. about 33° 20′, it throws off the lateral branch of the Salt Range (q. v.). The highest summit of the range is Tacht-i-Suliman (Solomon's Throne), 11,000 feet high, and covered with snow for three months of each year.

SULI'NA, one of the lower branches of the Danube (q. v.), flows through the middle region of the delta of the great river, and enters the sea at about the same distance from the Kilia mouth on the north and St. George's mouth on the south. It is the smallest outlet of the Danube, and conveys only $\frac{8}{17}$ths of the main river to the sea; but its channel through the bar that lines the coast is deeper than that of the other mouths, and therefore the S. is more frequented by vessels than any other branch of the Danube.

SU'LIOTS, a tribe who inhabited the valley of the Acheron, in the pashalik of Janina (*Epirus*) in European Turkey, are a mixed race, being partly of Hellenic and partly of Albanian origin. They are the descendants of a number of families who fled from their Turkish oppressors to the mountains of Suli (whence they derive their name) during the 17th century. In this obscure corner of the Turkish Empire they prospered, and towards the close of the 18th c., numbered 560 families, inhabiting 90 hamlets. For about 15 years they heroically resisted the encroachments of Ali Pasha (q. v.) of Janina upon their independence, the very women taking part in the strife. Vanquished in 1803, they retreated to Parga, and afterwards to the Ionian Islands, where they remained till 1820, when their old oppressor, Ali Pasha, finding himself hard pressed by the Turks, invoked their aid, offering them guarantees for his faith, and his grandson as a hostage.

Eager to return to their cherished home, they accepted these terms, and under Marcos Bozzaris (q. v.), maintained a long and desperate conflict with the Turks, but were ultimately forced again to flee from their country, and take refuge to the number of 3000 in Cephalonia, though a large remnant preferred to skulk in the neighboring mountains. Though they took a glorious part in the war of Greek independence, their country was not included by the treaty of 1829 within the Greek boundary-line; but most of them established themselves in Greece, where their leaders were raised to important offices. The old seat of the S. lies in the portion of Epirus which the Berlin Congress of 1878 recommended to be restored to Greece—a recommendation not carried out at the rectification of the Greek frontier in 1881.—See Perrhaebos's *History of Suli and Parga* (1815; trans. 1823).

SU'LLA, L. Cornelius, surnamed by himself Felix, the ablest Roman after the younger Scipio until the appearance of Julius Cæsar, was born 138 B.C. His family was a member, but not a distinguished one, of the Cornelian *gens*, or 'clan.' In 107 B.C., he was elected quæstor, and sent to Africa with the cavalry that the consul Marius (q. v.) required for prosecuting the Jugurthine War. He rapidly acquired a brilliant reputation as an officer, and crowned a series of important services by inducing Bocchus, the Mauritanian king, to surrender Jugurtha, whom he brought in chains to the Roman camp (106 B.C.). Marius was not over well pleased at the distinction achieved by his subordinate. In the campaigns that followed (104—101 B.C.) against the Cimbri and Teutones, S.'s reputation continued to rise, although Marius was still regarded (and with justice) as the first general of the state.

For several years after the destruction of the barbarians, S. lived quietly, taking no part in public affairs; but in 93 B.C. he stood for the prætorship, and won it by a liberal distribution of money among the people. Next year, he was sent to Cilicia as proprætor, to replace Ariobarzanes on the throne of Cappadocia, from which he had been driven by Mithridates. On his return to Italy (91 B.C.), the long-smouldering animosity between Marius and him was on the point of bursting forth, but the terrible *Social War* forced all Romans to postpone their quarrels until the common danger had been averted. Both Marius and Sulla commanded armies in this great struggle; but the successes of S. threw those of Marius into the shade, and the mortification of his rival was deep and bitter. In 88 B.C., S. was elected consul along with Q. Pompeius Rufus, and the senate conferred on him the command of the Mithridatic War. But this was a command that Marius himself passionately desired, and when he heard that S. had obtained it, he rushed headlong into treason and civil war.

Here it may perhaps be necessary to observe that Marius and S. were not only personal rivals, but the leaders of opposite political parties. The former, a man of humble origin (see Marius), was a rough, stubborn, irascible, and alliterate *plebeian*; the latter a finely cultivated *patrician*, subtle and sagacious in policy, and winning in manners. In the terrible scenes that ensued, although S. showed himself by far the fiercer and more sanguinary of the two, it should not be forgotten that it was Marius who commenced the contest. Allying himself with the tribune P. Sulpicius Rufus, a political adventurer in difficulties, Marius placed himself at the head of the new Italian party, on which the rights of Roman citizenship had been conferred, and hoped to force the senate to recall the appointment of S. to the command of the expedition to the East. S. was compelled to flee to Nola in Campania, where his camp then was; but finding the soldiers full of enthusiasm, he resolved to lead them against the pseudo-government that had been established at Rome.

The story of the overthrow of the Marian party, the expulsion of Marius, and his subsequent wanderings in Africa, &c., are well known, and intimately as these events are inwoven with the fortunes of S., cannot be repeated here. Suffice it to say, that after settling affairs at Rome as well as he could, S. embarked for the East (87 B.C.), and was away for four years. Most of his fighting, however, was done in Greece against Archelaus, an ally of Mithridates, whom the latter repeatedly subsidized with men and money. Athens was stormed and plundered (86 B.C.), and Archelaus himself was defeated with frightful slaughter at Chæroneia in the same year, and again in the neighborhood of Orchomenos (84 B.C.). S. now crossed the Hellespont, crushed Fimbria, a general sent out by the Marian party (which, in S.'s absence, had again got the upper hand in Italy), forced Mithridates to sue for peace, and after extorting heavy contributions from the cities of Asia Minor, sailed for Italy, and landed at Brundusium in the spring of 83 B.C. Marius was now dead, but his party were strong in numbers, if not in organization; yet, before the close of 82 B.C., the Marian party in Italy was utterly crushed. In Spain, however, under the gallant and high-souled Sertorius (q. v.), it held out for ten years longer.

When S. felt himself master of the situation, his thoughts turned to revenge. Then followed the fearful period of the *proscriptions* (81 B.C.)—a virtual 'Reign of Terror' throughout Italy, the object of which was literally to extirpate the Marian party. In this, however, it was only partially successful; and the next generation saw that party rise to more splendid predominance than ever in the person of Julius Cæsar (q. v.), nephew of old Marius. In 81 B.C., S. got himself appointed dictator, an office which he held until 79 B.C. This period was signalized by his framing a series of laws—often spoken of collectively as the 'Sullan legislation'—the design of which was to make the senate and the aristocracy as vigorous and powerful as in the times of the Punic Wars, but which utterly failed of its end.

On resigning his dictatorship, S. retired to his fine estate at Puteoli, to enjoy at his ease those sensual pleasures to which he had been deeply addicted from his earliest manhood. Literature, wine, and women were luxuries in which he had always indulged, but now he wholly devoted himself to them—in a sort of *swinish* manner. It is strange to reflect that the man who undertook to legislate with the view of mending the public morals, should himself have surpassed in profligacy all his contemporaries. What more convincing proof could we have that morality in Rome had ceased to be more than a name! S.'s debaucheries hastened his end. He died 78 B.C., when only 60 years of age, of the disgusting disease known as *Morbus Pediculosus*.

SU'LLIVAN'S ISLAND, a large island, six miles below Charleston, South Carolina, U. S., between the harbor and ocean, the site of Fort Moultrie, now dismantled, and of the summer residences of the wealthy inhabitants. When Fort Moultrie was evacuated by Major Anderson, December 26, 1860, several batteries were erected on the shore of this island, bearing upon the channel and Fort Sumter.

SULLY, Maximilien de Bethune, Duke of, the celebrated minister of Henry IV. of France, was the second son of François, Baron de Rosny, and was born at Rosny, near Mantes, in 1560. The Rosny family, an offshoot from the great House of Flanders, was never possessed of much wealth or influence, and had severely deteriorated in both respects during the early religious wars. S. was at an early age committed to the care of Henry of Navarre, the head of the Huguenot party, which not only obtained for him an excellent education, but laid the foundation of a companionship which lasted, without intermission, till Henry's death. After narrowly escaping during the St. Bartholomew massacre, he accompanied his patron in his flight from court (1575), and during the civil war which followed, exerted himself to the

utmost, by daring valor in the field and otherwise, to serve the master for whom he cherished the most absorbing devotion.

After Henry's authority had been well established, S., who had for some years previous been his trusted adviser, became (1594) counselor of state and of finance. The financial affairs of the country were then in a frightful condition; from the chief of the department down to the very lowest country agent, the administration was an organized system of pillage, and but a small percentage of the taxes levied found its way into the imperial treasury. The Baron de Rosny was the very man to remedy this state of matters; rude, obstinate, and haughty, but at the same time resolute, active, indefatigable, wholly devoted to his master's interests; and backed by the influence of Gabrielle d'Estrees, and by Henry's own clear-sighted convictions, he cared nothing for the clamor and hatred of the court, which had largely profited by the former state of chaos. Not content with regulating the affairs of the revenue from the seat of power, he made a tour through the chief provincial districts, armed with absolute authority, personally examined the accounts, dismissed or suspended delinquents, and largely replenished the treasury with the ill-gotten wealth which he compelled them to disgorge. By indomitable perseverance, he little by little brought the affairs of the country into an orderly state; although in the diminution of the expenditure his efforts were by no means so successful, as the king, his mistresses, and the other companions of his pleasures, combined to oppose all retrenchment as far as they were concerned. In 1596, the disposable revenue of the state was 7—9 millions; in 1609, it was no less than 20 millions, with a surplus of 20—22 millions in the treasury, and the arsenals and fleet in a state of excellent equipment. S., however, was more than a mere financier; he had the supreme charge of various other branches of the administration, zealously promoted agriculture by diminishing the taxes of the peasantry, encouraging export trade, draining marshlands, and constructing numerous roads, bridges and causeways.

S. was the servant of the king and government alone, and was of necessity disliked by the people for his severity, by the Catholics for his religion, and by the Protestants for his invariable refusals to sacrifice the smallest jot of his master's or the country's interest for their sake. Accordingly, with the death of Henry, his career of supremacy was at once ended, and he was forced to resign the superintendence of finance, 26th January 1611, though he retained his other high offices, and was presented by Maria de Medicis with 300,000 livres as acknowledgement of his services. He had been created Duke of Sully and Peer of France in February 1606. S. wrote three treatises on war and police, which are lost, and two pieces of verse, which are extant; but the work which will ever be connected with his name is the *Mémoires des sages et royales Œconomies d'Estat de Henry le Grand;* a dull, wearisome, and disorderly collection of writings, but of priceless value to a historian of Henry IV.'s time. S. printed the first two volumes of the *Mémoires* at his own château of Sully in 1634, the third and fourth were published at Paris in 1662, and the whole has been several times republished, as well as translated into English, German, and Russian. S. died at Villebon, near Chartres, (Eure-et-Loir), 22d December 1641. Artists have generally represented S. as older than Henry IV., while in reality he was seven years younger.

SULMO'NA, or SOLMONA, a city of Southern Italy, province of Aquila, in Abruzzi. Pop. (1881) 17,600. It is situated in a vast fertile plain, watered by two rivers, and bounded by hills. It is very well built, having one very wide street in the center of the city. There is a handsome town-hall, a cathedral, and a convent dedicated to S. Pietro Celestino, built with stones from the ancient *Corfinium*. It has paper manufactories, dye-houses, and tan-yards. S. was the birthplace of Ovid. In the 8th and 9th centuries, it was sacked by the Saracens, but was restored under the Normans, and has ever since been a flourishing and industrious city.

SU'LPHATES. See SULPHURIC ACID.

SU'LPHIDES, METALLIC, formerly known as *Sulphurets*, are combinations of sulphur with a metal. Many of them occur native, and form highly valuable ores. They are all solid at ordinary temperatures, and, with the exception of those of potassium, sodium, calcium, strontium, barium, and magnesium, are insoluble in water; they are, moreover, conductors of electricity. Many of them, especially of those that occur native, exhibit very brilliant and characteristic colors. The same metal may have several sulphides, and in general there is a sulphide for each oxide. The sulphides are, however, sometimes the more numerous. Most of these compounds may be fused at a heat a little above redness, and if the air be excluded, the protosulphides (those containing one atom of sulphur and one atom of metal) remain unaffected; but many of the higher sulphides, such as the bisulphide of iron (FeS_2) and the bisulphide of tin (SnS_2), give off an atom of sulphur, and are reduced to protosulphides. If, however, there is a free admission of air or of oxygen gas to the heated sulphides, they are all decomposed, the sulphur becoming oxidized, and passing off as sulphurous acid (SO_2), while the metal usually remains in combination with oxygen. When heated before the blowpipe, most of the sulphides evolve an odor of sulphurous acid, and very small quantities of soluble sulphides may be detected in neutral or alkaline solutions by the addition of a solution of nitroprusside of sodium ($Na_2.Fe_2Cy_5NO_2 + 4Aq$), when a magnificent purple color, which, however, is not permanent, is evolved. It has very recently been discovered by Mr. Barrett, and announced in his paper 'On some Physical Effects produced by the contact of a Hydrogen Flame with Various Bodies,' in the *Philosophical Magazine* for November 1865, that the sudden appearance of a blue color when the hydrogen flame is brought in contact with a body containing sulphur, is a most delicate test for the presence of this element, detecting it even when the nitroprusside of sodium test fails. By this test Mr. Barrett detected $\frac{1}{100000}$th of a grain of sulphur.

The sulphides are prepared in various ways, of which it is sufficient to notice the most important. (1.) The protosulphides of the metals of the alkalies and alkaline earths may be obtained by decomposing their sulphates by igniting them in closed vessels with charcoal, the oxygen being removed in the form of carbonic oxide. (2.) Many of the metals, when heated with sulphur, combine directly with it; sulphide of iron, for example, is usually prepared in this manner. (3.) Hydrated sulphide of tin, titanium, molybdenum, tungsten, vanadium, arsenic, antimony, bismuth, copper, lead, mercury, silver, gold, and platinum with its allied metals, may be obtained by passing a stream of sulphuretted hydrogen through neutral or acid solutions of their salts, when they are precipitated in an insoluble form; and the hydrated sulphides of zinc, iron, manganese, cobalt, and nickel may be prepared by double decomposition, by mixing a solution of the salt of the metal with a solution of a sulphide of one of the metals of the alkalies, as, for example, sulphide of potassium: thus, sulphate of zinc, if mixed with sulphide of potassium, yields sulphate of potash, which remains in solution, and sulphide of manganese, which falls as an insoluble precipitate. 'In many cases,' says Professor Miller, 'the atoms of these hydrated sulphides are characteristic of the metal; for example, the hydrated sulphide of zinc is white; that of manganese, flesh red; those of cadmium, arsenic, and persulphide of tin are yellow; that of tersulphide of antimony is orange red; and that of the hydrated protosulphide of tin is chocolate brown. The sulphides of molybdenum, rhodium, iridium, and osmium are brown, each with its peculiar shade, whilst in a large number of instances—including the sulphides of iron, cobalt, nickel, uranium, vanadium, bismuth, copper, lead, silver, mercury, gold, platinum, and palladium—the precipitated sulphides are of a black, more or less pure.'—*Inorganic Chemistry*, 2d ed. 1860, p. 322. A recollection of the colors of these precipitates will save the young chemist a large amount of labor in testing for the presence of the metals.

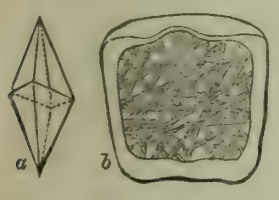
SULPHOCYA'NOGEN AND THE SULPHOCYA'NIDES. The former of these terms is given to a monobasic radical, C_2NS_2 or CyS_2, which has never yet been isolated, but which forms an acid compound, known as hydrosulphocyanic acid (H,C_2NS_2), with hydrogen, and yields numerous metallic salts. These salts, known as sulphocyanides, may be represented by the general formula, M,CyS_2, where M represents any metal. The sulphocyanides of potassium, sodium, and ammonium are crystallizable and soluble in water; those of the heavy metals are comparatively insoluble. These salts do not possess the poisonous character of the cyanides. *Sulphocyanide of potassium* (K,CyS_2) is anhydrous, but very deliquescent, and occurs in long streaked colorless prisms, somewhat resembling niter both in appearance and taste; it is extremely soluble in water, and fuses on the application of a gentle heat. The *sulphocyanide of mercury* is a white powder which possesses the property of swelling or growing in size to an almost incredible degree when moderately heated, so as to decompose it into a mixture of mellon ($C_{18}N_{18}$), with a little sulphide of mercury. The resulting mass often assumes a most fantastic shape, and is sufficiently coherent to retain its form; it is of a yellow color externally, but black within. It is this sulphocyanide which is the ingredient of the well-known toy known as 'Pharaoh's serpents.' Each serpent consists of a little cone of tinfoil, resembling a pastille in shape, and filled with the above-named compound. On lighting the cone at the apex, there begins to issue from it a thick serpent-like coil, which continues twisting and increasing in length to an extraordinary degree, the serpent-like shape resulting from the salt being burned in the tinfoil cone. The compound is readily obtained by precipitating a strong solution of pernitrate of mercury with sulphocyanide of ammonium, which is most cheaply prepared by Mr. Wood's method from bisulphide of carbon.

SULPHOVI'NIC or SULPHETHY'LIC ACID (HO,C_4H_5O,S_2O_5) is formed by mixing alcohol with an equal bulk of oil of vitriol. Great heat is evolved, and the two bodies enter partially

into combination; this new compound acid possessing only half the saturating capacity of sulphuric acid. In connection with the theory of the formation of ether from alcohol and sulphuric acid, it may be observed that this sulphovinic acid is developed as an intermediate product, if the temperature be raised to 212°, but not otherwise. This is one of the class of acids to which the term *vinic acids* is applied.

SU'LPHUR (symb. S, eq. 16—new system, 32—sp. gr. of rolled sulphur, 1·98 [see ATOMIC WEIGHTS], and of amorphous sulphur, 1·957; sp. gr. of vapor, 6·617 at 824°, and 2·2 at 1900°, atmospheric air being the unit of comparison for the vapor) is one of the most important of the non-metallic elements. At an ordinary temperature, it exists as a solid, brittle, tasteless, and inodorous body, of a characteristic yellow color, and insoluble in water. A piece of solid sulphur, heated to a temperature of 239°, fuses into a thin yellow liquid; while in closed vessels, it may, by a further heat, be distilled, the boiling-point being about 824°, and at this temperature it yields a deep yellow vapor, of sp. gr 6·617. When the sulphur-vapor comes in contact with cold air, it condenses in the form of a fine yellow powder, known as *Flowers of Sulphur*. If fused sulphur be rapidly cooled, it solidifies into a compact mass, of a granular crystalline texture; and if, in its liquid state, it be allowed to run into cylindrical wooden moulds, we obtain it in the ordinary form of roll-sulphur, or common brimstone; if, on the other hand, it be allowed to cool slowly, it crystallizes in long, glistening, deep, yellow, oblique prisms, with a rhombic base, which, however, soon lose their most characteristic properties. As native sulphur is frequently met with in yellow crystals, whose form is derived from the octahedron with a rhombic base, it is obviously a dimorphous substance.

It has been already stated that sulphur fuses at 239°; from that temperature up to 280°, it forms a yellow, transparent, limpid liquid; as the heat increases, the color becomes brown, and almost black, and the liquid becomes viscid, these changes being very distinctly seen at 350°. If the external application of heat be steadily continued, it will be found that for a while the temperature remains constant, but it afterwards rises, and at nearly 500°, the sulphur again liquefies, although less completely than when first melted. If it be now suddenly cooled by pouring it, in a slender stream, into cold water, we obtain a spongy, tenacious, and plastic mass, which may be drawn out into elastic threads, whose color, after they have cooled, varies from an amber to a deep brown color, according to the heat that has been employed. After some hours, the ductile sulphur loses its characteristic properties, increases in density, and returns to the brittle form; or, if it be heated to 212°, it suddenly returns to the brittle condition; the temperature rising to 230° during the change. Hence, sulphur may be obtained in three (if not in more) allotropic states, which are distinguished by the symbols $S\alpha$, $S\beta$, $S\gamma$. The first variety, $S\alpha$, is the native octahedral crystal of sulphur (*a*); it may be obtained artificially by dissolving sulphur in bisulphide of carbon, or chloride of sulphur, and submitting the solution to spontaneous evaporation. These crystals are semi-transparent, of an amber-yellow color, and undergo no change on exposure to the air. The second variety, $S\beta$, is the oblique prismatic crystal already described as being formed when fused sulphur cools slowly. The best method of obtaining these crystals is to melt a few pounds of sulphur, and allow it to solidify on the surface. On perforating the external crust with a hot wire, and pouring out the sulphur that remains liquid, the interior of the cavity is found to be traversed in all directions by these crystals (*b*), occurring as transparent brownish needles, having a specific gravity considerably less even than that of roll-sulphur. On exposure to the air, they soon lose their coherence, and form an opaque and crumbling mass, consisting of minute rhombic octahedra. This conversion of the prismatic into the octahedral form takes place immediately, if the prisms are immersed in bisulphide of carbon.



The third variety, S., is the plastic amorphous sulphur, which has been sufficiently described. If sulphur be frequently heated to 600°, and suddenly cooled, a black variety of this element is produced; and a red variety has been obtained, but the redness is now supposed to be due to the presence of a trace of some fatty body.

Sulphur is a bad conductor of heat, and the mere heat of a warm hand often causes it to crackle, and even to fall to pieces, from the unequal expansion. It is an insulator of electricity, and becomes negatively electric by friction. It is slightly soluble in alcohol, ether, and the fatty oils; its best solvents being the bisulphide of carbon and chloride of sulphur. When it is heated in the air, it takes fire at about 470°, burning with a blue flame, and becoming converted into sulphurous acid, whose pungent suffocating fumes are characteristic of sulphur. This element is second only to oxygen in its powerful affinity for other elements, with most of which it unites, and often in several proportions. With most of the metals it combines very readily, and in some cases, with a development of light and heat; thus, silver and copper burn in sulphur-vapor just as iron-wire or zinc-foil burns in oxygen. In consequence of its power, with the aid of heat, of forming sulphurous acid with the oxygen of the air, and thus rendering the latter incapable of supporting combustion, burning sulphur may be usefully employed for the extinguishing of fire—as, for example, in chimneys.

Sulphur occurs very widely distributed in the mineral kingdom, partly free and partly combined with other elements. The free sulphur is either found pure in regularly formed crystals, or intimately mixed with earthy matters. The principal sources of crystalline sulphur are Urbino in Italy, Girgenti in Sicily, and Radoboy in Croatia; while the earthy sulphur is mainly derived from Italy, Moravia, and Poland. Iceland is rich in both varieties, but the mineral wealth of that island remains almost unworked. At present, by far the greatest quantity of the sulphur employed in Europe comes from Sicily; and, as a general rule, it is abundant in volcanic districts. In the form of sulphide, sulphur occurs abundantly in combination with iron, copper (iron and copper pyrites), lead (galena), zinc (blende), &c., the bisulphide of iron (or iron pyrites) furnishing most of the sulphur that is employed in the manufacture of sulphuric acid. Sulphur is still more extensively distributed in the form of sulphates, the sulphates of lime, magnesia, baryta, &c., being abundant natural productions. In the vegetable kingdom, sulphur is a constituent (although only to a small amount) of the albuminous bodies which are so widely diffused in plants; and of certain volatile irritant oils, as those of mustard, garlic, asafœtida, &c.; and, moreover, the vegetable juices contain it in the form of certain sulphates. In the animal kingdom, it is not only a constituent of the albuminous, fibrinous, and gelatinous tissues, but of the hair, saliva, bile, urine, &c. The two animal substances in which it is most abundant are Cystin (q. v.), an occasional constituent of urinary calculi, and Taurine (q. v.), a constituent of the bile, in both of which it forms about a quarter of the entire weight.

It would be out of place in this article to enter into details regarding the *extraction* or *preparation* of sulphur. It is sufficient to state that the grosser impurities are removed by crude processes of fusion and distillation at or near the place from whence it is obtained. That which is imported into Britain undergoes further purification. What is called *refined sulphur* is that purified by distillation in a large cast-iron still, and condensed in a receiver kept cool. When the vaporized sulphur is condensed in a large chamber, it is obtained in the form of *sublimed sulphur*, or *flowers of sulphur;* but as the walls get hot it melts and collects on the floor, and is run into cylindrical wooden moulds, from which, when cool, it is taken out as *roll* or *stick sulphur*. The residue left in the retort is a mixture of sulphur with various impurities. Under the names of *Black Sulphur*, or *Sulphur vivum* (commonly inquired for at the chemist's under the title of *Sulphur of Ivy*), it is used in veterinary medicine, and for the purpose of dressing mouldy hops. Sulphur is thrown down from certain of its compounds (as from a strong solution of a polysulphide of calcium, sodium, or potassium) by dilute hydrochloric acid; it falls as a grayish-white, very fine, light powder, known in the Materia Medica as *milk of sulphur*, or *precipitated sulphur*. For the method of obtaining sulphur from iron pyrites, we must refer the reader to Miller's *Inorganic Chemistry*, 2d ed. p. 154. The proceeding is usually conducted on a large scale, 2000 tons of pyrites being roasted at once, the roasting extending over five or six months, and the final result being about 20 tons of sulphur. The most common impurities met with in ordinary commercial sulphur are selenium and realgar (bisulphide of arsenic). Flowers of sulphur frequently exhibit a slight acid reaction, in consequence of a little sulphurous acid clinging to them. By rinsing them with water, this impurity is at once removed.

Sulphur is extensively employed in the arts and manufactures; as in the manufacture of matches, gunpowder, &c. When converted into sulphurous acid, it is employed as a powerful bleaching agent, and also for the destruction of insects, fungi, &c.; but its chief consumption is in the manufacture of sulphuric acid.

The compounds of sulphur and oxygen are no less than seven in number, all of which present the character of acids. These acids have the following composition :

		Sulphur.		Oxygen.
Sulphurous acid	SO_2	16	:	16
Sulphuric acid	SO_3	16	:	24
Hyposulphurous acid	S_2O_2	32	:	16
Hyposulphuric acid	S_2O_5	32	:	40
Trithionic acid	S_3O_5	48	:	40
Tetrathionic acid	S_4O_5	64	:	40
Pentathionic acid	S_5O_5	80	:	40

The last five of these acids have never been obtained in the anhy-

drous form. We shall only notice the most important members of this group, viz., the first three of them, and of these, the second, *Sulphuric Acid*, is so extremely important, that it is discussed in a special article. (The last three derive the essential portion of their name from the Greek word *theion*, sulphur.)

SULPHUROUS ACID or SULPHUROUS ANHYDRIDE (SO_2), occurs under the ordinary relations of temperature and pressure as a colorless gas, possessing the suffocating odor of burning sulphur. In its concentrated form, it is quite irrespirable, and in a diluted state it excites cough, and produces the symptoms of an ordinary catarrh. It is not only incapable of burning, but it rapidly extinguishes the flame of burning bodies. It is very freely soluble in cold water, which at 32° takes up nearly 69 times its volume of the gas, while at 75° it only takes up 32 volumes; the solution known as *Aqueous Sulphurous Acid* having at first the same smell and taste as the gas, but soon absorbing oxygen from the air, and becoming converted into sulphuric acid. By the action of cold, sulphurous acid may be condensed to a colorless transparent limpid liquid, which freezes at —105°, forming a transparent crystalline solid.

The specific gravity of the gas is 2·247 (atmospheric air being the unit), and that of the liquid is 1·49 (water being the unit), the solid being considerably heavier. Although dry sulphurous acid gas and dry oxygen, when mixed, exert no action on one another, there are many conditions under which sulphurous acid rapidly absorbs oxygen, and is converted into sulphuric acid. It has been mentioned that this takes place if the gas be dissolved in water; a similar action takes place under the influence of hydrated nitric acid, iodic acid, and certain metallic oxides. For example, oxide of lead, when immersed in the gas, burns and is converted into white sulphate of lead ($PbO_2 + SO_2 = PbO,SO_3$). Hence, sulphurous acid is a powerful reducing or deoxidizing agent. This gas is a common and abundant product of volcanic action, and is occasionally met with in solution in the springs in volcanic regions. It may be prepared artificially by simply burning sulphur in the air or in oxygen gas, or by heating in a flask 4 parts of flowers of sulphur mixed with 5 parts of powdered black manganese, sulphurous acid and sulphide of manganese being the products, as shown by the equation $2S + MnO_2 = SO_2 + MnS$. In consequence of its solubility in water, this gas should be collected over mercury. In addition to the uses of sulphurous acid as a bleaching agent, it is valuable both as a disinfectant agent and as a powerful antiseptic; its latter property has been applied to the preservation of meat, which, after exposure to this acid, will keep fresh for years, if it be enclosed in metallic canisters filled with nitrogen, to which a little binoxide of nitrogen has been added, to remove any trace of oxygen. But by far its most important use is, as a first stage in the manufacture of sulphuric acid. In combination with bases, this acid forms the *sulphites*—a class of salts which, excepting the sulphite of soda, are of little practical importance, except for their power, when moist, of extracting oxygen, and thus acting as reducing agents. For example, the salts of the sesquioxide of iron are reduced by them to salts of the protoxide.

HYPOSULPHUROUS ACID (S_2O_2) as yet is only known in a state of combination with bases; for on attempting to separate the acid from the base, the former becomes decomposed into sulphur and sulphurous acid. The most important of its salts is the *Hyposulphite of Soda* ($NaO,S_2O_2 + 5Aq$), whose mode of preparation and characters are described in the article SODIUM. This and other soluble hyposulphites may be easily recognized by the facility with which they dissolve the haloid salts of silver, forming a solution of an extremely sweet taste, and containing a double hyposulphite of silver and soda, with an admixture of chloride, iodide, or bromide of sodium. It is this power of dissolving those salts of silver which are insoluble in water, that renders the hyposulphite of soda so important an agent in photography. The only other salt of this acid which we shall notice is the *Hyposulphite of Gold and Soda* [$AuO,S_2O_2,3(NaO,S_2O_2) + 4Aq$] which may be prepared by mixing concentrated solutions of 1 part of chloride of gold and 3 parts of hyposulphite of soda, and adding alcohol, when the required salt is precipitated. It is used for gilding the daguerreotype plate, and for coloring the positive proof obtained in photographic printing.

With hydrogen, sulphur forms two compounds, viz., *Sulphuretted Hydrogen*, or *Hydrosulphuric Acid* (q. v.), and *Persulphide of Hydrogen*, an oily liquid, having the smell and taste of sulphuretted hydrogen, and in many of its properties having an analogy to binoxide of hydrogen. Sulphur combines with carbon to form a *Bisulphide of Carbon* (CS_2), a very volatile colorless liquid, of a high refractive power, of an acrid and pungent taste, and a very disagreeable odor. It is heavier than water, in which it is insoluble, but dissolves freely in alcohol and ether, and is the best solvent for sulphur and phosphorus. Bisulphide of carbon does not occur as a natural product, but may be obtained by heating fragments of charcoal to bright redness in a porcelain tube, and passing sulphur vapor along it. Its vapor, when freely inhaled, exerts a similar anæsthetic action with those of chloroform and ether. Workmen in caoutchouc or other manufactures in which bisulphide of carbon is used as a solvent, suffer very much from prolonged exposure to its vapor, which produces headache, loss of appetite, impairment of vision and hearing, and causes general derangement of health by its deleterious action on the nervous system. Sulphur combines with chlorine in several proportions, the most important of these compounds being the *Subchloride of Sulphur* (S_2Cl) and the *Chloride of Sulphur* (SCl). Both of them are liquids, and are formed by the direct action of the combining elements. The subchloride is a yellow volatile liquid with a penetrating and disagreeable odor. When dropped in water, it sinks to the bottom (its spec. grav. being about 1·687), and is slowly decomposed into hydrochloric and various sulphur acids, and free sulphur. It is capable of dissolving about 67 per cent. of sulphur at an ordinary temperature, and, like bisulphide of carbon, is extensively employed in vulcanizing india-rubber. The chloride of sulphur is formed by saturating the subchloride with chlorine. It is a deep red liquid, resembling the previous compound in most of its properties. It is decomposed by the sun's rays into the subchloride and free chlorine.

With regard to the history of sulphur and its compounds, it may be observed that sulphur seems to have been known from the earliest times, and that sulphuric acid was most probably known to the Arabians. The manufacture of English sulphuric acid dates, however, only from the 18th century. Sulphurous acid was first investigated by Stahl, Scheele, and Priestley; hyposulphuric acid was discovered by Welter and Gay-Lussac; hyposulphurous acid, by Gay-Lussac and Herschel; trithionic acid, by Langlois; tetrathionic acid, by Fordos and Gelis; and pentathionic acid, by Wackenroder. Scheele was the first who accurately studied hydrosulphuric acid, or sulphuretted hydrogen.

Sulphur is used to a considerable extent and for very different purposes in medicine. It is given internally either as sublimed sulphur (flowers of sulphur) or as precipitated sulphur (milk of sulphur), in somewhat large doses, as a mild cathartic—its purgative effects being due to its stimulating the muscular coat of the intestines. In consequence of its being both gentle and sure in its action, it is the best purgative to employ in cases of piles or in stricture or other painful affections of the rectum. The only objection to its use is that, from its becoming partly converted in the system into sulphuretted hydrogen, the evacuations, and even the insensible perspiration, often become abominably fœtid, and continue so for some time after the primary operation of the medicine. As a purgative, the dose is about two drachms, made into an electuary with treacle or honey. It is, however, generally combined with jalap and cream of tartar.

The *Confection of Sulphur* of the Pharmacopœia is composed of sulphur, cream of tartar, and syrup of orange-peel rubbed together—the dose being from half an ounce to an ounce, or from one to two tablespoonfuls. In small doses, sulphur is of great value in cases of atonic gout and chronic rheumatism. An electuary known as *The Chelsea Pensioner*, consisting of two ounces of sublimed sulphur, one ounce of powdered rhubarb, half an ounce of resin of guaiacum, one ounce of cream of tartar, half an ounce of ginger, and two drachms of powdered nutmegs, with as much treacle as is necessary, in doses of one or two teaspoonfuls night and morning, is a combination of great value in these cases. It originally gained its reputation by curing Lord Amherst of rheumatism, and is still a favorite remedy at Chelsea Hospital. Dr. Neligan states that steaming the lower bowel, by sitting over the vapor of warm water upon which a tablespoonful of flowers of sulphur had been sprinkled, constitutes a most valuable remedy in what is popularly known as a 'fit of the piles.' The external use of sulpher in the form of ointment has been already noticed in the article ITCH. It is also used externally in many other cutaneous disorders, particularly in lepra and psoriasis; and in chronic cases, its application in the form of vapor is often of great service.

SULPHU'RIC ACID, or, more correctly, Hydrated Sulphuric Acid (SO_3,HO), is the chemical name of the liquid commercially and properly known as *Oil of Vitriol*.* It is a dense, colorless, oily liquid, without smell, of a spec. grav. of 1·846 at a temperature of 60°, and of an intensely acid taste and reaction. It has a powerful caustic action, and chars and destroys organic matters for its strong affinity for water; and in consequence of this destructive property, it must always be handled with the greatest caution. So powerful is this affinity, that if the acid be exposed for a few days to the air in a shallow dish, so as to present a large surface, it often doubles its weight by absorbing aqueous vapor from the air; and in consequence of its possessing this property, it is extensively used in laboratory operations as a desiccating agent. It mixes completely with water in all proportions, and as great heat is given out at the moment of mixture, the dilu-

* It received this name from having been first produced by the distillation of green vitriol (sulphate of iron); Basil Valentine being usually credited with the discovery. See ALCHEMY.

tion should be performed by very gradually adding the acid to the water. When cold, the mixture occupies less bulk than the two components previously occupied. This acid freezes at a temperature of —15°, and boils at 620° (or according to Marignac, at 640°), and just above the boiling-point, it assumes the form of a vapor, with a spec. grav. of 2·15. Oil of vitriol, or the protohydrate, is not the only hydrate of sulphuric acid. Three others are known to exist. When the fuming oil of vitriol of Nordhausen is exposed to a low temperature, a white crystalline substance separates, which is a hydrate, containing half as much water as the common liquid acid.

Its formula is $2SO_3.HO$, or $(SO_3)_2HO$. Its fusing-point is 95°. Then, again, a mixture of 49 parts of the strong liquid acid and 9 parts of water ($SO_3,2HO$) freezes at 47°, and crystallizes into splendid rhombic prisms, from which property it is often termed *glacial sulphuric acid*. It boils at 435°, and its spec. grav. is 1·780. Lastly, when a very dilute acid is concentrated by evaporation *in vacuo*, at 212°, till it ceases to lose weight, there will be a resulting compound, consisting of 40 parts of the real acid, and 27 of water, and represented by the formula, $SO_3,3HO$. It boils at 348°, and its spec. grav. is 1·602. There are thus no less than four hydrates of sulphuric acid—viz. (1) the dihydrate, $2SO_3.HO$; (2) the ordinary protohydrate, $SO_3.HO$; (3) the bihydride, $SO_3.2HO$; and (4) the terhydrate $SO_3,3HO$. The compound formerly known as *anhydrous sulphuric acid* possess none of the characteristic properties of an acid. See SULPHURIC ANHYDRIDE; also CHEMISTRY.

Sulphuric acid in its free state is a very rare natural product; although, in combination with bases, it is common in the animal and vegetable, and abundant in the inorganic kingdom. The only cases in which it is known to occur free are certain American rivers, especially the Rio Vinagre, and some lakes in Tennessee and in Java; and it has been found to be a normal constituent of the saliva of *Dolium galia*, a species of snail found in Sicily. In all these cases, the acid is, of course, in an extremely diluted form. In plants, it exists in the juices, and in animals in the blood and its derivates chiefly in the form of sulphates of the alkalies; while in the mineral kingdom it occurs as gypsum (sulphate of lime), heavy spar (sulphate of baryta), celestine (sulphate of strontia), &c.

Sulphuric acid may be prepared on a small scale by boiling sulphur in *aqua regia*, or in nitric acid, the sulphur becoming gradually oxidized into sulphuric acid. As a general rule, however, the commercial acid is employed even for laboratory experiments. See below.

In order to obtain the acid in a pure form, suitable for medical use or medico-legal analyses, it must be redistilled with sulphate of ammonia in a retort containing a few slips of platinum foil, the first and last portions being rejected. The distillation is attended with violent concussions, partly owing to the high specific gravity of the acid, and partly owing to its high boiling-point, and this convulsive action is moderated mechanically by the platinum slips. Sulphuric acid thus prepared according to the directions of the British Pharmacopœia may be regarded as perfectly pure, presuming arsenic is not present. Strong sulphuric acid has comparatively little action on the metals except at a high temperature, when it dissolves them, and, at the same time, undergoes partial decomposition; the metal being oxidized by a portion of the acid which becomes decomposed into oxygen and sulphurous acid, and then uniting with a portion of undecomposed acid to form a sulphate. Silver, copper, mercury, arsenic, antimony, bismuth, tin, lead, and tellurium are thus acted on. Gold, platinum, rhodium, and iridium are not affected by the acid even at a boiling temperature. The more oxidisable metals, such as zinc, iron, nickel, and manganese, are readily soluble in the dilute acid, water being decomposed, and hydrogen liberated, while the oxygen of the water unites with the metal; and the metallic oxide, at the moment of its formation, combines with the sulphuric acid to form a sulphate.

The *sulphates*—or salts formed by the combination of sulphuric acid with a base—are generally composed, as in the case of green vitriol (FeO,SO_3+7Aq), of 1 equivalent of acid and 1 of metallic oxide, with or without water of crystallization. With the alkalies, this acid also forms acid salts, as bisulphate of potash, and in a few cases, copper, for example, it forms basic salts. The insoluble sulphates, such as that of baryta, may be obtained by precipitating a soluble salt of the base by a soluble sulphate; thus, nitrate of baryta and sulphate of soda yield an insoluble sulphate of baryta and nitrate of soda, which remains in solution. The soluble sulphates may be prepared by dissolving the oxide or carbonate in dilute sulphuric acid, in those cases in which the metal itself is not readily attacked by the acid. Sulphuric acid and the soluble sulphates are easily detected by their yielding, with a solution of a baryta salt, a white precipitate of sulphate of baryta insoluble in acids.

This acid is employed in the arts and manufactures for a large number of purposes. Its use as a desiccating agent for laboratory purposes has been already noticed, and its application to the development of oxygen gas has been described in the article on that element. But its greatest consumption, doubtless, is in the preparation of the *Salt-cake*, which is used in the manufacture of Carbonate of Soda (q. v).

In medicine, a *dilute sulphuric acid*, formed by gradually mixing three fluid ounces of the strong purified acid with thirty-five fluid ounces of water, or *aromatic sulphuric acid* (known also as *elixir of vitriol*), prepared by mixing three ounces of sulphuric acid with a quart of rectified spirit, adding cinnamon and ginger, digesting for a week, and filtering, are almost always employed. In doses of from ten to thirty minims, properly diluted, these preparations exert a strong astringent power, and are serviceable in all forms of passive hæmorrhages, and in checking inordinate discharges when they arise from debility. In ordinary diarrhœa, and even in the premonitory diarrhœa of cholera, dilute sulphuric acid is of great use. In painters' colic, it is given in order to convert any lead that is absorbed into an insoluble sulphate, which is inert. Sulphuric acid lemonade is also used as a prophylactic against the disease. As this acid exerts a deleterious action on the teeth, it should be directed to suck it through a quill. In some cases, it is prescribed not so much for its specific as for its solvent power; with this object, it is usually prescribed with quinia. The strong acid is used in surgery as a caustic. In cases of *poisoning* with this acid, the most prominent features are: burning pain extending from the mouth to the stomach, intense pain in the bowels, vomiting, great prostration, coldness of the surface, and fœtor of the breath. The mucous membrane of the parts injured by the acid is at first converted into a white slough, which soon becomes black, and the patient usually dies from exhaustion within twenty-four hours. The best antidotes are the alkaline bicarbonates, or carbonate of magnesia. If the primary symptoms be conquered, the patient often dies subsequently from stricture of the œsophagus.

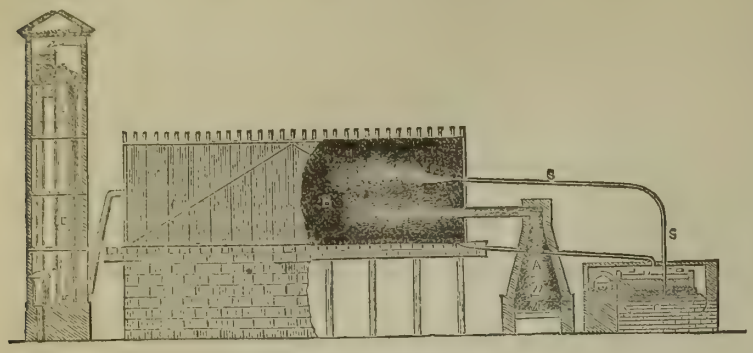
Sulphuric Acid Manufacture.—There are two distinct processes by which sulphuric acid is at present prepared on a large scale—viz., by the distillation of green sulphate of iron—the original process of Valentine; and by the oxidation of sulphurous acid through the agency of nitrous acid and hyponitric acid. The first process is chiefly employed at Nordhausen, in Prussia, and is thus described by Fownes: 'The sulphate of iron, derived from the oxidation of iron pyrites, is deprived by heat of the greater part of its water of crystallization, and subjected to a high heat in earthern retorts, to which receivers are added as soon as the acid begins to distil over. A part gets decomposed by the very high temperature; the remainder is driven off in vapor, which is condensed by the cold vessel containing a very small quantity of water or common sulphuric acid. The product is a brown oily liquid of about 1·9 specific gravity, fuming in the air, and very corrosive. It is chiefly used for the purpose of dissolving indigo.'

The second method is that universally followed in Great Britain, the germs of which were likewise discovered by Valentine. He observed that when the fumes of burning sulphur were collected under a bell jar, slightly moistened with water, a small quantity of liquid was deposited. This liquid, which was simply sulphuric acid, on being concentrated from its solution by boiling, was long sold as oil of sulphur *per campanum* at prices as high as 2*s*. 6*d*. per ounce.

About the year 1740, the French chemists Lefevre and Lemery suggested that, by the use of nitre along with the sulphur, the operation might be conducted in close vessels, and a much greater quantity of acid might be produced. This idea was acted on in England by a Dr. Ward, who established works at Twickenham and Richmond, conducting his manufacture by burning the mixed sulphur and nitre in large stoppered glass receivers, into each of which a small quantity of water was first introduced. The substitution, by Dr. Roebuck of Birmingham, of lead chambers in place of the glass vessels, may be regarded as essentially the establishment of the process of manufacture followed at the present day. Dr. Roebuck established his first works at Prestonpans in 1749.

The first stage in the manufacture of sulphuric acid is the preparation of sulphurous acid by the burning of sulphur or of iron pyrites. Previous to the year 1838, Sicilian sulphur was almost exclusively used in the manufacture, but in that year, the very ill-advised establishment of a monopoly of the sulphur trade by the Sicilian government, and its consequent increase in price, diverted the minds of manufacturers to the employment of iron pyrites (sulphuret of iron), the use of which, as a source of sulphurous acid, was already not unknown. The monopoly was quickly abolished, on the representations of the English government, but not until it was demonstrated that the world was independent of Sicily both for sulphuric acid and sulphur. Iron pyrites is now much more used than sulphur, and the only hindrance to its universal adoption is the presence of foreign matter in the pyrites, the most deleterious being arsenical compounds; and it has hitherto been found impracticable to free the sulphuric acid wholly from the arsenious acid which consequently accompanies it. This renders the acid prepared from pyrites inapplicable for many purposes.

When sulphate is the material used for producing the sulphurous acid, it is burned in an oven or 'burner' (A) of brickwork, having a sole or bottom of iron, termed the 'burner-plate.' Under this, a small fire is at first lighted, which is allowed to go



Manufacture of Sulphuric Acid:
A, sulphur-burner, or furnace; B, lead chamber, shown in section at B'; C, steam boiler; D, leaden pan; E, coke tower; S, steam-pipe; *n*, niter pot.

out after the sulphur has ignited. A little above the sulphur, a small pot, called the niter pot, *n*, is either placed on a stand, or hung from the roof, filled with a quantity of either nitrate of soda or nitrate of potash, with sulphuric acid sufficient for its decomposition—8 or 10 lbs. of the niter, with 5 or 6 lbs. of sulphuric acid, being allowed for every cwt. of sulphur. The decomposition of the niter by the heated sulphuric acid, furnishes nitric acid fumes, which go over into the chamber along with the sulphurous acid. The sulphurous readily abstracts from the nictric acid the additional equivalent of oxygen required for its conversion into sulphuric acid, reducing the nitrous compound from nitric acid, NO_5, to nitrous oxide NO_2; the reaction being thus—$3SO_2 + NO_5 = 3SO_3 + NO_2$. Nitrous oxide in its turn quickly converts itself into nitrous acid, NO_4, by the abstraction of two additional equivalents of oxygen from the air that is constantly entering the chamber through the burners. Again, in the presence of moisture which is supplied by a jet of steam from the boiler C, sulphurous acid readily deprives the nitrous acid of two equivalents of oxygen, and thus forms two more volumes of sulphuric acid, and again liberates nitrous oxide; which is ready once more to seize upon the oxygen of the air, and would continue so acting and reacting *ad infinitum*, were it not carried forward and out by the chimney provided for the escape of the freed nitrogen.

The chamber is an immense box or room of lead, bound together with a strong framework of timber, and generally raised on arches several feet above the ground. Chambers vary in size from 60 to 140 feet in length, and from 20 to 40 feet in width and height. Curtains of lead proceeding alternately from the bottom to near the top, and *vice versâ*, are very frequently used; they serve to retard the progress of the gases, and thus insure the transformations desired. The floor of the chamber is covered with water, into which the sulphuric acid falls as it is formed; and when this solution attains a certain strength, it is tapped off for concentration. When the gases reach the chimney, on account of the reactions of the nitrous compounds already explained, a large amount of nitrous acid would not only be wasted, but would also be deleterious to the neighborhood, were steps for its recovery not adopted. This recovery is usually effected by means of a tower filled with coke, E, down which a constant stream of strong sulphuric acid trickles, the acid absorbing the nitrous fumes in their way upwards. Instead of a single chamber, curtained off or not as the case may be, sometimes three or five distinct chambers, connected by pipes, are employed, those communicating directly with the burners being termed working chambers, and the others receiving chambers, the last either acting as or communicating with a condenser or chimney.

When iron pyrites is used as the source of sulphurous acid, suitable burners are used. In England these are arched chambers about four feet each way, on plan with furnace-bars placed a little above the ground. There are also the necessary doors and air-holes. The pyrites is broken into pieces, and spread in layers on the bars, which are previously heated to redness, and the heat evolved by the burning sulphur is thereafter sufficient fuel for the fresh charges. The exhausted ore is frequently sufficiently rich in copper for its extraction; indeed, when there is not more than 2½ per cent. present in pyrites, it is now recovered.

In consequence of strong sulphuric acid absorbing both sulphurous acid and nitrous acid, the acid requires to be drained off from the chamber while the solution is comparatively weak, at which strength, viz., of a specific gravity of about 1·4, it is used for some purposes in the arts, under the name of 'Chamber Acid.' This is concentrated by evaporating, in lead pans, D, till it reaches the specific gravity of 1·6, then boiling in a platinum retort, on which strong acid does not act, even at high heat, or in large flint-glass retorts.

An important improvement has recently been introduced into the manufacture of sulphuric acid, by Mr. W. Glover of New-castle-on-Tyne. Instead of conducting the gaseous sulphurous acid from the sulphur or pyrites burners direct to the lead chamber, it is first passed through a 'Glover' or 'denitrating tower,' which nearly resembles in form and size the 'coke-tower' shown in the figure. This is packed openly with fire-brick or flints. On the top of it are placed two cisterns, one containing strong nitrated sulphuric acid from the coke-tower, and the other, the weaker 'Chamber Acid.' Both of these are allowed to flow down through the flints, and thus mixing, the strong acid becomes too weak to retain the dissolved nitrous fumes. As these fumes separate, they are carried away with the sulphurous gas from the pyrites burners into the lead chambers. By the use of the 'Glover tower,' the sulphuric acid is purified of nitrogen compounds; these are saved for use in the lead chamber; and the 'Chamber Acid' is concentrated to about 1·75 specific gravity, without the use of lead pans and coal.

The manufacture of sulphuric acid is a very extensive industry; immense quantities of it being consumed in the manufacture of soda, in that of bleaching-powder, in calico-printing and dyeing, and, in fact, in most chemical operations both in the manufactory and the laboratory. See Lunge's *Manufacture of S. A. and the Alkalies* (3 vols. 1879–81).

SULPHURIC ANHYDRIDE, formerly known as ANHYDROUS SULPHURIC ACID, is commonly represented by the formula SO_3, but there are good reasons for believing that it is a compound of two atoms of sulphur with six of oxygen. It is a colorless crystalline solid, which is tough and ductile, and can be moulded in the fingers like wax without injuring the skin. It liquefies at 65°, and boils at about 112°, forming a transparent vapor, if hot water be present. It unites with moisture when exposed to the air, and gives off dense white fumes. When thrown into water, the heat emitted is so great that it hisses as red-hot iron would do; and the solution has all the properties of ordinary sulphuric acid. It may be obtained by the distillation of fuming Nordhausen acid, when white fumes pass over in the cooled receiver, and solidify into a white silky-looking fibrous mass. It may be also obtained by the distillation of acid sulphate of soda ($NaO,HO,2SO_3$), after it has been deprived of its atom of water. It combines with sulphur, iodine, and hydrochloric acid; but both it and its compounds are of chemical interest rather than practical value. See CHEMISTRY.

SULPHURIC ETHER is a term commonly but improperly applied to ethylic, vinic, or ordinary Ether (q. v.). True *sulphuric ether*, known also as *sulphate of ethyl* ($2C_4H_5O,S_2O_5$), is an oily liquid, of burning taste and ethereal odor, resembling that of peppermint, of specific gravity 1·120 (while that of ordinary pure ether is 0·720), and almost incapable of being distilled without decomposition, as at a temperature of about 280° it resolves itself into alcohol, sulphurous acid, and olefiant gas.

In the article ETHER, reference is made to the anæsthetic properties of that compound. Dr. Richardson has discovered that local insensibility may be readily induced by the application to the skin of the finely divided spray of perfectly pure rectified ether, of specific gravity 0.723. The skin blanches in from half a minute to two minutes; and by following the knife with the spray, more than merely superficial incisions may be rendered painless. It has been successfully employed in amputations of fingers and toes, removal of tumors, opening of abscesses, removal of teeth, &c.

SU'LPHUROUS ACID some years ago became one of the most popular articles in our Pharmacopœia. This sudden popularity was mainly due to the researches of a Scottish provincial physician, Dr. Dewar of Kircaldy, who, from beginning his experiments on cattle during the period of the cattle-plague of 1866, extended them to other animals and to man, and obtained remarkably satisfactory results (see *Medical Times and Gazette* for 1867, vol. i., pp. 492, 548). There is, of course, nothing new in applying sulphur-fumes—which in reality are composed of suphurous acid gas—as a disinfectant. The classical scholar will recollect that Ulysses employed them to remove the unpleasant smell arising from the dead bodies of Penelope's murdered lovers. 'Bring brimstone, the relief of evils,' he exclaims, 'and bring me fire that I may sulphurize the house.'—Hom. *Od.* xx. 481, 482. It is also recorded by Ovid (*Fasti*, iv. 735) and other writers that the shepherds of Italy yearly purified their flocks and herds with 'the blue smoke of burning sulphur.' Professor Graham's remark, that of gaseous disinfectants, sulphurous acid (obtained by burning sulphur) is preferable, on theoretical grounds, to chlorine, and that no agent checks so effectually the first development of animal and vegetable life,

may be said to contain all that was known with regard to the medicinal value of this gas, till Dr. Dewar began his investigations. In his experiments in connection with the cattle-plague, he found that the most safe and convenient apparatus consists of a chafer two-thirds full of *red* cinders, a crucible inserted in the cinders, and a piece of sulphur-stick. A piece of sulphur as large as a man's thumb will burn for nearly twenty minutes, and will suffice for a cow-house containing six animals; and it appears undoubted that if there be due ventilation, this process may be performed four times a day for at least four months with positive advantage to the animals.

When this system had been efficiently carried out—and it has been largely tried by his friends—no case of illness, not to say of death, occurred. In Mr. Crookes's Report *On the Application of Disinfectants in arresting the Spread of the Cattle-plague*, that able chemist observed that 'the value of sulphurous acid in arresting the progress of the cattle-plague has been proved beyond a doubt by the experiments of Dr. Dewar, and my own results entirely confirm his.' His experiments in relation to the cattle-plague led Dr. Dewar to the further discovery of the value of sulpur fumigation in other departments of veterinary medicine. Peripneumonia, ringworm, mange, are amongst the diseases which rapidly disappear under its influence; and in the sudden undefined illnesses known in Scotland as 'drows' and 'towts,' to which most of our domestic animals are liable, sulphurous fumigation, if applied at the outset, rarely fails to cut short the attack.

In medical practice, there are three different forms, independently of the sulphites, in which sulphurous acid may be employed—viz. (1) As the sulphurous acid of the British Pharmacopœia, which contains 9·2 per cent. by weight, or about twenty times the volume of sulphurous acid gas dissolved in water; (2) in the form of spray, which escapes from the preceding compound under the action of an apparatus called a Spray-producer; and (3) as a gas evolved by sprinkling at intervals small quantities of 'flowers of sulphur' on red-hot cinders placed on a common shovel, resting on a stool in the middle of the room, or by burning bisulphide of carbon (*Lancet* for 1876, vol. ii., pp. 712, 811). A mixture of equal parts of sulphurous acid and water has been recommended in all cases of 'breaches of the skin,' as primary wounds (whether resulting from injuries or surgical operations), in ulcers, burns, bed-sores, chapped hands, chilblains, saddle-sores (whether of man or beast), sore nipples, and in cases of bruises, such as black-eye, &c. Moreover, in erysipelas, its soothing properties, if diluted with two or three parts of water, are very striking.

According to Dr. Dewar, the feverish irritability of young children is speedily relieved by dropping from time to time a few minims (5 to 30, according to age) of the acid on a few folds of muslin fastened on the breast: here, however, the action is not local, but is due to the evolution of the gas which is inhaled. Amongst the cases in which the acid is serviceable, when applied in the form of spray or inhaled as gas, are asthma, bronchitis, catarrh, croup, diphtheria, facial neuralgia, laryngeal affections, phthisis (at all events as a palliative), scarlatina, and typhoid. Dr. Dewar ascribes the healing action of sulphurous acid to its power of destroying fungi. That the acid has this power, we freely admit, but we cannot so readily admit the correctness of his view that all the diseases in which he has found it serviceable (including piles and chilblains) are dependent on fungous growths. Dr. Dewar reports a case of severe sciatica, in which immediate and perfect relief was afforded by the injection of an ounce of sulphurous acid in a breakfast-cupful of gruel into the rectum. There is one affection of this class, to which Dr. Dewar does not refer, in which it has been prescribed with advantage—viz., the form of gastric disorder in which *Sarcina Ventriculi* (q. v.) occurs in the vomited matter, the dose being half a drachm, largely diluted with water.

None of the *sulphites* or *hyposulphites* have as yet been introduced into the Pharmacopœia. We notice them here because their action is supposed to depend upon the liberation of sulphurous or hyposulphurous acid when the salt comes in contact with the acid juices of the stomach. It is mainly to Dr. Polli that we are indebted for the introduction of the sulphites and hyposulphites of the alkalies and alkaline earths (soda, potash, and magnesia) into medicine. From the year 1857 onwards, he for several years devoted almost all his time to the study of these agents. His labors are briefly summed up as follows by Dr. Sanson in an excellent Memoir on 'The Germs of Cholera, and the Means of their Destruction,' published January 22, 1868, in the *Medical Press and Circular*: 'It was found that animals could, without any apparent ill effects, swallow and absorb large doses of the sulphites. It was then observed that when the animals were killed, they long resisted the putrefactive process. Another series of experiments—and in this series 300 dogs were the basis of the deductions—showed that the sulphites exerted a prophylactic and curative power when septic poisons were introduced into the economy. Then, as regards the human subject, it was found that the stomach would tolerate large doses of the sulphites of soda or magnesia. They were tried in the various eruptive fevers, intermittent, diphtheria, typhus, typhoid, cholera and choleraic diarrhœa, pyæmia, puerperal fever, dissection wounds, malarial infection, &c. The records of cases treated in this way show an extraordinary amount of success.'

In a paper published by Dr. Polli himself in *The British Medical Journal* for November 16, 1867, he states that since the promulgation, in 1861, of his views regarding the therapeutic value of the sulphites, no less than 158 papers on the subject have appeared; and with the exception of five or six containing certain criticisms on his labors, 'all the remainder confirm, in the strongest terms, by many hundreds of detailed observations, the value of these remedies.' A scruple of the salt dissolved in a wine-glassful of water flavored with tincture of orange-peel, is the average dose, and it should be taken every four hours; and in some cases, as in typhoid, a grain of quinine may be advantageously added to each dose. Dr. Polli's directions for its use in the prevention and cure of cattle-plague are given in the *British and Foreign Medico-Chirurgical Review*, Jan. 1872, p. 266. In the hands of other physicians, however, sulphurous acid has not led to such remarkable results as those of Dr. Dewar; and although recognized as a valuable remedy in many diseases, especially those caused by parasites, it cannot be said to have shown the same extraordinary efficacy as he claimed for it.

In consequence of the powerful antiseptic properties of sulphurous acid, either in the form of gas or gaseous solution in water, and of the sulphites, these substances have been employed for the purpose of preserving meat from putrefaction. A joint of meat or a fowl submitted to a daily sulphur fumigation may be kept fit for use for many weeks. The bisulphite of lime has been found to be the most applicable of the various compounds of this class as a preservative; and Messrs. Medlock and Bailey have patented a method of preserving meat by means of a preparation of this salt. In hot weather, a few drops of a strong solution of this salt will serve to keep fresh a pint of soup, jelly, milk, &c. Dr. Dewar patented a method of preserving meats by sulphurous acid, or some of its compounds; but as yet the process has not come into extensive use.

SU'LTAN, or SULTAUN, an Arabic word, signifying 'mighty man,' and evidently closely connected with the Hebrew word *shalal*, to rule, is in the East an ordinary title of Mohammedan princes, and also used in private life as a title of courtesy for people of high rank. It is given, *par excellence*, to the ruler of Turkey, who assumes the title Sultan-es-Selatin, or Sultan of Sultans. It is also applied to his mother and daughters; the word in Turkish having no grammatical gender, and corresponding also to our princess. The wife of the S. is not now entitled to the epithet S. or Sultana.

SULU ISLANDS, an archipelago of above 60 islands in the Mindoro Sea, between the Philippines and Borneo (q. v.). Ca. gayan Sulu, the chief of the islands, 36 miles long and 12 broad, contains the town of Soong, the residence of the sultan of the group. See PHILIPPINE ISLANDS.

SU'MACH (*Rhus*), a genus of small trees and shrubs, of the natural order *Anacardiaceæ;* having small inconspicuous flowers in panicles or in corymbs; a 5-parted calyx, 5 petals, springing from beneath a large orbicular disk; 5 stamens; a 1-celled germen with three stigmas; the fruit a small, nearly dry drupe, with bony *putamen*. The species are numerous, diffused over almost all parts of the world, except its coldest regions and Australia; and some of them, on account of peculiar principles which they contain, are of importance in the arts and in medicine; some are remarkable for their poisonous properties.—VENETIAN S. (*R. cotinus*), known also as Wig S. or Wig Tree, is a native of the south of Europe and west of Asia, and is often planted in Britain as an ornamental shrub. It has simple leaves, and hairy corymbs of fruit, which have a sort of resemblance to periwigs. The wood dyes yellow; and, with the addition of other substances, green and brown, and is known in trade by the name of *Young Fustic*. It is largely imported into Britain. The bark is sometimes used as a substitute for Peruvian Bark. The leaves are astringent, and are used in dyeing Turkey Red. The root is also used in dyeing, and the whole plant is used in Italy for tanning, and is there called *Scotino*. The seed resembles the almond in flavor.

The very acid fruit of the ELM-LEAVED S. (*R. coriaria*)—a native of the countries around the Mediterranean, with pinnate leaves, not unfrequent in British shrubberies—has been used from the earliest times, as it still is by the Turks and Persians, as a condiment with different kinds of food. Both the seeds and the leaves are used medicinally, in the south of Europe and the East, as tonic and cooling. This species is also extensively used for tanning, particularly in Turkey and in Spain. The leaves and twigs are used for dyeing black, the roots and fruit for dyeing red, and the bark for dyeing yellow.—Similar to this in its properties and uses is the VIRGINIAN S., or STAG'S-HORN S. (*R.*

typhina), a native of almost all parts of North America, and common in British shrubberies, which has the branches curiously crooked, and covered, when young, with a soft velvety down. It has pinnate leaves, with numerous leaflets.—The SMOOTH-LEAVED S. (*R. glabra*), a very similar species, also North American, has very acid leaves, which are eaten by children, and are

Sumach (*Rhus cotinus*), showing leaves, flowers, and fruit.

used in domestic economy and in medicine on account of the malic acid which they contain. The bloom of the fruit is also very acid. This species is sometimes troublesome in North America, overrunning ground as a weed.

Of the acrid and poisonous species, the most important is the POISON OAK (*R. toxicodendron*) of North America, a shrub from one to three feet high, with leaves of three leaflets, and a milky juice, which becomes black on exposure to air. The leaves are used in medicine in cases of paralysis, amaurosis, and other nervous affections, as a stimulant of the nervous system, also in chronic rheumatism and obstinate eruptions; but are efficacious only when fresh, as the poisonous substance is volatile. Similar to this in properties are the POISON IVY, or POISON VINE (*R. radicans*), the POISON ALDER, POISON S., or SWAMP S. (*R. venenata*), also known as Dogwood, and other North American species, the juice of which is very acrid, and even the emanations are injurious to some persons, who, from remaining a short time near these plants, or from handling them, experience swelling of the whole body, with subsequent inflammation of the skin, pustules, and violent itching, whilst it is remarkable that others appear quite unsusceptible of their influence.—The VARNISH S., or JAPAN VARNISH TREE (*R. vernicifera*), a native of Japan and Nepaul, yields a varnish much used in Japan for lacquer-work. This varnish is the juice which flows from wounds in the tree, and which becomes thick and black by exposure to the air, but is still so transparent that the finest veins of wood varnished with it may be seen through it. It is sometimes mixed with coloring matters, sometimes with gold-leaf finely ground. The expressed oil of the seeds becomes as hard as tallow, and is used for candles.

The name TANNERS' S. is given to *Coriaria myrtifolia*, a shrub of the south of Europe, of the natural order *Ochnaceæ*. The leaves are astringent, and are used for tanning, and for dying black.

SUMA'TRA (called by the Arabians *Srimat*, or *Srimata* 'the happy,' whence its present name), the most westerly of the Sunda Islands, lies south of the Malay Peninsula, from which it is separated by the Strait of Malacca. Lat. between 5° 45′ N. and 5° 50′ S. It is 1040 miles long and 266 miles in extreme breadth; area, 168,000 sq. m; pop., including that of the adjacent isles, 5,000,000, about two-thirds of whom are directly or indirectly under Netherlands rule. The Europeans in 1873 numbered 2654, not including the army in Atcheen.

Physical Features.—The Barisan Mountains run throughout its entire length, varying in altitude from 1550 feet in the south-west to 6000 under the equator. Lofty cones, of which about 20 are volcanoes, attain to from 6000 to upwards of 10,000 feet. Another series of mountains runs parallel with the Barisan, lofty plateaux of great extent linking them together at various points. On the west coast, a few miles of low land lie between the mountains and the sea, in some parts spurs reaching the shore in beetling cliffs. Wide alluvial plains, covered with dense jungle and forest, through which the rivers run sluggishly, forming deltas at their mouths, stretch along the north-east coast; while the tidal action is eating into the west coast, new ground is forming on the east.

Extensive valleys lie between the mountain chains. Several beautiful lakes are scattered over the interior. The largest is Lake Singkarah or Samawang, in Upper Padang, 17 miles long and 6 broad. It is 1167 feet above the sea, and discharges its waters by the Ombilin, which, flowing towards the east coast, becomes the Indragiri.

The mountain systems are of trachyte, granite, limestone, red sandstone, and a wide-spread conglomerate composed of granitic and quartzose particles, the hollows in many places being filled with lava. Sienite, porphyry, serpentine, jasper, basalt, and tufa occur. Tertiary deposits are found in the valleys, and in some parts of the coasts a rich vegetable mould rests on beds of red and grey clay, or on coralline limestone. Potter's clays are met with, and gold is widely diffused. Coal, iron-ore, copper, sulphur, lead, silver, saltpeter, alum, naphtha, &c., abound.

Rivers.—S. has many rivers, the most important being the Tūlang-Bawang; the Mūsi, or river of Palembang; the Djambi, Indragiri, and Siak, on the east; the Singkel, Tabūjong, Indrapūra, Moko-Moko, Bencoolen, and Padang Gūtjie on the west. The capes and bays are numerous, the Bay of Tapanūli being capable of containing a large fleet. A chain of islands lies parallel to S. in the Indian Sea. The most important are—Babi or Si Malu, Nias (q. v.), the Batū Islands, North Pora, Coco Island, South Pora, North Pagei, and South Pagei. To the south-east lies Banca, rich in tin, producing also iron, lead, silver, copper, arsenic, and amber.

Climate.—The climate of S. is moderately healthy, especially on the east coast. In Tapanūli, however, are large marshes, inducing intermittent and typhoidal fevers, dysentery, and other diseases. A slight increase of temperature takes place from October to March, the minimum being in May. Except in the highlands of the interior, where it is cool, the thermometer ranges from 70° F., at sunrise, to 94° at 2 P.M. The monsoons are irregular, and rain falls during all the months, though the quantity in October and December is double that in February and June.

Flora.—S. has many fine species of timber trees—as the Djati (*Tectona grandis*), the Maris, a hard and heavy wood, ebony, iron-wood, &c. The magnificent *Dryobalanops camphora*, and other resin-producing trees, are abundant. Several species of fig, the *Urceola elastica*, from which caoutchouc is obtained, and the gutta-percha tree (*Isonandra gutta*), are numerous. In the villages, the Bombax, or silk-cotton tree, forms a shady resting-place at noon. The lovely *Cinnamomum cassia*, the *Melaleuca leucadendron*, which yields the medicinal cajeput oil, the satin-wood (*Chloroxylon swietenia*), the gigantic reed (*Calamus draco*), from the ripe fruit of which the dragon-blood gum exudes, and a great variety of palms, form part of the botanical wealth of the island. Flowering plants and shrubs are numerous, and countless parasites garland the forest trees with flowers of every hue. The most curious of these is the *Rafflesia* (q. v.), which, clinging to the bark of large trees, spreads out the largest known flower, with a calyx 3 feet in diameter and 9 inches deep, and capable of containing 2 gallons of fluid.

The fruits are richer in flavor than those of Java. Among these are the guava, citron, oranges, lemon, durian, mango, bread-fruit, cocoa-nut, pomegranate, water-melons, pine-apples, and the highly-prized mangosteen, or berry of *Garcinia mangostana*. Cacao, cotton, maize, indigo, tobacco, gambier, and more especially rice, millet, pepper, and coffee, are cultivated.

Fauna.—The elephant, single and double horned rhinoceros, tiger, leopard, black bear and tiger-cat, wild swine, tapirs, antelopes, deer, monkeys (including the ourang-outang), ant-eaters, many kinds of bat, &c., abound. Buffaloes, cows, goats, horses, sheep, and swine are kept by the natives. The peacock and the pheasants of S. are of rare beauty. Hippopotami and crocodiles frequent the rivers, which have many kinds of fish, including a species of salmon.

Geographical and Political Divisions.—The kingdom of Atcheen (q. v.), Acheen, or *Achin* occupies the north-western portion of the island (extending further south on the east coast than on the west); area, 20,000 sq. miles; pop. about 400,000. The Dutch began in 1873 a tedious was for the subjugation of the country, which in 1882 war not yet completed. It is well cultivated, and produces much pepper. Singkel, Tapanūli, and Lower Padang, administratively under the Presidency of Padang, lie in succession to the south-east of Acheen. Bencoolen stretches along the west coast from 101° to 104° 40′ E. long.; and the extreme south and the east coast, between 4° 4′—5° 56′ S. lat., form the Lampong districts. North of these is the residency of Palembang, with the kingdom of Djambi, ruled over by a native prince under Dutch control. Farther north are Indragiri, Kampar, and Siak, governed as Djambi. Between Siak and Acheen are many petty states.

People.—The natives are chiefly Malays who profess Mohammedanism. In appearance, manners, and customs, however, the inhabitants of Acheen and the Lampongs differ widely from those of other parts. The Acheenese are tall, well-made, active, and intelligent, but cunning, proud, treacherous, and blood-thirsty. They live simply, but are slaves to opium. The Lampongers are of middle stature, well formed, of pleasant exterior, mild, but uncivilized and lazy. Caste prevails, and they follow the usages

of their fathers, Mohammedanism being imperfectly known and practised. Polygamy obtains, the wives being bought from their relatives. The houses are on posts of iron-wood, several families living under the same roof. In other parts of S. the usual Malay type is found. The Kūbūs, in the north-west of Palembang, are probably the remains of the aborigines, a harmless race who live chiefly by the chase and fishing. Theft and murder are scarcely known among them. They believe in an after spirit-life.

Trade and Produce.—The imports and exports of the independent and half-independent kingdoms cannot be ascertained. Acheen alone produces 8000 tons of pepper annually, and also exports gold, precious stones, cotton, raw silk, sapan wood, benzoin, camphor, sulphur, betel, &c., to the west of India by way of Pūlū Penang and Singapore, receiving in return manufactured goods, salt, opium, &c. On the S.W. coast, Bencoolen, the Lampongs, and Palembang, the imports have an annual value of about £750,000; the exports to £850,000. Java has nearly half the trade, Europe and Eastern countries the remainder. Imports—rice, cotton and other textile fabrics, &c.; exports—benzoin, gum, elastic, resin, pepper, rattans, cotton, coffee, drugs, ivory, dyestuffs, edible nests, wax, tobacco, bêche-de-mer, &c. The rice-culture is extensive, the west coast producing as much as 320,000 tons in a single year. The coffee yield varies from 5500 tons to nearly twice as much. Upper Padang sends the largest quantity of coffee and rice, with much cocoa-nut oil, to market.

History.—Marco Polo visited S. in the 13th c,, Alvaro Talezo in 1506, and Siquera in 1509, the Portuguese then entering into trading relations with the natives. About 90 years later, the Dutch under Houtman reached the island, and on a second visit he was treacherously murdered at Acheen. In 1601, two ships from Zeeland, with the Netherlands commissioners, General De Roi and Laurens Bikker, arrived, were favorably received by the king, obtained a full cargo, and returned with two Acheneese ambassadors. Later, the Dutch drove the Portuguese from their factory at Pūlū Tjinko, to the south of Padang; and in 1666, the latter place became the seat of the Netherlands power on the west coast. In 1795 Padang was taken by the British, and retained till 1819. A few years after, Bencoolen was also given up to the Dutch, and the southern division of the island soon fell under the same rule. Various rebellions against the Netherlands dominion have since arisen, with the uniform result of extending the power of the Dutch towards the interior and the north. The appalling eruption of 1883 at the volcanic island of Krakatoa, between S. and Java, raised a vast sea-wave which swept destructively the southern shore of S., and raised a new line of volcanic cones in the Straits of Sunda.—See the work, *Nederlandsch Indie*, by Nijhoff; *The Malay Archipelago*, by A. R. Wallace (1869); *Australasia*, by A. R. Wallace (1880).

SUMBA'WA, one of the chain of islands to the east of Java, lies between 8° 4′—9° 2′ S. lat., and 116° 50′—119° 15′ E. long., is now divided into the kingdoms of Sumbawa, Bima, Dompo, and Sangar, each governed by its own sovereign. Area, 5838 square miles. Pop. nearly 100,000. The island is mountainous, but except the volcano Tambora, which is 9522 feet, the elevation does not exceed 5660. The most valuable timber-tree is the Djati (*Tectona grandis*, or Indian teak), and the tamarind is so abundant as to be little valued. Rice is extensively grown. Sapan-wood is contracted for with the princes, by the Netherlands colonial government.

The natives of S. belong to the Malay race, but speak three different languages. They are inoffensive and industrious, murder, robbery, and theft being almost unknown. Many of them are Mohammedan, but the mountaineers are chiefly heathen, with an idea of a supreme being. Ancient relics recently found in Bima, indicate that they were formerly professors of Hinduism.

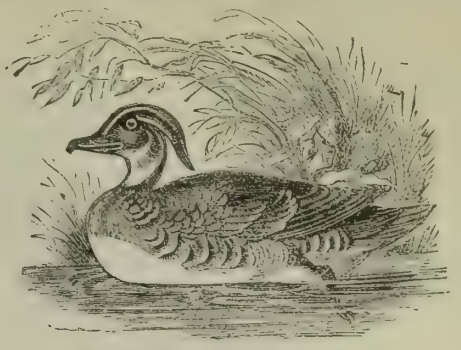
In 1815, an eruption of Tambora depopulated the kingdoms of Tambora and Papekat, 12,000 lives being lost, and great damage done to the whole island by the ashes. Another took place in 1836, and one of Gunong Api, in Bima, in 1860, but with little loss.

SU'MBUL (see MUSK PLANT) has been extensively employed for some years past, both in this country and in America, in the treatment of epilepsy, hysteria, and other diseases of the nervous system. It has a musk-like odor, and an aromatic and somewhat bitter taste. It may be given in the form of infusion, tincture, or resin.

SU'MMARY DILIGENCE, in the practice of the law of Scotland, means issuing execution without the formality of an action, as a creditor enforcing payment of a bill of exchange or of a bond.

SUMMER, a horizontal beam, called also Breast Summer.

SUMMER DUCK, or WOOD DUCK (*Dendronessa sponsa*, or *Aix sponsa*), a very beautiful species of duck, of the section having the hind-toe destitute of membrane, a native of North America. It is found during the breeding season in almost all parts of the United States, and as far north as Nova Scotia, migrating southwards in winter, when it abounds in Texas and Mexico, but some remain during winter even in Massachusetts. It has been found capable of domestication.—Very similar to it is the MANDARIN DUCK (*Dendronessa* or *Aiz galericulata*), a Chinese species. Both of these species have the power of perching on trees. The S. D. makes its nest in the hollow of a tree.



Summer Duck (*Dendronessa sponsa*).

SUMMER ISLANDS, a small archipelago of islets off the west coast of Scotland, near the entrance of Loch Broom, an inlet in the north-west of the county of Ross. The islets are about 20 in number; and the largest of them, Tanera, 2 miles long, and 1 mile broad, has a pop. (1881) of 119.

SU'MMONS, in English Law means generally a writ directed to a party to appear and answer some complaint before a court or judge. It is the first writ in an action at law; and a similar writ issues incidentally both in Chancery and in interlocutory matters. It is also the first step in proceedings before justices.—In Scotland, it is also the first writ in an action.

SUMNER, CHARLES, American statesman, was born at Boston, Massachusetts, January 6, 1811. His father was a lawyer, and for many years sheriff of the county. He was educated at Harvard College, where he graduated in 1830; studied law at the Cambridge Law School; was admitted to the bar in 1834, and entered upon a large practice; edited the *American Jurist;* published three volumes of Sumner's *Reports of the Circuit Court of the United States;* gave lectures at the Law School, but declined a proffered professorship; and from 1837 to 1840, visited England and the continent of Europe. On his return, he edited Vesey's *Reports*, in 20 vols., and in 1845, made his début in politics in a 4th of July oration, on the True Grandeur of Nations—an oration against war and the war with Mexico, pronounced by Mr. Cobden the noblest contribution by any modern writer to the cause of peace. Identifying himself with the Free-soil party, he was, in 1850, chosen U. S. senator from Massachusetts, in place of Daniel Webster, where he opposed the Fugitive Slave Law, and declared 'freedom national—slavery sectional.' In 1856, he made a two days' speech on 'the Crime against Kansas,' some of which was of a violently personal character, in consequence of which he was attacked in the Senate Chamber, May 22, and severely beaten by Preston C. Brooks, and so severely injured that his labors were suspended for three or four years; during which he visited Europe for repose and health. Returning to the Senate, he supported the election of Mr. Lincoln, urged upon him the proclamation of emancipation, and became the leader of the Senate, as chairman of the Committee on Foreign Relations. In 1862 he was again elected a senator, and re-elected in 1869. In 1871 he opposed the annexation of Hayti to the United States. He published *White Slavery in the Barbary States* (1853); *Orations and Speeches* (1850), &c. He died in 1874. A *Memoir and Letters* appeared in 1878.

SU'MPTUARY LAWS (Lat. *sumtus*, expense), laws passed to prevent extravagance in banquets, dress, and private expenditure. They abound in ancient legislation. The Locrian legislator, Zaleucus, 450 B.C., ordained that no woman should appear in the streets attended by more than one maid-servant, unless she were drunk, or wear gold or embroidered apparel, unless she designed to act unchastely. At an early period in Roman history, the Censors, to whom was intrusted the superintendence of public and private morality, punished with the *notatio censoria* all persons guilty of luxurious living; but as the love of luxury grew with the increase of wealth and foreign conquest, various legislave enactments were passed with the object of restraining it. The Lex Orchia, 161 B.C., limited the number of guests to be present at a feast; the Lex Fannia, 161 B.C., regulated the cost of entertainments, enacting that the utmost sum which should be expended on certain festivals was to be 100 asses, 30 asses on certain other festivals, and 10 asses on an ordinary entertainment, where also

no other fowl than one hen was permitted to be served up, and that not fattened for the purpose. There were also the Lex Didia, Lucretia, Cornelia, Æmilia, Antia, Julia, and others, most of them passed in consequence of the practical disregard of the similar laws that had preceded them; but they all seem to have been habitually transgressed in the later times of the Republic.

Sumptuary laws were in great favor in the legislation of England from the time of Edward III. down to the Reformation. Statute 10 Edward III. c. 3, narrates, that 'through the excessive and over-many costly meats which the people of this realm have used more than elsewhere, many mischiefs have happened; for the great men by these excesses have been sore grieved, and the lesser people, who only endeavor to imitate the great ones in such sorts of meat, are much impoverished, whereby they are not able to aid themselves, nor their liege lord, in time of need, as they ought, and many other evils have happened as well to their souls as their bodies;' and enacts that no man, of whatever condition or estate, shall be allowed more than two courses at dinner or supper, or more than two kinds of food in each course, except on the principal festivals of the year, when three courses at the utmost are to be allowed. All who did not enjoy a free estate of £100 per annum were prohibited from wearing furs, skins, or silk, and the use of foreign cloth was allowed to the royal family alone. Act 37 Edward III. declares that the outrageous and excessive apparel of divers people against their estate and degree is the destruction and impoverishment of the land, and prescribes the apparel of the various classes into which it distributes the people; it goes no higher than knights, but there are minute regulations for the clothing of women and children. This statute, however, was repealed the next year. In France, there were sumptuary laws as old as Charlemagne, prohibiting or taxing the use of furs; but the first extensive attempt to resist extravagance in dress was under Philip IV.

By an edict of Charles VI., no one was allowed to exceed a soup and two dishes at dinner. Sumptuary laws continued to be introduced in England in the 16th, and in France as late as the 17th century. Scotland had also a similar class of statutes. The Scottish Parliament attempted to regulate the dress of the ladies, to save the purses of the 'puir gentlemen their husbands and fathers.' There was a prohibition against their coming to kirk or market with the face muffled in a veil; and statutes were passed against superfluous banqueting, and the inordinate use of foreign spices 'brocht from the pairts beyond sea, and sauld at dear prices to monie folk that are very unabill to sustain that coaste.' Neither in England, Scotland, nor France do these laws appear to have been practically observed to any great extent: in fact, the kings of France and England contributed far more, by their love of pageantry, to excite a taste for luxury among their subjects, than by their ordinances to repress it. Mr. Froude suggests that such statutes may have been regarded, at the time when they were issued, rather as authoritative declarations of what wise and good men considered right, than as laws to which obedience could be enforced. Enactments of this kind have long been considered to be opposed to the principles of political economy. Most of the English sumptuary laws were repealed by 1 James I. c. 25, but a few remained on the statute-book as late as 1856.

SU'MTER, Fort (originally spelled *Sumpter*, after General Sumpter, in whose honor it was named), an American fort of the second class, built 1845—1855, in the form of a truncated pentagon 50 feet high, on an artificial island, at the entrance of Charleston Harbor, two and a half miles distant from Forts Moultrie and Pinckney, on either side. On the secession of South Carolina, December 1860, Major Anderson, in command of the defences of the harbor, was called upon to surrender them to the state authorities. Instead of doing this, he abandoned the other forts, and occupied Fort S., mounting 52 guns, with a garrison of 70 men and 30 or 40 workmen. This was considered an act of war by the Confederates and their troops, who, under command of General Beauregard, took possession of Forts Pinckney and Moultrie, and erected additional batteries. While the surrender of the fort was under consideration, a fleet was sent from New York for its relief. On its appearance off the harbor, the attack on the fort was opened by General Beauregard, April 12, 1861, and it surrendered on the 13th. This event aroused the North, and began the war which terminated in 1865. During the siege of Charleston, this fort was battered by the heaviest artillery, until its walls were completely crushed and shattered. The flag-shaft was shot away fifty times, and thousands of tons of iron projectiles were mingled with the débris of the fort; but the garrison constructed a still stronger fortress on its ruins, and held it for three years against assault and bombardment, until the operations of General Sherman compelled its evacuation, and the United States flag was again raised April 14, 1865; an event soon followed by the evacuation of Richmond, and the surrender of all the Confederate armies.

SU'MY, a town of Russia, in the government of Kharkov, and 90 miles north-west of the town of that name, on the Psiol. It contains several factories, and has an important annual fair. Pop. (1880) 26,000.

SUN, The, the great luminary upon which not only our well-being but our very existence depends, has been from the earliest ages a source of wonder and admiration, and its worship was probably the very first form of idolatry. See Sun-worship.

When the true system of the universe became known, one of the first labors of astronomers was to ascertain the distance and size of the sun, and these have been known for some time with tolerable precision; but until lately, the most vague and unsatisfactory theories regarding its chemical and physical constitution have continued to prevail.

Within the last few years, however, our knowledge of its chemical and physical constitution has increased with a rapidity probably unequalled in any other branch of science.

Our knowledge regarding the sun is best arranged under three heads; viz., *The general relations of the sun to our globe; the sun's chemical constitution;* and *its physical constitution.*

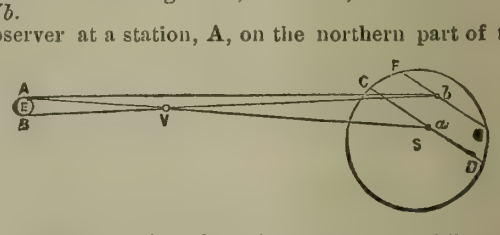
Relations of the Sun to the Earth, as the Source of Light and Heat.—In order to appreciate the grandeur of the scale on which solar activity is carried on, it is only necessary to know a few facts relative to the sun, which are best expressed by numbers.

1. *Distance of the Sun from the Earth.*—The difficulty in ascertaining the Parallax (q. v.) of the sun arises from the smallness of the base line as compared with the distance of the object. The distance of the observing stations must always be less than 8000 miles; from this the parallax of the moon, which is only 30 times 8000, can be observed directly with tolerable nearness. But when the distance is many thousand times the length of the base line, the triangle is 'ill-conditioned' or unfavorable to accuracy, and the problem must be approached indirectly. The first attempt to measure the distance of the sun was that made by the Greek astronomer Aristarchus in the third century B.C., who made it only about one-twentieth of what we now know it to be. Even the great astronomer Kepler in the seventeeth century could only say that the distance must be at least between 13 and 14 millions of miles. Subsequent estimates—for, owing to the imperfection of the methods and instruments, they were little better than estimates—rose to 80 millions. At last, in 1716, the English astronomer Halley proposed a method of employing the transits of Venus. Accordingly the transits of 1761, 1769, were observed in a variety of places; but the results at first deduced were discordant and unsatisfactory, until in 1824 the German astronomer Encke 'discussed' the observations of 1769, and arrived at a distance of about $95\frac{3}{10}$ millions of miles; and this number held its place in books of astronomy for a good many years. In the meantime, in the absence of transits, other methods, become possible through the growing perfection of astronomical instruments, were tried, and most of them concurred in pointing to a value nearly $3\frac{1}{2}$ millions less than that above stated; so that 91,500,000 came to be accepted as the approximate distance of the sun, until the transit of 1874 should settle it more definitely.

A transit can occur only when the planet is in or near one of her nodes at the time of inferior conjunction, so as to be in a line between the earth and the sun. The coincidence of these two conditions follows a rather complex law. There are usually two transits within eight years of one another, and then a lapse of 105 or 122 years, when another couple of transits occur, with eight years between them. The transit of 1874 had for its successor that of 1882, and there will not be another until June 2004.

The way in which a transit is turned to account may be understood by the help of the accompanying diagram, where E represents the earth; V, Venus; and S the sun. It is to be premised that the *relative* distances of the planets from the sun are well known. Their periodic times can be observed with accuracy, and from these by Kepler's (q. v.) Law we can deduce the *proportions* of the distances, but not the distances themselves. It is thus known that if the distance of the earth from the sun is taken as 100, that of Venus is 72. In the fig. then, AV is 28, or about one-third of V*a* or V*b*.

An observer at a station, A, on the northern part of the earth



will see the planet projected on the sun as at *a*, while a southern observer will see it at *b*. The distance of the sun from Venus being about three times her distance from the earth, it is obvious that the distance *ab* will be three times the distance AB; and it is a great advantage to have the stations A, B, as far apart as possible, as the interval *ab* is thus increased and its measurement rendered more accurate.

But how is it measured? For each observer sees only one of the spots, and does not know where the other is; and there are no permanent marks on the sun's surface to guide us. The difficulty is got over in the following way: Each observer notes the exact duration of the transit, that is, the time the spot takes to travel from C to D, or from F to G. Now as we know the rate of Venus's motion in her orbit, this gives us the lengths of the lines CD and FG in minutes and seconds of arc. Knowing then the angular diameter of the sun (32′) and the lengths of two chords CD and FG, we can easily, by the properties of the circle, find the distance *ab* between them. This gives us the angle *a*A*b*. In the triangle AV*b*, then, we know the angle at A and the proportion of the sides AV and V*b*, and from that we can find the angle A*b*V or A*b*B. Now this is the quantity sought, being the parallax of the sun as seen from two stations on the earth. Whatever the distance AB actually is, the angle is reduced to correspond to a distance equal to the earth's semi-diameter. The parallax deduced by Encke, as above referred to, was only 8″·5776, while the parallax corresponding to the other smaller measurement above stated is 8″·94. The advantage of this roundabout procedure is that a comparatively large angle (*a*A*b*) is measured in order to deduce from it a smaller (A*b*B), so that any error in the measurement is diminished in the result.

The transit of 1874 was observed at more than fifty stations, astronomers from all the civilized world taking part in the work. The labor of discussing and comparing the observations has not yet been overtaken, but several partial results have been announced, which still show considerable discrepancy. The chief source of uncertainty arises from the difficulty the observers found in determining the exact moment of 'ingress' and 'egress' of the planet, owing to the dense atmosphere of the latter rendering the limbs of the two bodies indistinct and distorted. Much was expected from the multitude of photographic pictures taken, but they have proved a failure. They are said to lack the necessary sharpness, and to be liable to other sources of error. The first partial discussion of the British observations gave, according to the Astronomer Royal, a result of $93\frac{4}{10}$ millions of miles. A more extended discussion since announced results in $92\frac{5}{10}$ millions of miles.

Elaborate arrangements were made, on an international plan, for observing the transit of 1882, and attempts made to obviate the defects of previous observations. In the meantime astronomers are turning with greater hope to other methods, especially to observations of Mars, and of some of the minor planets. From observations of Mars made in 1862, the American astronomer Newcomb deduced a distance of $92\frac{8}{10}$ millions of miles. The velocity of light, which has been determined by the ingenious optical experiments of Foucault and others, has also been pressed into the service of the problem. The aberration of Light (q. v.) results from the relation of the velocity of light to that of the earth's motion in her orbit; and from the observed amount of the aberration we are thus able to deduce the earth's velocity. From knowing then the time of the earth's revolution, we can find the circumference of her orbit, and hence her distance from the sun. The most careful investigation by this method gives a distance of 93 millions of miles. An ingenious method of observing the parallax of Mars at its opposition, first suggested by the Astronomer Royal, but carried out by Mr. Gill on the island of Ascension in 1877, promises still more satisfactory results. The essence of the method consists in this, that instead of depending upon two sets of observers at different parts of the earth, one observer and one station are made to suffice. One observation is taken in the evening when the planet is rising, and another in the early morning when it is setting. In the meantime the rotation of the earth has transported the observer 6000 or 7000 miles through space, and this forms his base line. Mr. Gill's observations were made by means of the heliometer, the most effective of instruments for such purposes. From such of his observations as had been reduced at the end of 1878, Mr. Gill announces his belief that the sun's distance will prove to be nearer to 93 than to 92 millions of miles.

The other important numerical facts relative to the sun are the following: Its *diameter* calculated on the basis of the shorter distance hitherto received, is, in round numbers, 850,000 miles, or more than 107 times the mean diameter of the earth; so that the *volume* or bulk of the sun exceeds that of the earth 1,200,000 times, and is 600 times greater than the bulk of all planets at present known, together. The *mass* of the sun, or quantity of matter it contains as measured by weight, exceeds that of the earth only 300,000 times; and thus it appears that the matter of the sun has only one-fourth the density of that of the earth. From this and other facts, it is inferred that the matter of the sun exists for the most part in a gaseous condition. Still his mass is 740 times greater than the masses of all known planets put together. The *period of rotation* of the sun upon its axis, which Galileo was the first to calculate from observations of the sun-spots, and which takes place in the same direction as that of the earth, is about 25 days 8 hours. It appears, however, that this period varies according to the solar latitude of the spots from which it is calculated. The *inclination* of the axis of the sun to the ecliptic is about 7½°, and the *longitude of the ascending node* is about 74° 30′.

2. The form or *figure of the sun* has been the subject of recent investigations. The polar and equatorial diameters of the sun's disc as observed, have been supposed to differ, though by a very small quantity only. The photographs of the sun do not quite agree in the amount of the value for the diameter with that given by observations.

The general laws by which the relation of our earth to the sun, as the source of light and heat, is governed, are of the most simple kind. The rays which emanate from the sun's disc into space, proceed in diverging lines, and on arriving at the earth, their intensity will be inversely proportional to the square of the sun's distance. This may be called the primary law; but the more obvious phenomena of solar heat and light are manifested to us under a secondary law depending on the obliquity of incidence of the sun's rays. See CLIMATE, EARTH, TEMPERATURE, &c.

3. *Chemical Constitution of the Sun.*—Astronomy has weighed and measured the sun long ago, and in our days, chemistry, aided by physics, makes an analysis of it. The way in which this surprising result is arrived at is explained under SPECTRUM. The main fact on which the method rests is briefly this: that a substance, when comparatively cold, absorbs the very same rays which it gives out when heated. Hence it was inferred by Kirchhoff, that if there were sodium or iron in a comparatively cold state in the solar atmosphere, above the source of light, these substances would produce black lines corresponding in spectral position with the bright lines which they give out when heated. On this principle the presence in the solar spectrum of hydrogen, magnesium, calcium, sodium, and metals of the iron group has been ascertained with something like certainty. There are less clear indications of other metals such as zinc and lead; while metals of the tungsten, antimony, silver, and gold classes have been searched for in vain. Of the metalloids, such as oxygen, carbon, nitrogen, sulphur, and the like, none had been detected till, in 1877, Professor Henry Draper of America announced the discovery of oxygen. The presence of these substances in the sun is hardly doubted, but their identification is difficult. A chief source of complication in research of this kind is the effect on the spectra of substances produced by differences of temperature and pressure. Excessive heat seems to dissociate the groups of atoms forming the molecules into simpler groups, and thus produces a different spectrum difficult to recognize. The labors of Lockyer, Huggins, Janssen, Draper, and others are directed towards overcoming these and other obstacles.

4. *Physical Constitution of the Sun.*—Since the first discovery by Galileo of those remarkable phenomena on the sun called *sun-spots*—dark patches with an area frequently exceeding several times the surface of the earth—an immense variety of theories, as to the probable constitution of the solar body, has been brought forward by nearly every observer. Solar photography promises valuable aid in this research by enabling us to keep a permanent record of passing phenomena, ready at any time for deliberate measurement and comparison.

One of the most important discoveries in connection with sun-spots, science owes to Dr. Alexander Wilson of Glasgow, who, in the year 1769, observed certain general and remarkable features of sun-spots, which enabled him to establish the significance of these phenomena for a solution of the question as to the sun's physical constitution. These features are as follows: When a spot was near the middle of the sun, it was found to consist of a dark *central* part, called the *nucleus* or *umbra*, and *around this* was a comparatively brighter envelope, called the *penumbra*, and at such a time both parts were distinctly visible. But as the spot approached one border, the penumbra on the side nearest the observer became gradually more and more foreshortened, while the penumbra on the other side grew broader and broader, and at length, as the spot was disappearing, that is, passing the edge of the limb, the near side of the penumbra, as well as the dark central part, entirely vanished, nothing remaining except the opposite penumbra. When a spot made its appearance on the other side of the border, Wilson noticed the same phenomena in an opposite order, and soon discovered that they were nearly universal. It followed from these observations at once, that every spot presents the appearance of a funnel-shaped opening in the sun's body, which by the rotation of the latter, successively presented the described appearances. These observations have been abundantly confirmed by the photographic records of Messrs. De la Rue, Stewart, and Loewy.

Schwabe showed, as the result of nearly forty years' observations, that the number of groups of sun-spots is not the same from year to year, but has a maximum about every ten or eleven years; and General Sabine recorded the wonderful fact, that the various epochs of maximum spot-frequency are also those of

maximum disturbance of our earth's magnetism. Here, then, we have a very curious bond of union between the sun and the planets of our system

It was next shown by Carrington that sun-spots have a proper motion of their own—those near the solar equator moving faster than those near the poles.

While spots are darker than the general surface of the sun, there are also frequently observed patches brighter than the general surface. These are called *faculæ*, and they generally accompany spots, most frequently in their wake; but they are only distinctly visible near the sun's limb, and lose their specific luminosity near the center of the sun's disc.

Another phenomenon connected with our luminary is not less remarkable than sun-spots. This is the red flames, or *protuberances*, which were first observed surrounding the sun's disc on the occasion of a total eclipse, but which by ingenious methods of observation can now be rendered visible even when the sun is not eclipsed. This colored envelope, less brilliant than the *photosphere*, or light-giving surface, and having a mean height of 5000 to 6000 miles, is known as the *chromosphere*, and seems to consist mainly of incandescent hydrogen, jets of which are seen at times to be projected to a height of 200,000 miles. The velocity of these movements has been calculated to exceed at times 120 miles a second. Above the chromosphere there is a far deeper layer of cooler, sub-incandescent gases, among which is an unknown substance, which chiefly composes the outer portion, and is apparently lighter than hydrogen. These gaseous envelopes, extending together to 300,000 or even 500,000 miles above the photosphere, are now believed to cause the appearance called the *corona*, or white halo, which is seen to surround the dark body of the moon during an eclipse of the sun.

If a spot be a hollow, as we have reason to suppose, it is only necessary to believe that there has been a descending current of this cold absorbing atmosphere to account for the want of luminosity. In like manner, on this hypothesis, a facula will be a portion of the luminous matter, which has been removed high up into the atmosphere, and which thus escapes the absorbing influence of the atmosphere. A spot may thus be supposed to be produced by two currents—one ascending, and carrying the hot luminous matter up; the other descending, and carrying the cold atmosphere down. The photosphere is thus in a constant state of agitation like ebullition.

Spots and their accompanying faculæ are an indication of the activity of those 'convection currents' by which heat is brought to the surface to replace what has been radiated off. Their temporary prevalence then is held to be a sign of more than ordinary solar activity or expenditure of energy. This is palpably manifested on our globe in the greater magnetic disturbance that takes place when sun-spots are numerous, as before mentioned. The diurnal range of the magnet freely suspended in the Kew Observatory, shows an unmistakable correspondence with the waxing and waning of the spotted area on the sun; and the frequency of auroræ is found to be in perfect correspondence with prevalence of spots. It is natural to seek to connect cycles of weather with the spot-period of the sun, but nothing has yet been conclusively established. A coincidence has seemingly been made out between the recurrence of famines in Southern India through deficient rain and the period of minimum spots; but the coincidence does not hold for other localities. Attempts have even been made to bring commercial crises and other recurring events into the spot-cycle.

As to the cause of the periodicity of sun-spots, observations made at Kew seem to establish a connection between the behavior of spots and the proximity of prominent planets; and it may thus be found that the recurrence of certain planetary positions in some way determines the spot-period.

SUN AND FIRE WORSHIP. All investigation tends to show that nature-worship was the basis of all polytheistic religions, and that the chief deities of the several mythologies were originally personifications of the sun, or of particular influences of the sun. The original solar nature of Jupiter, Zeus, Odin, Baal, Amen Ra (see EGYPT), Indra, &c., can hardly be mistaken. See those heads; also SCANDINAVIAN MYTHOLOGY, PHŒNICIA; and for a full development of the subject, Max Müller's essay on *Comparative Mythology* (Oxford Essays, 1856). The actual sun, however, still continued an object of worship, more especially as in the abstract and more strictly personal gods, moral and intellectual attributes came to predominate over and obscure the physical (see HELIOS); and with the worship of the sun was more or less closely associated that of fire—his representative on earth. See PARSEES, NEEDFIRE, BELTEIN.

The most complete system of sun-worship that we have any account of is that existing in Peru when discovered by the Spaniards (1526). 'Our northern natures can hardly comprehend how the sun, and the moon, and the stars were imaged in the heart of a Peruvian, and dwelt there; how the changes in these luminaries were combined with all his feelings and his fortunes; how the dawn was hope to him; how the fierce mid-day brightness was power to him; how the declining sun was death to him; and how the new morning was a resurrection to him: nay, more, how the sun, and the moon, and the stars were his personal friends, as well as his deities; how he held communion with them, and thought that they regarded every act and word; how, in his solitude, he fondly imagined that they sympathized with him; and how, with outstretched arms, he appealed to them against their own unkindness, or against the injustice of his fellow-man.'—Helps's *Spanish Conquest of America*. The Incas, as the Peruvian monarchs were called, claimed to be children of the sun, and his representatives on earth. Their government was a despotic theocracy, of which the Inca was both high-priest and king. In Cuzco, the capital, stood a splendid temple to the sun, all the implements of which were of gold. On the west end of the interior was a representation of the sun's disc and rays in solid gold, so placed that the rising sun, shining in at the open east end, fell full upon the image, and was reflected with dazzling splendor. In the place or square of the temple, a great annual festival was held at the summer solstice. The multitude, assembled from all parts of the empire, and presided over by the Inca, awaited in breathless solemnity the first rays of their deity to strike the golden image in the temple, when the whole prostrated themselves in adoration. Sacrifices, similar to those of the Jews, were offered on the occasion, and bread and wine were partaken of in a manner strikingly resembling the Christian communion.

'It must not be supposed that the sun alone absorbed the devotion of the Peruvians. There was little in nature that they did not contrive to make a deity of. The Moon, as the spouse of the Sun, the planet Venus as his page, the Pleiades, and the remarkable constellation of the Southern Cross, were minor deities. The rainbow and lightning were also worshiped as servants of the Sun; and fire, air, earth, and water were not without adoration.'

S'UNAH'S'EPHA is, in the ancient legends of India, the son of a poor Brahman, Ajîgarta, who was sold by his father for 100 cows to *Haris'chandra* (q. v.), and offered by the latter as a victim to Varun'a, instead of his own son Rohita, whom he had pledged himself to sacrifice to this god. The legend relates that when S. was bound to the sacrificial post by his own father—for no priest could be found to perform the ceremony—and when his father came whetting his sword to kill him—for neither was any priest to be found who would perform such a sacrifice—S. prayed in succession to the gods Prajâpati, Agni, Savitr'i, Varun'a, again to Agni, then to the Vis'we-Devâh', Indra, the As'wins, and the Dawn; and while he praised the Dawn with three verses, at the delivery of each verse his fetters became looser, and when the last verse was said, he became free again. He left afterwards the family of his parents, and was adopted by *Vis'wâmitra*, under the name of S'unah's'epha Devarâta (the God-given). The *Aitareya Brâhman'a* (see VEDA), where this legend is related, also ascribes to him the first performance of some Vedic ceremony.

SU'NART, LOCH, an inlet of the sea in the west of Argyleshire, length, 19 miles.

SUNBIRDS (*Cinnyridæ*), a family of birds of the order *Insessores*,

Sunbird (*Nectarinia phœnicura*).

and tribe *Tenuirostres*, which may be regarded as a connecting link between the Creepers and the Humming-birds, and as occupying nearly the same place in the tropical parts of the Old World which belongs to the humming-birds in America. They are all of small size, although none are so small as the smallest humming-birds; they rival humming-birds in brilliancy of plumage, and like them they feed on the juices of flowers, which they suck by

their long bill; they do not, however, flutter on the wing when feeding, like humming-birds, but perch on or beside the flower into which the bill is to be inserted. The species are very numerous, and are natives of the southern parts of Asia, the Eastern Archipelago, and Africa. The resplendent metallic plumage belongs only to the male, and only to the breeding season.

SU'NDA ISLANDS, that great chain of islands belonging to Malaysia, running east, commencing with Sumatra (q. v.), and ending with Timor (q. v.), and separating the Java Sea from the Indian Ocean. Sunda Strait is a passage from 79 to 90 miles in breadth, between Sumatra and Java. A dreadful volcanic eruption (26th August 1883) at the small island of Krakatoa, in the strait, did much damage on the shores both of Sumatra and Java, and raised new volcanic islets in the strait, so that a new survey was rendered necessary.

SU'NDAY. See SABBATH; LORD'S DAY; PUBLIC-HOUSES.

SUNDAY SCHOOLS were founded about the year 1780 or 1781 by Robert Raikes, a printer in Gloucester. Business leading him into the suburbs of the town, inhabited by the lowest class of the people, he was struck with concern at seeing a group of children, miserably ragged, at play. He was informed that 'on Sunday the street was filled with a multitude of wretches, who, having no employment on that day, spent their time in noise and riot, playing at chuck, and cursing and swearing.' To check this deplorable profanation of the Lord's Day, he engaged four women, who kept dame schools, to instruct as many children as he should send them on the Sunday, in reading and the church catechism, for which they were to receive one shilling each. In a short period, a visible improvement was effected both in the manners and morals of the children, who came in considerable numbers; they attended church with their mistresses, and a great many learned to read and say their catechism. Such was the origin of the Sunday schools. This excellent scheme was noticed in the Gloucester newspaper in 1783; but a letter of Mr. Raikes, from which the above account is taken, published in the *Gentleman's Magazine* in 1784, first drew general attention to it. Numerous schools, formed on the same model, sprang up in all the principal towns; and a society, under high patronage, was formed in London in 1785 for the establishment and support of Sunday schools throughout the kingdom, which in fourteen years expended £4000 in payment of teachers. Her Majesty, Queen Charlotte, admitted Mr. Raikes to an audience, and expressed her high approbation of his plan. This was the first stage of the Sunday school. The great impediment to its prosperity was the expense of hiring so many teachers. Even in Gloucester, the birthplace of the Sunday schools, after Mr. Raike's death in 1811, all the Sunday schools were closed for a time owing to want of funds.

Whoever first conceived the idea of gratuitous instruction, has nearly as great merit as Mr. Raikes himself; but probably it was suggested by necessity to many minds in different places at the same time. It was the means of starting Sunday schools on a new career of success, and the idea spread so rapidly, that, by the year 1800, the teaching was almost universally gratuitous. A higher class of teachers offered their services; the schools ceased to be filled by the very poorest alone; handsome buildings were erected in connection with the different churches and chapels, or by general subscription, and that system was organized which has covered the land with schools. The secular teaching, which in certain instances included writing and arithemetic, was not of a very high order; but it placed the key of knowledge in the hands of multitudes who would otherwise have been unable to read; and the religious instruction with which it was combined has moulded the character of some of the best men in England. In 1803, the Sunday School Union was formed, which, by its numerous publications, its traveling agents, and its connection with branch societies in every part of the kingdom, has exercised great influence on the Sunday school cause. The Institute of the Church of England, which operates in a similar manner, is of later date. Within the last twenty years, the Sunday school has entered upon a third stage of its history. The improvement and multiplication of week-day schools obviate the necessity for teaching reading in Sunday schools, so that they have gradually become restricted to religious instruction. This for a time threatened to affect their popularity, but as the teachers were earnest men, they cultivated the art of teaching with considerable success. Sunday schools have prospered in Scotland, where religious teaching alone ever prevailed, and the stability of this modern invention is accomplished.

The Sunday school found its way into Scotland as early as the year 1782; but it was not till 1786, when the Society for promoting Religious Knowledge among the Poor was formed, that it was publicly recognized; nor till 1797, when the Gratis Sunday School Society was originated, that schools became general. At first, they met with considerable opposition from portions of the ecclesiastical courts, but they are now supported by all the churches. Sunday School Unions exist in Edinburgh, Glasgow, and most of the large towns. The names of Dr. Chalmers, James Gall, the author of the *Lesson System*, and David Stowe, the author of the *Training System*, deserve mention in connection with the progress of Sunday schools in Scotland. In Ireland, Sunday schools had been partially anticipated in County Down in 1770; but it was not till 1785 that the system pursued by Mr. Raikes was adopted, since which, its history has been analogous to that of England. The Sunday School Society for Ireland was established in 1809. Sunday schools were introduced into New York in 1816, through the exertions of some benevolent ladies, from which they have spread themselves through the United States. They are now to be found wherever the English tongue is spoken. They thrive vigorously in the Protestant churches of France; and more recently have been planted in parts of Germany and Italy. The Roman Catholics, in this country at least, have numerous Sunday schools. It is stated on good authority that there are in the United Kingdom about 300,000 teachers and 3,000,000 scholars; and in the United States there are 750,000 teachers, and nearly 6,000,000 scholars. The centenary of the foundation of Sabbath schools was celebrated in 1880.

SU'NDERBUNDS, a tract of British India, presidency of Bengal, consists of a number of low islands, forming the delta of the Ganges. The tract extends east from the mouth of the Hoogly to the island Rabanabad, is 158 miles long, 75 miles broad, has an area of 5341 sq. m., and an inconsiderable population. The islands are separated from each other by narrow channels, through which the waters of the Ganges force their way to the sea. The chief channels (14 in number) are navigable for the largest craft used in inland navigation. In such of the islands as have not been cleared, luxuriant woods abound, and afford lairs for the tiger, wild boar, and other ferocious animals. Government have commenced vigorous operations for the clearing of the islands, and grants of land are offered to settlers at a nominal rate. The climate, though improving, and capable of further improvement, is, as might be expected, very unhealthy. Rice, sugar, and indigo are produced in the cleared districts. Large quantities of fish, obtained in the waters of the S., are sent to Calcutta. Large and fierce alligators abound in the channels.

SU'NDERLAND, a thriving municipal and parliamentary borough and seaport, in the county of Durham, 13 miles north-east of the city of that name, at the mouth of the Wear. The town may be said to be co-extensive with the parliamentary borough, and to include the suburbs of Bishop-Wearmouth on the south bank, and Monk-Wearmouth and Southwick on the north bank of the river, connected with S. proper by an iron bridge of one arch, 236 feet long, and nearly 100 feet above the river at low water. The bridge over the Wear was erected in 1796, but was repaired and widened in 1858 by Robert Stephenson (q. v.), at the cost of about £40,000. On both sides of the river there are extensive wet docks, much of the area of which has been reclaimed from the sea. The harbor, which is defended by batteries, is formed by two great piers, one 650 yards and the other 590 yards in length; and the port is resorted to by vessels of the largest tonnage, from all commercial countries. The exports (chiefly coal) have a value of above £700,000 per annum. After Newcastle, S. is the greatest coal-shipping port in the world. The sanitary condition of the town has been recently greatly improved; a large new infirmary was built in 1867, and in 1868 a spacious workmen's hall. Ship-building is one of the principal branches of industry. Glass, earthenware, ropes and chains, anchors, and other ironwares, are very extensively manufactured. The public park of S., about 70 acres in extent, is adorned with a bronze statue of General Sir Henry Havelock, a native of the town. The harbor and docks have been frequently improved, and in 1881 harbor extension was decided upon, at an estimated cost of £150,000. The village of Roker, a mile from the town, is much resorted to for sea-bathing. Fishing is carried on to a considerable extent. Pop. of parl. bor., which elects two members (1871) 104,409, mun. bor. 98,242; (1881) parl. bor. 124,960, mun. bor. 116,262.

SUNDERLAND, ROBERT SPENCER, second Earl, was the only son of HENRY, first earl, who had been raised to the peerage in 1643, for his exertions in the royal cause. He was born in 1642, and after serving as ambassador to several courts, became in 1679 Secretary of State. He had by this time manifested remarkable talent. Bishop Burnet says of him: 'He had a superior genius to all the men of business that I have yet known.' At first, he united with Essex and Halifax in opposing Shaftesbury, who wished to set Monmouth on the throne, and favored the exclusion of the Duke of York. He encouraged the king to persevere in the degrading French alliance, and, with the Duchess of Portsmouth, to whom he attached himself, negotiated a treaty by which, in consideration of an annual pension from the French king, Charles was to agree to assemble no parliament for three years. Before the end of a year, he had shaken off Essex and Halifax; and a new triumvirate, consisting of himself, Lord Hyde, and Godolphin, succeeded to the confidence of Charles II.

The treaty with France was broken off, and S., who was now afraid of the Whigs, engaged the king in a more popular alliance with Spain. After the dissolution of the last of the exclusion parliaments, he lost his office; but the duchess remained faithful to him in disgrace; and by her influence and that of Lord Rochester, he was, in 1682, says Bishop Burnet, 'upon great submission made to the Duke [of York], again restored to be Secretary.' He remained in office until the accession of James II., when his influence in the ministry became greater than ever. He who had so often saved himself in the former reign by the influence of the Duchess of Portsmouth, now secured himself another patroness in the king's second wife, the Princess of Modena. Although there is reason to believe he gave some encouragement to Monmouth in his rebellion, he managed, with consummate art, to obtain the entire confidence of James, and in 1685 became prime-minister. He was intrusted with a knowledge of the king's intention to establish the Roman Catholic religion as the national church, and was indeed the only minister in whom the king confided. In 1687, he privately conformed to the Roman Catholic Church, and afterwards openly professed his conversion. His influence was so great, that James would grant no favor until he had asked the question: 'Have they spoken to Sunderland?' and when told that this nobleman got all the money of the court, he would reply: 'He deserves it.' Yet we find him about this time in correspondence with the Prince of Orange, afterwards William III.

The Princess Anne described S. as 'the subtillest workingest villain that is on the face of the earth.' Burnet says he entered into a particular confidence with the Prince of Orange, which he managed by his uncle, Mr. Sidney, who was sent envoy to Holland. With profligate but masterly dexterity, he contrived to deceive both his master and Barillon, and to keep them in ignorance of the events that were passing in Holland. When the Prince arrived in England, S. and his wife went to Amsterdam, whence he wrote to the new monarch, claiming his favor and protection on the ground that he had all along been in his interest. In 1691, he was allowed to return to England, and to kiss the king's hand. In 1695, William III. spent a week at S.'s house at Althorpe. It was imputed to him that he had changed his religion, in the late reign, in order the more effectually to ruin King James; and it was generally believed that he had rendered King William, when Prince of Orange, some signal services, which no one else could have done. This belief gained credit from the favor shown him by William. He was made Lord Chamberlain, and as such took his seat at the head of the council table. After directing affairs as the acknowledged head of the government, he resigned office in 1697, and retired to private life. He spent the rest of his days at Althorpe, where he died in 1702. He never shone as a public speaker. He had, however, unusual abilities for business, and a rare skill in the art of insinuation. He possessed exquisite courtly talent, extraordinary versatility, and a flexibility of principle too common in his day, but carried by him to the most reprehensible lengths. By his wife, Anne, daughter of the second Earl of Bristol, he left CHARLES SPENCER, third earl, who was born in 1674. He was described by Evelyn as a youth of extraordinary hopes, very learned for his age, and ingenious. He was for some time Secretary of State in the reign of Queen Anne, and under George I. rose to be all-powerful; but in 1721, being accused of receiving £50,000 worth of the fictitious stock distributed by the directors of the South Sea Scheme (q. v.), in order to bribe the government, he was acquitted only by an inconsiderable majority and that from party considerations, and the indignation of the public made him resign his office. He died in 1722, not without suspicion of having intrigued, after his fall, for the restoration of the Tories, if not for the return of the Pretender.

S. was a type of the political morality, or rather immorality, of a disgraceful age, when the greatest statesmen made no scruple of sacrificing either their own party, or the interests and dignity of the nation, to personal ambition. His title descended to CHARLES, his second son, who succeeding, 1733, to the honors of his illustrious grandfather, John Churchill, the earldom of Sunderland became absorbed in the dukedom of Marlborough. His third son, JOHN, was ancestor of the Earls Spencer.

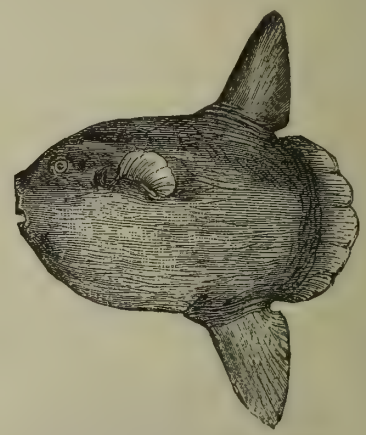
SU'NDEW (*Drosera*), a beautiful and interesting genus of plants of the natural order *Droseraceæ*, three species of which are natives of Britain, found in bogs and moist heathy ground. The most common is the ROUND-LEAVED S. (*D. rotundifolia*), which is plentiful in almost all places suitable to the plant. The leaves all spring from the root, and spread out in a rosette, from the center of which springs the flower-stem or scape, with a raceme of flowers all on one side. The leaves of this and the other species are fringed and beset in all parts with hairs, which bear at their extremity viscid glands, and the irritation of these glands causes them to contract and fold up, so that insects are imprisoned by them. Recent observation has proved that these insects are actually digested by the plant, their nutritive material being absorbed by it. Compare the *Dionæa* (q.v.), and see Darwin's *Insectivorous Plants* (1875). The whole plant is acrid, curdles milk and has a

Round-leaved Sundew (*Drosera rotundifolia*).

reputation for removing corns, bunions, and warts. An agreeable liqueur, called *Rossoli* (*Ros Solis*) is made by infusing the plant in brandy, with sugar, &c.

SUN-DIAL. See DIAL.

SU'NFISH (*Orthagoriscus*), a genus of fishes of the family *Diodontidæ* (see DIODON), having the body compressed, and not capable of inflation, as in the other *Diodontidæ;* abruptly terminating in a very short tail; the dorsal and anal fins long and pointed, united to the short tail-fin; each jaw furnished with a cutting edge of bone instead of teeth. The species chiefly inhabit the seas of warm climates, but two are occasionally seen on the coasts of Britain. The SHORT S. (*O. mola*), when young, is almost perfeetly round, but becomes rather more elongated when full grown. The name S. is variously regarded as derived from



Short Sunfish (*Orthagoriscus mola*).

the form of the fish, and from its habit of floating at the surface of the water, in fine weather, as if to enjoy the sunshine. It attains a large size, being sometimes more than six feet in length, and is captured by sailors. Its flesh is white and well flavored, somewhat resembling that of the skate. The liver yields a large quantity of oil, which is in repute among sailors as an external application for the cure of sprains, rheumatism, &c. The OBLONG S. (*O. oblongus*), of which specimens have also been taken on the British coasts, but more rarely, is of a longer form. It also attains a large size. The Sunfishes feed upon sea-weeds.

SU'NFLOWER (*Helianthus*), a genus of plants of the natural order *Compositæ*, suborder *Corymbiferæ*, having large flowers; the florets of the ray strap-shaped, without stamens or pistils, yellow or orange; the florets of the disc tubular, perfect, yellow or purplish brown; the flowers solitary or in corymbs, with an involucre of numerous leaves; the fruit compressed, with a pappus of two or more deciduous scales. The species are numerous, all natives of America; large herbaceous plants, with opposite or sometimes alternate undivided leaves. The ANNUAL S. (*H. annuus*), common in our flower-gardens, is a native of tropical America, where it sometimes attains a height of twenty feet. The stem is thick and rough; the flowers solitary, and from one foot to two feet in diameter, nodding; the leaves heart-shaped ovate. This plant is now cultivated in almost all parts of the world, and in the south

of Europe is sometimes a field-crop; the seeds being valued as food for cattle and poultry, and on account of the oil which they yield, which is little inferior to olive oil. An acre of good land produces about fifty bushels of seed, each bushel yielding a gallon of oil. The seeds are also used like almonds for making demulcent and soothing emulsions; and in some parts of Europe,

Sunflower (*Helianthus annuus*).

a bouilli is made of them, which is used as food for infants. The American Indians make bread of them. The flowers abound in honey, and are much frequented by bees. The leaves are good fodder for cattle. The stems are used for fuel, and yield much potash.—The Jerusalem Artichoke (q. v.) belongs to this genus.

SUNN (*Crotalaria* [q. v.] *juncea*), a leguminous plant, native of India, which has been in general cultivation there from time immemorial, for the fibre of its bark. It has a strong general resemblance to Spanish Broom. It is, however, an annual plant. The plant is cultivated not only for its fibre, but as food for milch-cows. The seed is generally sown in April or May, and in August it is pulled, or cut close to the ground—when grown for its fibre—laid in long rows till the leaves begin to rot and separate from the stalks, and steeped in water for a few days, till the bark separates freely. The fibre is not so strong as hemp; but good cables, canvas, and cloth are made of it. It is now imported in considerable quantity into Britain. It is known by various names. *Taag* is one of its Indian names, and it is sometimes called *Brown Hemp*, *Bengal Hemp*, &c. The confusion of names makes it difficult to ascertain the quantity imported.

SU'NNA (Arab. custom, legal usage), originally denotes among Muslims the sayings and the example of Mohammed and his community, provided they are in accordance with the Koran, the meaning of which, however, is itself explained by the Sunna. The term is therefore (though incorrectly) used for the collections of moral and legal traditions traced to the Prophet, which supplement the Koran, somewhat like the Mishna (q. v.), which supplements the Laws of the Pentateuch. The Sunna not only comprises religious doctrines and practice, but also civil and criminal laws, and the usages of common life: the way to eat and to drink, and to dress, and the like. This tradition is first heard of during the civil wars, among the adherents of the new faith, about half a century after the Flight. The single traditions, as we now possess them, rarely exceed six lines. The diction is carefully wrought, and the form is that of a dialogue. For the credibility and canonicity of a tradition, it was originally necessary that it should have been *heard* by one truthful witness; but this law was much relaxed in after-time. At the end of the 3d c. (H.), a countless number of individual collections (Mosnad), mostly of an apocryphal character, had been produced by different theologians, but the first who sifted them critically, and without regard to any special theological system, was Bochary (d. 256 H.). His collection contains 7275 single traditions, 4000 of which, however, occur twice in the work. Moslim, his pupil, supplemented Bochary with another collection, containing 12,000, again including 4000 repetitions. Besides these, there are four more 'canonical' collections; by Abû Dawûd (d. 275 H.), Tirmidzy (d. 279), Nasây (d. 303), and Mâga (d. 273). The Sunna, as we have it in these collections, contains, broadly speaking, more truth than it is generally supposed to contain, and, critically used, is, besides the Koran, the most authentic source of Islam. A selection from the different collections (both canonical and otherwise), called *Mishcat al Masabih*, has been translated into English by Captain Matthews (Calcutta, 1809). Fragments from Bochary are found in a German translation, by Hammer, in the *Fundgruben des Orients*.

SU'NNITES, traditionists or believers in the Sunna (q. v.); the name of the 'orthodox' Muslims, as opposed to the Shiites (q. v.). They are subdivided into four principal sects, who, though at issue on different minor points, yet are acknowledged, by each other, to belong to the Faithful, and to be capable of salvation, and they each have a special oratory at Mecca. The first of these sects are the Hanefites, founded by Abu Hanifa, who died 150 years after the Hedjrah. They are emphatically called 'the followers of reason,' whilst the other three are guided exclusively by tradition. They allow reason to have a principal share in their decisions on legal and other points. To this sect belong chiefly the Turks and Tartars. The second sect are the Malekites, founded by Malek Ibn Ans, who died about 180 H. at Medina. As one of the chief proofs of his real piety and humility, it is recorded that when asked for his decision on 48 questions, he would only decide on 16, freely confessing his ignorance about the others. In Barbary and other parts of Africa, the greatest part of his adherents are found. Mohammed Al Shâfeï, born in Palestine, 150 H., but educated in Mecca, is the founder of the third sect, the Shâfæites. He was a great enemy of the scholastic divines, and seems altogether to have been of an original cast of mind. He never swore by God, and always took time to consider whether he should at all answer any given question or hold his peace. The most characteristic saying recorded of him is: 'Whosoever pretends to love both the work and the Creator at the same time, is a liar.' He is accounted of such importance, that according to his contemporaries, 'he was as the sun to the world, and as health to the body;' and all the relations of the traditions of Mohammed were said to have been asleep until he came and woke them. He appears to have been the first who reduced Muslim jurisprudence into a method, and thus made it, from a number of vague sayings, a science. His followers are now chiefly found in Arabia and Persia. Ahmed Ibn Hanbal founded the fourth sect, the Hanbalites. He was born 164 H., and was a most intimate friend of Shâfeï. His knowledge of the traditions (of which he could repeat no less than a million) was no less famed than was his piety. He taught that the Koran was not created, but everlastingly subsisted in the essence of God; a doctrine for which he was severely punished by the Calif Al-Motasem. On the day of his death, no less than 20,000 unbelievers (Jews, Christians, and Magians) are said to have embraced the Mohammedan faith. Once very numerous, the Hanbalites now are but very rarely met with out of Arabia. On the differences between the S. and Shiites, see SHIITES.

SUN-STROKE (otherwise called *Heat Apoplexy*, *Heat Asphyxia*, *Coup de Soleil*, *Erythismus tropicus*, and *Insolatio*, the name by which it is officially known in the returns of the Registrar-general) is a very fatal affection of the nervous system, which seldom occurs in Great Britain, except in extremely hot summers, but is very common in India and other tropical countries. Our knowledge of the nature of this remarkable disease is almost entirely based upon the accounts which have been given of it by Indian medical officers. It is from their reports that the most satisfactory history of this disease at present published—that, namely, of Dr. Aitken in his *Science and Practice of Medicine*, 3d ed. 1864—is mainly drawn up. From the accounts given by these observers, it is clear that the symptoms of the disease are liable to be greatly modified in different cases. Mr. Russell, when in charge of the 68th Regiment in May 1834, shortly after its arrival at Madras, with the men in robust health, has given the following account of this disease. 'The funeral of a general officer being about to take place, the men were marched out *at an early hour in the afternoon, buttoned up in red coats and military stocks, at a season, too, when the hot land winds had just set in*, rendering the atmosphere dry and suffocating even under the shelter of a roof, and when the sun's rays were excessively powerful. After having proceeded two or three miles, several men fell down senseless. As many as eight or nine were brought into hospital that evening, and many more on the following day. Three men died—one on the spot, and two within a few hours.

The symptoms observed (and they were alike in the three cases) were, first, excessive thirst, and a sense of faintness; then difficulty of breathing, stertor, coma, lividity of the face, and in one whom Mr. Russell examined, contraction of the pupil. The remainder of the cases (in which the attack was slighter, and the power of reaction perhaps greater) rallied; and the attack in them ran on into either ephemeral or a more continued form of fever.' Aitken, *op. cit.* One of the earliest symptoms, noticed by several observers, is the skin becoming rough and scaly, and the perspiration ceasing; the heat of the surface becomes at the same time much increased; the bowels become obstinately constipated. The actual attack, in the various cases described by the Indian surgeons and physicians, came on generally when the men were in their tents, sometimes during the day, but in several cases during the night. The patient had been generally lying down, often seemingly asleep, when the attention of his comrades would be directed to his hurried and heavy breathing, and on attempting to rouse him, he was found to be insensible. The mortality from sun-stroke is about 50 per cent. In the cases that terminate favorably, a gradual remission of the symptoms takes place; and

when the skin becomes cool and moist, and sleep has been procured (phenomena which usually occur within 36 hours of the attack), the patient may be regarded as out of danger.

The prediposing causes of sun-stroke are (1), an unusually elevated degree of temperature, accompanied by great dryness of the air; (2) The electrical condition of the atmosphere that precedes a thunderstorm; (3) A contaminated atmosphere from overcrowding; (4) All debilitating causes, such as prolonged marches, previous disease, intemperate habits, &c. Death sometimes occurs so suddenly that there is little opportunity for treatment, but the general indications in these cases are—the cold douche, from a height of three or four feet, keeping the surface wet and exposed to a current of air, the exclusion of light as far as possible, and the free employment of stimulants. In less rapidly fatal cases, the outer clothing should be removed, and the douche applied, as before, over the head and along the spine. Relaxation of the pupil is the first favorable sign. If the pulse flags, the douche must be replaced by the mere application of cold to the head. The hair must be cut as short as possible, and the nape of the neck blistered as speedily as possible. If insensibility recurs after an interval of ten or twelve hours, a blister should be applied to the crown of the head. The extremities and chest should be stimulated with mustard poultices. Immediately after the employment of the douche, a strong purgative injection should be thrown up the lower bowel, by means of a long stomach-pump tube (as, for example, a mixture of an ounce and a half each of castor oil and oil of turpentine, and two drachms of tincture of asafœtida in about half a pint of barley-water). Under no circumstances, should there be any abstraction of blood. The preventive measures are of more importance than the treatment; but this is a subject into which we have not space to enter. The advice of the regimental surgeon is too often disregarded by the commanding officer. There was an extraordinary mortality from sunstroke in the United States in the hot summer of 1881 : of 583 deaths occurring in little more than a week in Cincinnati, 314 were reported as being due to sunstroke and other heat-effects.

SUONADA (inland sea), an inland sea of Japan, which separates the island of Kiusiu and Sikopf from the larger one of Nipon. It is about 250 miles in length from the strait of Simonoseki to Osaca; and Sir R. Alcock estimates its greatest breadth at 50 miles. It is studded with innumerable islets and a few rocks. The scenery is picturesque. The prince of Nagato and Soulio having, contrary to treaty stipulations, closed this sea to foreign vessels and fired upon them, the English, French, and Dutch fleet destroyed the forts that barred its entrance (5th and 6th September 1864), with the loss, to the allied squadron, of 12 men killed and 60 wounded.

SUPERANNUA'TION is a retiring allowance granted under an act of 1859, 22 Vict. cap. 26, to all persons not being weekly laborers employed permanently in the civil service of the country. Before the age of 60, retirement can only take place from broken health (or ostensibly so), or from abolition of office : after 60, any person may retire. If the retirement take place before completing ten years' service, a gratuity only is allowed. After ten years, the pension is $\frac{1}{60}$th of the salary at the time of retirement for every year of service, up to $\frac{40}{60}$ths, which is the maximum allowed, except under very special circumstances, when the Treasury may grant larger pensions, never, however, exceeding the salary vacated. Professional persons appointed later in life than the usual age, may have pensions computed with a number of years, not exceeding 20, added to their actual service. On the other hand, the Treasury may, for grave demerit, diminish a pension below the scale granted in the act. A person on a pension is liable to recall to a position as good as he vacated, up to the age of 60, if in suitable health. A civil servant is defined to be one holding appointment direct from the crown, or under certificate from the Civil Service Commissioners; and his salary must be paid out of the consolidated fund or out of moneys voted by parliament. Weekly laborers are ineligible; but artificers may serve for superannuation, provided they are not paid at the full current market rates of wages. See RETIREMENT.

Superannuation is one of the great boons of the permanent civil service, in which the officials are, as a rule, paid salaries lower than they could earn elsewhere; but to render promotion tolerably certain, retirement at 60 should be, not as now voluntary, but compulsory. At present, an official may at his option serve as long as he is capable of attending office; and many actually do die in harness, years after they have become useless.

SUPERCA'RGO is an important officer in a merchant vessel, charged with the control of all her commercial transactions. The cargo is under his care, and he judges as to its disposal and replacement.

SUPEREROGA'TION, WORKS OF (Lat. *Supererogata*, over and above things required), a class of works which, in the Roman Catholic system, are described as not absolutely required of each individual as conditions to his eternal salvation. Roman Catholics found this definition on the distinction between what they believe to be commanded and what they hold to be only counselled, for an example of which they appeal to the words of our Lord to the young man in Matthew xix. 21, which distinguish one class of works which are necessary in order to 'enter into life,' and a further class which must only be done if we 'would be perfect.' Roman Catholics do not profess to recognize in works of supererogation, any distinctive essential quality by which they differ, whether in their physical or their moral entity, from other works, and in virtue of which, by their own nature, the individual may found upon them a personal claim to reward. For works of supererogation, as for all supernaturally good works, they hold that the assistance of God's grace is indispensably necessary; and they do not ascribe to them any merit, except that which arises from God's own free and gratuitous promise. In one word, the only distinctive characteristic of a work of supererogation lies in its not being supposed to be prescribed or commanded as absolutely necessary for the salvation of the individual, and its being done for the sake of greater perfection; and the doctrine which teaches the possibility of such works is, according to Catholics, a necessary consequence of the unequal fervor and unequal degrees of holiness which exist even in the class of the virtuous servants of God.

A further consequence of this doctrine is that God may accept the superabundant works of one in atonement for the defective service of another; and hence, in the Catholic theory of Indulgences (q. v), along with what they regard as the infinite and inexhaustible treasure of the merits of our Lord, they also regard, although in a degree infinitely inferior, the superabundant merits of the saints as forming part of that 'treasure of the church' which is applied in the form of indulgences.

SUPERFŒTA'TION, or the circumstance of two distinct conceptions occurring in the same woman at an interval of greater or less duration, so that two fœtuses of different ages—the offspring possibly of different parents—may co-exist in the uterus, is a subject of great interest both in a scientific and in a medico-legal point of view. A couple of centuries ago, there was a universal belief in not only the possibilty but the comparative frequency of this occurrence. Fifty years ago, it was as universally disbelieved; and now again (owing to the investigations of various inquirers, amongst whom Dr. Bonnar of Cupar deserves special mention), we are returning to the belief of our ancestors. The cases described as instances of superfœtation may be arranged in three classes; but as will be presently seen, it is only to the cases of the third class that the term superfœtation is truly applicable. The *first class* includes the numerous undisputed cases in which two mature children, bearing evidence from their different colors, that they are the offspring of different parents, are born at the same time. In the slave states of America, it was by no means uncommon for a black woman to bear at the same time a black and a mulatto child—the former being the offspring of her black husband, and the latter of her white lover; and the converse has occasionally occurred—a white women at the same time bearing a white and mulatto child. There is no difficulty in accounting for these cases, which are examples of contemporaneous conception rather than true superfœtation.

The *second class* includes those cases in which a twin has been aborted, leaving its fellow undisturbed in the uterus, to be matured and born in due time, or in which twins have been produced at the same time, one of which was fully formed, while the other was small and apparently premature, from being 'blighted' or arrested in its development at an early period. Cases of these kinds are by no means rare; but there is no reason for believing that the infants were conceived at different periods. The *third class* includes the cases in which a *mature* child has been born, and an *immature* fœtus, the product of a different conception, has either been left in the womb until its period of maturation, or, if expelled along with the other, has presented no mark of wasting or of arrested development. 'In a case of genuine superfœtation,' says Dr. Bonnar, 'a woman must bear two (or more) *mature* children, with an interval of weeks or months between the birth of each; or, if she part with the whole contents of the uterus at the first delivery, the difference of the ages of the fœtuses, or the mature child and the fœtus as the case may be, must be unmistakable, and there must be the absence of all marks of blight of the latter, so as to leave no doubt that, had it remained in utero, it would have gone on to perfect maturity.' Amongst the cases of superfœtation that have been specially discussed by writers on Midwifery and Medical Jurisprudence, are the following : (1) Velpeau quotes from the *Recueil de la Société de Médecine* the case of a woman named 'Arles,' who, in 1796, gave birth to a child at the full time, and five months afterwards to another, which was also thought to be at the full time; (2) Dr. Maton, an eminent London physician, communicated to the College of Physicians the case of Mrs. T——, an Italian lady, who was delivered of an apparently healthy and mature male child on

the 12th of November 1807, but which lived only nine days. On the 2d of February 1808, or 82 days after the birth of the first, she was delivered of a second child, which likewise had every sign of being completely formed and mature.

The following case, which, as Dr. Bonnar (in his *Critical Inquiry regarding Superfœtation*, Edin. 1865) observes, 'has been the principal battle-field of the advocates of superfœtation and their opponents,' and has given rise to more discussion than any other, is recorded by Dr. Desgrange of Lyon. Madame Villard had a miscarriage at seven months on the 20th of May 1779. In about a month thereafter, she conceived again, and on the 20th of January 1780, she brought forth a living child. No milk appeared in her breasts, the abdomen did not seem to diminish in size, and other symptoms which normally follow delivery were absent. The two surgeons who were in attendance being naturally puzzled, called in Dr. Desgrange, who declared, in opposition to their views, that there was still a child in the womb; and his opinion was confirmed by her being delivered of a living child on the 6th of July 1780, 167 days after the first birth. Dr. Bonna has collected from *The Peerage* a number of cases of probable superfœtation occurring in married life. Excluding a very few exceptional cases, he adopts Dr. William Hunter's view, that 210 days, or seven calendar months, is the minimum period of uterine life at which a child should be born in order to be reared, and he assumes that no prolific intercourse can take place until at least fourteen days after the first delivery; and with these axioms, he quotes the following cases: (1) In the Hamilton (Lord Mountflorence) family, a daughter, who was born 182 days after the birth of a son who had reached maturity, lived to be married, whose supposed uterine life was not more than 168 days. (2) In the Aukland family, the Honorable William Frederick Eliot, who was born 173 days after the birth of a sister (who lived 60 years), survived 28 years, although his assumed uterine life was only 159 days. (3) Lord Cecil J. Gordon, brother to the 10th Marquis of Huntly, has a son, Cecil-Crosbie, who was born in January 1850 (only 127 days after the birth of a previous child). This son came to maturity, and his assumed period of gestation was only 113 days. 'We cannot conceive,' says Dr. Bonnar, 'how these three cases can possibly be explained except by the doctrine of superfœtation;' and Dr. Taylor (*Principles and Practice of Medical Jurisprudence*, page 849) fully adopts his view. Dr. Duncan believes, from anatomical investigations, that up to the third month of gestation, a second conception may follow the first; and he is of opinion that this will satisfactorily account for all the cases of superfœtation on record.

SUPE'RIOR, in Scotch Law, means one who, or whose predecessor, has made a grant of heritable property to a vassal, on condition of the latter paying an annual duty or sum of money, generally called a feu-duty. The superior is said to have the superiority, or *dominium directum*, and the vassal has the feu, or *dominium utile*. In popular language, the superior is a kind of landlord. See FEU.—In England, the word is not used, though in copyhold estates the term 'lord' corresponds to it.

SUPERIOR, LAKE, the largest body of fresh water in the world, is the highest and most western of the great lakes lying between West Canada and the United States. It is situated not far from the center of the North American continent. Its general form is nearly semi-lunar, the outer curve being towards the north. Greatest length from east to west, 355 miles; greatest breadth, 160 miles; area, about 32,000 sq. m.—fully that of Ireland. The surface of the lake is about 600 feet above the level of the sea, and its mean depth 1000 feet, so that its bottom is 400 feet below the level of the seal It surface has an elevation of about 22 feet above that of Lake Huron and Lake Michigan. The greater portion of this rise is at the Sault Ste. Marie, a strong rapid about a mile in length, at the commencement of the river St. Mary, which transmits the waters of Lake S. to Lake Huron.

Lake S., being situated very near the watershed between Hudson's Bay and the Mississippi, receives no rivers of importance, although hundreds of small rivers pour themselves into it. The largest are the St. Louis River, which falls into its western extremity at Fond du Lac, and is about 110 miles long; and the Neepigon River, on the north side, which, with the lake of the same name has a length of about 200 miles. One of the branches of the Mississippi in Minnesota approaches to within 20 miles of the western extremity of Lake S.; and a small lake near the head of the Albany River, of which the waters flow to Hudson's Bay, is only four miles from a bay opposite the State Islands on the northern shore, forming a route with little portage, which has long been used by the Hudson's Bay Company for the conveyance of goods from Lake S. to the northern country.

The promontory, Kee-wee-naw, near the middle of the south side, projects far into the lake. The islands are not numerous, the largest being Isle Royale, 44 miles long.

The country around Lake S. is generally bold and hilly, with the exception of the peninsula lying between it and Lake Michigan; but few of the hills rise more than 1000 feet above the level of the lake, and most of them are far below this height. On the southern shore, 100 miles west of the Sault Ste. Marie, are the Pictured Rocks, cliffs of gray and red sandstone from 100 to 200 feet high, in many places presenting fantastic forms, and marked by numerous perpendicular stripes of red and yellow, from ferruginous waters trickling down the face of the rock.

The boundary between the United States and W. Canada, starting from the outlet of the lake at the Sault Ste. Marie, sweeps towards the north, so as to include in the United States even the Isle Royale, which is only 13 miles from the British coast, and strikes inland from the mouth of Pigeon or Arrow River, on the north-west shore.

The only obstacle to navigation between Lake Huron and Lake S., is the Sault Ste. Marie, which is overcome by a canal of about a mile in length, with two locks, on the American side. This is, perhaps, the finest canal in the world. The sides and bottom are lined with stone throughout its whole length, the locks are admirably contrived, and the largest ships can pass through it with ease. The trade is increasing so rapidly, that a canal on the British side will also be required at no distant day.

The water of Lake S. is remarkable for its coldness, purity, and transparency, although the affluents on both sides are either turbulent, or deeply colored by vegetable matter from swamps and forests.

A rise or fall in the level of the water, amounting to several inches in a few hours, is frequently to be observed along the shore, and has been supposed to be due to a regular tide, but is probably caused by the wind. Fresh water being more easily moved by the wind than salt water, great waves arise in Lake S. with wonderful rapidity; and even in summer, large steamers are compelled to take shelter in some bay, or under the lee of an island. Owing to the low temperature of the water, compared with that of the air, in summer, fogs are prevalent, resting on the water at night, and vanishing an hour or two after sunrise.

Lake S. never freezes over, but the bays are sealed up in winter, and a rim of ice extends to some distance all around the shore.

The rocks around the lake are very ancient, belonging principally to the Laurentian and Huronian systems of the Azoic series, overlaid in some places, especially on the south side, with patches of the Lower Silurian. The prevalent Laurentian rock is orthoclase gneiss. Among the Huronian rocks are greenstones, slates, conglomerates, quartzites, and limestones. The Lower Silurian rocks are soft sandstones. There is everywhere much evidence of glacial action.

The Huronian rocks are well stored with useful minerals. The copper and iron mines of the south side are celebrated for their extent and richness, and there is every reason to think that the mineral resources of the British side are equal to those of the American, although as yet comparatively undeveloped. The richest copper-mines are situated near Kee-wee-naw Point. The metal occurs principally native, and sometimes in single masses of great size. One was met with in 1853, which measured about 40 feet in length, and was calculated to weigh about 400 tons. Native silver is found associated with the native copper, and sometimes intimately mixed with it. A rich vein in an islet in Thunder Bay (British side) yielded in one year silver to the value of 1,230,000 dollars. Gold has been found in small specks at Namainse on the British side. Lead ore occurs in some places. The beds of hæmatite, or red iron ore, at Marquette, on the south side, are of wonderful extent. The ore is conveyed by a railway to the harbor, thence by vessels to Cleveland, on Lake Erie, and thence by rail to Pittsburg, where it is smelted.

The fisheries of Lake S. deserve notice. The delicious whitefish and the gray trout abound, as well as other kinds of fish. The Canadian legislature passed a law in 1865 to put a stop to the wholesale destruction of them on the spawning grounds.

The shores of Lake S. are frequented by bands of the Ojibbeway tribe of aborigines. They are of very pure blood, retain in a great measure their primitive habits, and many of them are still pagans.

The white population of the British shore of Lake S. consists as yet only of the fishermen and explorers who visit the region during summer; and of miners who extract the silver ore from veins recently discovered on Silver Island, near Thunder Bay. But on the American shore, a number of thriving towns have sprung up. Until the completion of the Canadian Pacific Railway along its northern shore, the connection between the eastern and western sections will be formed by steamboats across the lake, from the Ottawa section at Sault Ste. Marie on the east side, to Prince Arthur's Landing on the western shore. A telegraph line has been established.

SUPERPHO'SPHATES. See PHOSPHORUS.

SUPERTO'NIC, in Music, the note which, in the diatonic scale, is next above the tonic or keynote, and forms with it the interval of the second, as D in the key of C major.

SUPPLE JACK, a name given in the southern parts of the United States of America to the *Berchemia volubilis*, a twining shrub of the natural order *Rhamnaceæ*, which is found as far north as Virginia. It has oval leaves, small flowers, and violet-colored berries. It abounds in the Dismal Swamp and in similar situations, and ascends to the tops of the highest trees. The genus *Berchemia* contains a number of species of twining shrubs, natives of warm climates in different parts of the world.—The name S. J. is also given in the West Indies and tropical America to *Serjania* (or *Seriana*) *triternata*, a shrub of the natural order *Sapindaceæ*, with a long, flexile, woody stem, which climbs to the tops of the highest trees, and is used for walking-sticks. It has poisonous properties, and is employed for stupefying fish.

SUPPLY', COMMISSIONERS OF, persons appointed by the acts imposing the land-tax in Scotland, to assess, and formerly also to collect, that tax. Their principal duty now is to assess the land-tax, and apportion the valuation according to the provisions of the Valuation of Lands Act, 17 and 18 Vict. c. 91. They are entitled to name a convener, who acts as preses of the meeting, and a clerk with a reasonable salary. The qualification, as recently modified by 17 and 18 Vict. c. 91, consists in the being named as an *ex officio* Commissioner of Supply in any act of supply; or the being proprietor, or husband of a proprietor, of lands of the yearly value of £100; or the eldest son of a proprietor of lands of the yearly value of £400: and a factor of a proprietor of lands of the yearly value of £800 is empowered to act as Commissioner of Supply in his absence.

By act 17 and 18 Vict. c. 91, the Commissioners of Supply of every county, and magistrates of every burgh, must cause a valuation roll to be made up yearly, showing the rents of all lands or heritages in the county or burgh, and the names of the proprietors and tenants; and for this purpose, they are empowered to appoint an assessor or assessors. A yearly court is to be held by the commissioners and magistrates, for hearing appeals against the determinations of the assessors, in which three Commissioners of Supply and two magistrates are to form a quorum, the preses having a casting vote. See VALUATIONS OF LAND, LAND-TAX.

SUPPLY, COMMITTEE OF. The sums granted in parliament to defray the public expenditure for the current year are called *Supplies*. All bills authorizing the expenditure of public money must originate in the House of Commons, and be based on resolutions moved in a Committee of Supply, which is always a committee of the whole House. The House having resolved that a supply be granted to her Majesty, resolves itself into a Committee of Supply. The various estimates are submitted to the committee, which has to consider what specific grants are to be voted; and the resolutions of the committee are reported to the House, and adopted or rejected. It belongs to another committee of the House, the 'Committee of Ways and Means,' to consider how the sums shall be raised which are voted by the Committee of Supply. See WAYS AND MEANS, PARLIAMENT.

SUPPO'RTERS, in Heraldry, figures placed on each side of an armorial shield, as it were to support it. They seem to have been, in their origin, a purely decorative invention of medieval seal-engravers, often, however, bearing allusion to the arms or descent of the bearer; but in the course of time, their use came to be regulated by authority, and they were considered indicative that the bearer was the head of a family of eminence or distinction. The most usual supporters are animals, real or fabulous; but men in armor are also frequent, and Savages (q. v.), or naked men, often represented with clubs, and wreathed about the head and middle. There are occasional but rare instances of inanimate supporters. On early seals, a single supporter is not unfrequent, and instances are particularly common of the escutcheon being placed on the breast of an eagle displayed. The common rule, however, has been to have a supporter on each side of the shield. The dexter supporter is very often repeated on the sinister side, but the two supporters are in many cases different: when the bearer represents two different families, it is not unusual for a supporter to be adopted from the achievement of each.

In England, the privilege of bearing supporters as now defined belongs to the sovereign and princes of the blood, peers and peeresses, and the heads of a very few families not of the peerage, whose right is based on an ancient patent, or very early usage. No right is recognized by the College of Arms as belonging to the sons of peers bearing courtesy titles. Knights of the Garter and Knights Grand Cross of the Bath are dignified with supporters, which, however, are not hereditary. Supporters have also been assigned to the principal mercantile companies of London. In Scotland, the use of supporters is somewhat less restricted. The distinction was much less wide than in England between the greater and lesser barons (see MINOR BARONS), and the right to supporters was considered to belong to the latter, so long as the baronial status conferred a right to sit in parliament. The act of 1587, which finally excluded the lesser barons from the Scottish parliament, and established a systematic parliamentary representation, was not held to interfere with this armorial privilege, and it is yet the practice of the Lord Lyon to grant or confirm supporters to the representatives of all minor barons who had full baronial rights prior to that date. A limited number of heads of important families, including the chiefs of the larger Highland clans, apart from considerations of barony, participate in the right to supporters. Lyon is also considered to have it in his power to confer them *ex gratiâ*, a prerogative which is but sparingly exercised, one of the instances of such departure from strict rule having been in favor of Sir Walter Scott. Nova Scotia baronets as such have no right to supporters, though many of them bear them in respect of their baronial qualification.

Arms of Duke of Argyll.

The lion and unicorn, familiar in the royal arms of the United Kingdom, were adopted, the former from the achievement of England, the latter, from that of Scotland prior to the union of the crowns.

In the more modern heraldry, supporters generally stand either on an escrol, containing the motto, or, more properly, on a carved panel of no definite form, which in Scotland is known by the name of a *compartment*.

SUPPURA'TION is a morbid process which gives rise to the formation of Pus (q. v.), which, as is well known, is one of the commonest products of inflammation. There are two doctrines as to the origin of pus. The opinion universally adopted till very recently was, that it was formed from an excessive exudation of the fluid portions of the blood through the walls of the capillaries; in which exudation, under certain conditions, pus-cells were developed. This view is now rejected for the doctrine of Virchow, the eminent professor of pathology at Berlin, who maintains that pus-cells are generated from the corpuscles of areolar tissue, which he supposes to permeate nearly every portion of the body. Pus, according to Virchow, is a young tissue in which, amidst the rapid development of cells, all solid intercellular substance is gradually dissolved. A single cell of areolar or connective tissue may, in an extremely short space of time, produce some dozen of pus-cells; but the result is of no service to the body, suppuration being, to use his own words, 'a pure process of luxuriation, by means of which superfluous parts are produced, which do not acquire that degree of consolidation or permanent connection with one another, and with the neighboring parts, which is necessary for the existence of the body.' There are two different modes of pus-formation, according as the pus proceeds from Epithelium (q. v.) or from connective tissue (see CELLULAR TISSUE). When pus is formed from epithelium, it is produced without any considerable loss of substance, and without ulceration; but when it is formed from connective tissue, ulceration must always exist. The mucous membranes vary in their power of forming pus.

A mucous membrane, according to Virchow, is the more qualified to produce pus without ulceration the more completely its epithelium is stratified, those with a single layer of epithelium being less adapted for the production of pus. Thus the intestinal mucous membrane scarcely ever produces pus without ulceration; while other mucous membranes, containing several strata of cells, are capable of secreting enormous quantities of this fluid without the slightest ulceration (as, for example, the urethral mucous membrane in gonorrhœa).

The above cases of suppuration occur on free or exposed surfaces, and are unaccompanied with loss of tissue. Deep-seated pus-formation takes place only in connective tissue. The first stage of formation consists in an enlargement of the normal cells, and a division and excessive and rapid multiplication of their nuclei. This is soon followed by division of the cells themselves, and their conversion into true pus-cells. If this process takes place beneath a surface which does not participate in the morbid change, or which is capable of resisting it for a time, an *abscess* is formed; whereas, when pus-cells are poured forth from an exposed surface, we have an *ulcer*.

Although suppuration is a morbid process, it often accompanies processes of a beneficial tendency (such as granulation), and frequently takes the place of other far more morbid processes. It further affords a mechanical means of removing foreign bodies,

such as thorns, splinters of glass, &c., from soft parts into which they may have been driven; and it is possible (as some pathologists believe) that the formation of abscesses may sometimes serve to eliminate morbid matters from the system.

SUPRALAPSA'RIAN (Lat. *supra*, before, *lapsus*, the Fall), the name given to the school of divines which maintain that God's absolute decree of election and reprobation is antecedent to His foresight of the fall of Adam, and irrespective of it. See SUBLAPSARIAN.

SUPRA-RE'NAL CAPSULES AND THEIR DISEASES. The supra-renal capsules are two small, flattened, glandular bodies of a yellowish color, situated, as their name implies, immediately in front of the upper end of each kidney. In weight they vary from one to two drachms. They belong to the class of ductless glands, and on making a perpendicular section, each gland is seen (like the kidney) to consist of cortical and medullary substance. The blood-vessels and nerves of the glands are exceedingly numerous. Of late years, much attention has been drawn to the diseases of these organs from the observation of the late Dr. Addison (of Guy's Hospital), that such cases are frequently associated with the deposition of pigment in the skin, causing it to assume a deep bronze color. The following definition of *Addison's Disease*, or *Supra-renal Melasma*, or *Bronzed Skin Disease*, embracing all the most important points in its natural history, is given by Dr. Aitken: 'A morbid state, which establishes itself with extreme insidiousness, whose characteristic features are anæmia, general languor and debility, and extreme prostration, expressed by loss of muscular power, weakness of pulse, remarkable feebleness of the heart's action, breathlessness upon slight exertion, dimness of sight, functional weakness and irritability of the stomach, and a peculiar uniform discoloration of the skin, which becomes of a brownish olive-green hue, like that of a mulatto, occurring in connection with a certain diseased condition of the supra-renal capsules. The progress of the disease is very slow, extending on an average over one year and a half, but may be prolonged over four or five. The tendency to death is by asthenia, the heart becoming utterly powerless, as if its natural stimulus—the blood—had ceased to act.'—*The Science and Practice of Medicine* (3d ed. vol. ii. p. 72). The numerous cases recorded by different physicians of all countries since Dr. Addison's original observations were made, show that the connection between *bronzing* of the skin and various morbid states of the supra-renal capsules is a fact beyond all dispute; but the exact relationship and pathological significance of the morbid states thus connected are still open questions. The special morbid changes in the capsules necessary for the production of the symptoms which constitute the disease, are first the deposition of a translucent, softish substance; the degeneration of this to a yellowish-white opaque matter; and afterwards a softening into an abscess, or drying up into a chalky mass. In the way of treatment, nothing can be done but to attempt to improve the general health by nourishing food, tonics, &c. The literature of this very singular disorder is mainly to be found in various memoirs in the *Guy's Hospital Reports*.

SUPRE'MACY, ROYAL. The term supremacy is, in politics, chiefly used with regard to authority in matters ecclesiastical. From the time of Pope Gelasius (494 A.D.) to the Reformation, the pope exercised a very extensive authority, judicial, legislative, and executive, over all the churches of Western Europe, somewhat undefined in its limits, varying in different countries and at different periods; which continues to be more or less recognized in all countries whose inhabitants are in communion with the Church of Rome. At the English Reformation, the papal supremacy was abolished, and act 26 Henry VIII. c. 1, declared the king and his successors to be the 'only supreme head on earth of the Church of England.' A curious document was at the same time drawn up by the government, in which, to avoid misconception, it was explained that the recognition of this headship of the church implies only that the king should have such power as of right appertaineth to a king by the law of God, and that he should not take any spiritual power from spiritual ministers, or pretend to 'take any power from the successors of the apostles that was given them by God.' In 1535, the same year in which this act was passed, John Fisher, bishop of Rochester, Sir Thomas More, and others, were beheaded for denying the king's supremacy; and in 1578, John Nelson, a priest, and Sherwood, a young layman, suffered the punishment of death for the same offence. The assumption by Henry VIII. of the title of 'Head of the Church,' notwithstanding the explanation alluded to, was much commented on; and on the accession of Elizabeth, it was thought prudent, while again claiming the supremacy in all causes, as well ecclesiastical as civil, to keep that designation in the background. By successive statutes, the oath of supremacy was appointed to be taken by the holders of public offices along with the oath of allegiance and of abjuration, and these three oaths were consolidated into one by 21 and 22 Vict. c. 48. The subject of oaths was, however, revised by the legislature in 1868 and 1871; and a new short oath of allegiance, in which the royal supremacy in matters ecclesiastical is not in express words specified, was substituted for the oath previously imposed upon members of both Houses of Parliament. See ABJURATION and OATH.

SURABAY'A, a leading seaport of Java, and capital of a residency, is situated on the Kali Mâs mouth of the river Kedirie, near the Strait of Madura, the citadel being in 7° 4′ 30″ S. lat., and 112° 40′ 40″ E. long. The population of the city and suburbs is about 110,000. The European town is on the west bank, five bridges connecting it with the Chinese and Javan quarters on the east. There are 2 Protestant clergymen, a Roman Catholic priest and assistant, several government and adventure schools for Christian children. There are regular steamboat services to Samarang, Batavia, and other places. The government sugar-culture in S. employs 6000 families, and produces above 30,000 tons per annum. The government coffee amounts to about 400 tons per annum. The residency of S. comprises an extensive tract of fertile land in the north-east of Java, and the island of Madura. The population amounts in all to 1,600,000, including 5500 Europeans and 11,000 Chinese. Rice, coffee, sugar, indigo, cotton, tobacco, and cocoa-nuts are extensively cultivated.

SURAKA'RTA, a residency of Java, south-east from Samarang, with an area of 2370 sq. m., is fertile and well cultivated, producing rice, maize, sugar, coffee, tea, indigo, tobacco, pepper, cacao, vanilla, and tropical fruits. About 4500 tons of coffee are produced yearly. Pop. 830,000, including about 2000 Europeans. The people are proud, and less obedient than in the other residencies, but abjectly submissive to the native emperor, though, in many things connected with his government, he must consult the European resident.

Surakarta, the capital of the empire, and seat of the residency, lies on the left bank of the Solo, in 7° 31′ 30″ S. lat., and 110° 46′ 7″ E. long., covers a large space, and has a population of over 50,000. Many princes and nobles have their palaces in S.; that of the emperor is of great extent and splendor, 10,000 persons, belonging to, or in the service of the royal family, living within the wall. North-east from the royal parks lies the European town, in front of which, surrounded by the parade ground, and commanding the palace, is a square fort, with broad canal and drawbridges at the four curtains, and mounted with 30 pieces of heavy artillery. There is a normal school for training Javanese teachers; a government school, with 80 pupils; and an adventure girls' school, with 40 pupils. A railway was completed in 1870, from Samarang to S., by which the produce is easily conveyed to the port of shipment, and an impulse given to trade and agriculture.

SURA'T (Sans. *Saurashtra*, good country), a large but declining city of British India, capital of a district of the same name, 150 miles north of Bombay, and about 17 miles from the mouth of the Taptí, in the Gulf of Cambay. It is 6 miles in circumference, and it is surrounded on the landward side by a brick wall. The river at S. is said to be fordable, although at high tide it can float vessels of 50 tons burden. The English and Portuguese factories, the former now used partly as a lunatic asylum and partly as hospital, are both imposing edifices of great strength and solidity. S. is said to have contained—but this is probably an exaggeration—800,000 inhabitants at the close of the 18th c., about which time its markets were crowded with the costliest wares, brought by merchants from the remotest countries. Its trade and manufactures, once almost extinct, revived during the American civil war, and it still exports cotton and grain to Bombay. S. is a place of considerable military strength, and the residence of a British military commandant and other dignitaries. Pop. in 1871, 107,149; (1881) 113,417.

S. was long thought to be one of the most ancient cities of Hindustan, but this opinion is now abandoned, and it is believed to have been a mere fishing-village as late as the 13th century. It first rose into importance as the spot whence the Mohammedans of Hindustan embarked on their religious voyage to Mecca. S. was sacked in 1512 by the Portuguese soon after their arrival in India. In 1612, an English force arrived here in two vessels, under the command of Captain Best, who defeated the Portuguese, and obtained a *firman* from the Mogul emperor, authorizing the residence of a British minister. The Dutch trade with S. commenced in 1616, when a Dutch factory was established. A French factory was founded in 1668. In the course of time, the English influence began to predominate. In 1759, the castle and fleet were made over to them; and from the year 1800 the government of the settlement has been entirely vested in their hands.

SU'RBASE. See PEDESTAL.

SURD. See IRRATIONAL NUMBERS.

SU'RETY. See GUARANTY.

SURFACE GRUB, the caterpillar of the *Great Yellow Underwing Moth* (*Triphæna pronuba*), a pretty large moth, with the upper wings deep brown or pale tawny, the under wings bright

orange with a black border. This moth abounds in hay-fields in Britain at the season of haymaking. The caterpillar, when full grown, is nearly an inch and a half long, pale green with a tinge

a, Surface Grub; *b*, Chrysalis; *c*, the Moth (*Triphæna pronuba*).

of brown, dotted with black, three pale lines down the back, and seven black spots on the inside of each of the two outer ones. It often does great mischief to the roots of cabbages and turnips, and also devours the roots of grass.

SURF DUCK, or SURF SCOTER (*Oidemia perspicillata*), a species of Scoter (q. v.) extremely plentiful on the coasts of Labrador, Hudson's Bay, and other very northern parts of America, from which great numbers migrate southwards in

Surf Duck (*Oidemia perspicillata*).

winter. It is a rare visitant of the coasts of Britain and other parts of Europe. In size, it is about equal to the Mallard. The plumage is black, except two patches of white on the head and back of the neck. It is never seen on lakes or rivers, but only on the sea-coast. It dives so quickly, that it is very difficult to shoot except when on the wing. Its flesh is rank, and has a fishy taste.

SU'RGEON, ARMY AND NAVY. In the army, surgeon is the grade in which an officer enters the medical department, and from which he is promoted in about 15 years to the rank of surgeon-major. He may be attached to a regiment, or serve with a district hospital; pay and duty being practically the same in either case. The pay rises gradually from £182, 10*s*. to £319, 7*s*. 6*d*. a year; and the surgeon ranks as a lieutenant for six years, and afterwards as a captain. In the medical department of the navy, surgeon is also the junior rank, reckoning for precedence as a sub-lieutenant for six years, and afterwards as a lieutenant. The pay varies from £200, 15*s*. a year to £310, 5*s*.

SURGEONS, COLLEGE OF. The present 'Royal College of Surgeons of England' dates its origin from the year 1460—1461, when Edward IV. 'did, at the supplication of the freemen of the mystery of barbers of the city of London using the mystery or faculty of Surgery, grant to them that the said mystery, and all the men of the same mystery of the said city, should be one body and perpetual community.' In 1500, four Masters in Surgery were appointed under the title of 'Magistri sive Gubernatores mistere Barbitonsorum et Sirurgicorum' (*sic*) and six years after this date the Barber-surgeons of Edinburgh were incorporated by a charter from James IV. Although the original charter granted to the Company of Barbers of London was confirmed by several succeeding kings, many persons practised surgery independently, and apparently in defiance of the Company; and in order to check unqualified persons, it was enacted in the 3d year of Henry VIII. (1511) 'that no person within the city of London, or within seven miles of the same, shall take upon him to exercise or occupy as a physician or surgeon, except he be first examined, approved, and admitted by the bishop of London, or by the dean of St. Paul's calling to him four doctors of physic, and for surgery other expert persons in that faculty.' Hence arose a company called the Surgeons of London. In the 32d year of Henry VIII. (1540), the Company of Barbers of London and the Company of Surgeons of London were united 'by the name of the Masters or Governors of the Mystery and Commonalty of the Barbers and Surgeons of London.'

It was not till the 18th year of George II. (1745) that the surgeons of London were by act of parliament separated from the barbers of London, and made a distinct corporation under the name of 'The Master, Governors, and Commonalty of the Art and Science of Surgery of London.' In the 40th year of George III. (1800), this company was dissolved, and replaced with their former and additional privileges by 'The Royal College of Surgeons of London.' A new charter was granted to the college in the 7th year of Victoria (1843), in which it was declared 'that it is expedient to create a new class of members, to be called Fellows,' and 'that from henceforth the corporate name or style of the said college shall be THE ROYAL COLLEGE OF SURGEONS OF ENGLAND.' Power was given to the council to elect not less than 250, nor more than 300, members of the college to be Fellows.

These 'first Fellows' were mainly elected from the London and provincial hospital surgeons. Other Fellows might subsequently be elected from the members, 'after having complied with such rules and regulations as shall be considered expedient, and after having passed a special examination.' Those who are admitted to the fellowship by examination are distinguished in the college calendar by the letters *Ex.* being prefixed to their name. By an addition to the charter, obtained in 1852, power was given to the council, subject to certain regulations, to appoint members of 15 years' standing to the fellowship without examination. The college was likewise empowered to test the fitness of persons to practice midwifery and to grant certificates of such fitness; and in 1859 it was similarly authorized to test the fitness of persons to practise as dentists, and to grant certificates of such fitness.

The government of the college is vested in a Council of twenty four persons, including one president and two vice-presidents; and none but Fellows of 14 years' standing are eligible as members of council. Three members of council go out annually by rotation, and the vacancies are filled up on the first Thursday of July. There is a Board and a Court of Examiners, each consisting of ten members, including a chairman at the former, and a president at the latter; and as the examiners, who receive large emoluments (the fees to the Court of Examiners for the professional examination of members for the year ending June 24, 1878, were £10,110 15s.), are elected by the council, whose remuneration is slight, a position in the council is eagerly sought for as a stepping-stone to an examinership. Besides the Court of Examiners, there are special boards of examiners in Midwifery, in Dental Surgery, and in Classics, Mathematics, and French for the preliminary membership and fellowship examination. There are four professorships in connection with the college—viz., that of Human Anatomy and Surgery, the Hunterian Professorship of Comparative Anatomy and Physiology, the chair of Surgery and Pathology, and that of Dermatology. A Hunterian Orator is appointed every second year. The college sends a representative to the General Council of Education and Registration. A candidate for the membership of the college is required to pass a preliminary examination in the usual branches of a liberal education. The fee for the anatomical examination is £5, 5*s*., and that for the surgical, or pass-examination, is £16, 15*s*., making a total of £22. The fellowship fee is an additional 10 guineas. For details, see the *Calendar of the Royal College of Surgeons of England*.

The Museum of the College of Surgeons is incomparably the finest museum of its kind in the United Kingdom. The Hunterian Collection (see HUNTER, JOHN), which forms its basis, was purchased by a parliamentary vote of £15,000, and presented to the College in 1799. The edifice in Lincoln's Inn Fields (the germ of the present pile of buildings) was completed in 1813. The Hunterian Collection was estimated to consist of 13,682 specimens; the total number of specimens was recently reckoned at above 40,000. The library contains 36,000 volumes. Both the Museum and Library are readily accessible to visitors.

SURGEONS OF EDINBURGH, ROYAL COLLEGE OF, was originally an association of those professing 'surregerie and barbour-craft,' who obtained their first civic charter in 1504, and had it confirmed by James IV. next year. About 1589 began the custom of granting leave to barbers to practise their profession, without admitting them to the full freedom of the incorporation. For a century and a half the members of the craft were sole teachers and almost sole professors of the surgical art in Edinburgh, and contrived to hold their own against the physicians, who, both before and after their incorporation as a Royal College in 1681, made efforts to secure authority over the surgeons. In 1637 the surgeons granted the apothecaries a civil status in alliance with themselves; the nominal connection with the barbers was dissolved in 1732. A patent of 1694 settled the relations between the surgeons and the physicians, making amicable terms possible; and in 1778 the surgeons became formally a Royal College too.

Nevertheless they remained, much against their will, one of the incorporations of Edinburgh, till the act of 1851 dissolved what survived of their civic rights, and set the College free from the galling control of the Town Council. The College, which in 1881 had more than 450 fellows, sanctions the lectures of a staff of its own members as qualifying for examination candidates for its diploma of licentiate, and appoints a board of examiners. This examination is now usually taken in connection with that for the diploma of the College of Physicians.

SU'RGERY. There can be no rational doubt that surgery (Gr. *cheir*, the hand; *ergon*, work, signifying the manual interference, by means of instruments or otherwise, in cases of bodily injury, as distinguished from the practice of medicine, which denotes the treatment of internal diseases by means of drugs) is as old as man himself. Passing over the very little that is known regarding the state of surgery amongst the early Egyptians and the Jews, and the skill ascribed to Chiron and other mythical personages among the early Greeks, we may regard the true history of surgery as commencing with Hippocrates, who flourished in the 5th c. B.C. He was acquainted with the ordinary means of counter-irritation, as issues, a kind of moxa, and the actual cautery. He seems to have performed the capital operations with boldness and success; he reduced dislocations and set fractures, but clumsily and cruelly; extracted the fœtus with forceps when necessary, and both used and abused the trepan. He did not perform lithotomy, the practice of which seems at that time to have been well known, but to have been confined to a few, who made it their exclusive study. From the time of Hippocrates, we may pass over a couple of centuries, when, on the death of Alexander the Great, Alexandria became the great school of anatomy, surgery, and medicine. Herophilus and Erasistratus (300 B.C.) were as distinguished for their surgical skill as for their anatomical knowledge. One member of this school, Ammianus, invented an instrument by which he broke down stones in the bladder, thus anticipating by about 2000 years Civiale's discovery of lithotrity. When the great Alexandrian Library was destroyed by fire, Rome became the headquarters of science in all its departments. The early Romans of all ranks held surgeons and physicians in abhorrence, and trusted for cures, even in cases of dislocation and fracture, to spells and incantations. The first regular surgeon who settled in Rome was Archagathus (220 B.C.), a student of the Alexandrian School. At first, his skill procured for him a high reputation, but the old prejudices soon revived, and he was banished from the Roman capital.

The first Roman surgeon of real merit was Celsus, who flourished at the beginning of the Christian era, who improved the mode of performing lithotomy and amputation, described the operation for cataract, and first recommended the application of ligatures to wounded arteries, for the purpose of arresting hæmorrhage. His works contain an exact representation of surgical knowledge up to his own time. Aretæus of Cappadocia, who practised in Rome during the latter half of the 1st c., was the first to employ blisters, using cantharides (as we still do) for that purpose. Rufus of Ephesus, who lived half a century later, first tied an artery which had become aneurismal in consequence of being wounded in venesection. Galen, who practised in Rome in the latter part of the 2d c., mainly obtained his great reputation by his medical practice. His surgery was confined for the most part to fomentations, ointments, and plasters for external application; to the art of bandaging, and to the employment of complicated machinery in fractures and dislocations. There is little to record for several future centuries. Aëtius, in the 6th c., recommended scarification of the legs in dropsy, tried to dissolve urinary calculi by internal remedies, studied the diseases of the eye, and is the first writer who notices the guinea-worm. Paulus Ægineta, in the 7th c., opened internal abscesses by caustics, improved the operation of lithotomy, described several varieties of aneurism, extirpated the breast, performed laryngotomy and tracheotomy, and was the originator of the operation of embryotomy. His sixth book is regarded as the best body of surgical knowledge previous to the revival of letters. Rhazes, an Arabian, who had charge of a hospital at Bagdad, at the end of the 9th c., was the first to describe spina bifida, but he did not understand its real nature; he cauterized the bites of rabid animals, and gave a better account of hernia than any of his predecessors. To Avicenna, who lived a century later, we probably owe the first use of the flexible catheter, and of the instrument now generally known as Hey's saw. Albucasis (died 1122) describes an instrument for the cure of fistula lachrymalis, the removal of tumors by ligatures when the knife is inexpedient, the suture of wounded intestines, the use of the probang in obstruction of the gullet, &c., and is the only ancient writer on surgery who describes the instruments used in each special operation.

In 1271, Pitard, an eminent surgeon of his time, laid the foundation of the College of Surgeons of Paris. In our own country, Gilbertus Anglicanus, who lived about the beginning of the 14th c., is the first known surgical writer; he was shortly followed by John of Gaddesden, author of the *Rosa Anglica*. In the middle of that century, Guy de Chauliac, the first to describe the Cæsarian operation, practised at Avignon; and contemporary with him was John of Ardern, who is regarded as the first surgeon of his time. During the 15th c., the local application of arsenic for cancer was proposed by Taranta, a Portuguese surgeon practising at Montpellier; and lithotomy was removed from the hands of itinerant quacks into the department of pure surgery, by Colot, a surgeon to the French court. Moreover, the College of Surgeons dates from this century, having been founded in 1460—1461; while at the commencement of the next century (1505) the Edinburgh College was founded. The surgery of the 16th c. may be said to be represented by Ambrose Paré (q. v.). His works, first published in 1535, exerted a most beneficial influence on the profession. Towards the close of this century, Fabricius ab Acquapendente (q. v.), to whom we are indebted for the modern trephine, and for the use of the tube in tracheotomy, published his *Opera Chirurgica*, which passed through 17 editions. Early in the 17th c. (1612), a Scotchman named Lowe published *A Discourse on the whole Art of Chirurgery;* and about fifty years later, Wiseman, who has been appropriately termed 'the Paré of England,' and 'the true father of British surgery,' flourished. He was Serjeant-surgeon to Charles II.; and his surgical works, published in 1676, may still be read with interest. He was the first to dispel the dangerous belief, that gun-shot wounds were of a poisoned nature, and had consequently to be treated with the most painful kinds of dressing. Contemporary with him were James Young of Plymouth, who first performed the flap-operation in amputation; Scultetus (a German), the author of *Armamentarium Chirurgicum;* Frère St. Cosme, commonly known as Frère Jacques, a French monk, who considered himself specially commissioned by Heaven to cut for stone, and who has the merit of having converted the tearing into a cutting operation; Rau of Leyden, one of the most successful lithotomists of any age, and a pupil of Frère Jacques; and Roonhuysen, who divided the sternomastoid muscle for wry-neck, and may thus be regarded as the inventor of tenotomy.

The 18th c. produced, in England, White, the originator of excision of joints; Cheselden and Douglas, famous as lithotomists; Percival Pott, John Hunter, and Hey of Leeds; in Scotland, Monro, Benjamin Bell, and John Bell; in Ireland, O'Halloran and Dease; in France, Petit and Desault—the former celebrated for his work on Diseases of the Bones, and the latter distinguished for his improvements in surgical instruments of various kinds: in Germany, Richter and the illustrious Haller; and in Italy, Lancisi, Morgagni, and Scarpa. Moreover, in this century (1784) the Royal College of Surgeons in Ireland was founded. Never was surgery so brilliantly represented as during the present century. The London medical schools can point with equal pride to the names of Abernethy, Blizard, Brodie, Astley Cooper, Dalrymple (the oculist), Earle, Guthrie and Hennen (the great military surgeons', Aston Key, Liston, Stanley, Travers, Tyrrell (the oculist), Ware (the oculist), James Wilson, and many other nearly equally celebrated surgeons of an earlier date; and to the more recent ones of Arnott, Bowman, Erichsen, Fergusson, Prescott Hewett, Hilton, Lane, Lawrence, Luke, Paget, Spencer Wells, and a host of others. In Edinburgh were Sir Charles Bell, Lizars, Miller, Syme (whose name will ever be associated with a special amputation of the foot, and with the operation for stricture), and Simpson, discoverer of the application of chloroform to surgical practice. Amongst the most recent innovations and improvements in surgical practice may be mentioned the practice of *antiseptic surgery*, with which the name of Joseph Lister is so worthily associated. The principle of Professor Lister's method consists in the exclusion of septic matter—usually existing in the form of germs, and derived from the atmosphere—from raw or wounded surfaces. Wounds are dressed under *carbolic acid* spray, and with other preparations of this and other antiseptic substances, care being taken in dressing the wound to exclude ordinary atmospheric air. The results of this practice have been on the whole surprising; and recoveries from many serious operations have taken place in remarkably short periods, and with an absence of suppuration and other secondary effects of the inflammatory process.

Amongst the surgical celebrities of Dublin must be mentioned Peile, the inventor of Peile's lithotome and staff; Todd (the father of the late eminent Dr. Todd of London), who was the first to successfully revive the treatment of aneurism by compression; Colles, the first to describe the fracture known as Colles's fracture of the radius; Carmichael, distinguished for his opposition to the indiscriminate use of mercury in syphilis; Bellingham, and Hutton, whose names are associated with the full development of the revived treatment of aneurism by compression; Cusack, Porter, M'Dowel, and Sir Philip Crampton; Adams (well known for his treatise *On the Diseases of the Joints, and Chronic Rheumatism*), R. W. Smith (celebrated for his researches on fractures and

neuroma), and Jacob (the discoverer of the *Membrana Jacobi*). It would be impossible to mention a tithe of the names of those who have attained high surgical celebrity in the provinces during the present century. The Barons Dupuytren and Larrey, and MM. Amussat, Chassaignac, Civiale, Brasdor, Broca, Desmarre (the oculist), Nelaton, Roux, Sichel (the oculist), Velpeau, &c., have honorably sustained the reputation of French surgery. Beer (the oculist), Chelius, Dieffenbach, Von Gräfe (the oculist), Gurlt, Jäger (the oculist), Langenbeck, Stromeyer, and Wützer, constitute but a small portion of the eminent surgeons of Germany. Callisen of Copenhagen, Porta of Pavia, and Perogoff of St. Petersburg, may be taken as the surgical representatives of their respective countries. Amongst American surgeons the names of Valentine Mott, the Warrens, Marion Sims, and Gross deserve special notice. To understand what surgery now is, and to trace its recent progress, the reader should study the standard surgical treasures of Erichsen, Fergusson, Miller, and Syme; and the comprehensive and most valuable *System of Surgery*, edited by Mr. Holmes, and contributed to by many of the most eminent authorities on surgery. He will also do well to read Fergusson's *Lectures on Conservative Surgery*, and Syme's *Address on Surgery*, delivered before the members of the British Association in August 1865.

With the increase of knowledge, specialties naturally develop themselves; and such has been the case in surgery. The diseases of the eye, the diseases of the ear, the diseases peculiar to women, the diseases of children, and deformities (the treatment of which is termed Orthorpædic Surgery), more or less separate themselves, at least in large towns, from general surgery, and constitute special departments, of which dentistry may be considered one; as most of the eminent dentists of the present day are regularly educated and qualified surgeons.

It is deserving of record that within recent years, nearly all the British universities have commenced to give Surgical as well as Medical Degrees.

For further information, see the histories of surgery by Le Clerc (1696), Freind (Lond. 1725), and Moir; those (German) by Sprengel, Bernstein, Gründer, and Häser (1865); the 'Historical Notice' in Miller's *Principles of Surgery;* and *The International Encyclopædia of Surgery*, edited by Professor Ashurst, of Pennsylvania University, and containing contributions by distinguished European surgeons (vol. i. 1881).

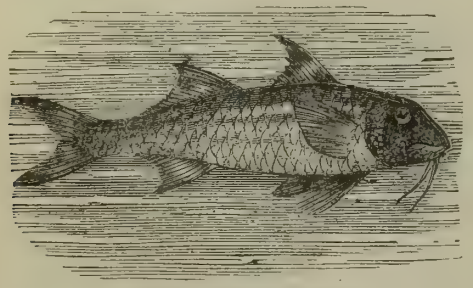
SURINA'M. See GUIANA, DUTCH.

SURINAM BARK. See ANDIRA.

SURMOU'NTED, in Heraldry, a term used to indicate that one charge is to be placed over another of different color or metal, as

in the annexed figures, which may respectively be blazoned: Sable, a pile argent surmounted by a chevron gules; and, Argent, a cross gules surmounted by another ore.

SURMU'LLET (*Mullus*), a genus of acanthopterous fishes of the family *Mullidæ*, a small family formerly included in *Percidæ*, but distinguished by having two dorsal fins widely separated from one another, the first spinous; and large, easily detached, strongly ciliated scales on the head and body. The genus *Mullus* has no teeth on the upper jaw, but a disc of pavement-like teeth on the



Surmullet (*Mullus surmuletus*).

front of the vomer. Two long barbels hang from the under jaw, or, when not in use, are folded up against it. Only two species are known, both abundant in the Mediterranean, and both found on the British coasts. They very generally receive the name MULLET, by which they are counfounded with a very different genus. The STRIPED S., or STRIPED RED MULLET (*M. surmuletus*), is sometimes very plentiful on the southern coasts of England, but is rarer towards the north. It approaches the shores in summer, and many surmullets are then taken in mackerel nets; but at other seasons it is only obtained from comparatively deep water by trawl-nets. It sometimes attains, in the Mediterranean, a weight of six or seven pounds, but has never been known much to exceed three pounds in the British seas, and is seldom more than two pounds in weight. The ancient Romans, who held it in the highest esteem, gave prodigious prices for fish of unusually large size. They kept surmullets in their *vivaria;* but there the fish did not increase in size. The color is pale pink, with three or four yellow longitudinal stripes; but where any of the scales have been rubbed off, beautiful tints of purple and bright red appear, which takes place also during the struggles of the fish when dying, and the Romans were therefore accustomed to bring surmullets alive into their banqueting-rooms, that the guests might see them die, and enjoy the brilliant display of color, before eating the fish. The liver was regarded as peculiarly delicious, and was bruised in wine to make a *garum* for the flesh. The S. is still regarded as one of the best of fishes.—The RED S., or PLAIN RED MULLET (*M. barbatus*), is very rare on the coasts of Britain. It is a much smaller fish than that already described. Other species of *Mullidæ* are found in tropical seas.

SU'RNAME (either from its being an additional name—Fr. *surnom*, Ital. *sopranome*—or from the practice of writing it over the Christian name, which is to be seen in the court rolls and other ancient munuments), in modern Europe, the family name. The Roman *cognomen* partook somewhat of the same character; but the introduction of the surnames of modern time cannot be traced further back than the latter part of the 10th century. See NAME.

SU'RPLICE (Lat. *super pellicium*, above the robe of fur), a linen or muslin vestment, worn by clerks of all degrees of orders in the discharge of their public religious offices. It is by some supposed to be derived from the longer and more flowing vestment which, in the Roman Catholic Church, is still used in the mass, and is called the 'alb;' but in that church the suplice is worn not alone by priests, but by all who have been admitted even to the church tonsure. Its most ordinary use is for the service of the choir, and it is also employed, along with the stole, by priests in the administration of the sacraments, and in preaching. The use of the surplice was strongly objected to by the Calvinistic and Zwinglian reformers on the continent, and by the Puritans in England, who regarded this vestment as a relic of popery, and made it the subject of vehement denunciations. The argument against it is to be found in Beza, *Tractat. Theolog.* iii. 29, and its defence in Hooker's *Ecclesiastical Polity*, book v., ch. 29. Ere ritualism became so common in England, no little stir used from time to time to be created by the use of the surplice by the preacher in the pulpit, contrary to the more general practice in the Anglican church. Preaching in the surplice has been associated in the popular mind with a Romanizing tendency, although it is difficult to say on what basis this association rests.

SU'RREY (Sax. *Suth-rice*, the south kingdom), an inland county in the south of England, bounded on the north by Middlesex, and on the east by Kent. Area, 483,178 acres; pop. (1871) 1,091,635; (1881) 1,435,842. S. is traversed from west to east by a well-marked ridge of the North Downs, which rises in Botley Hill, above Titsey, to the height of 880 feet. On the north side of this range, the land slopes gradually to the banks of the Thames, which runs along the northern border; but on the south side the descent is rugged and broken, affording pleasing and sometimes romantic scenery. South of the main range, and about four miles south of Dorking, is Leith Hill, 993 feet high, the most important elevation in this quarter of the country. Stretching along the southern bank of the Thames, and extending over a space about six miles in breadth, is a tract which belongs to the London clay formation; further south, and likewise extending from west to east, there is a tract of plastic clay, varying in breadth from one to five miles. Chalk, weald clay, and iron-sand formations occupy the south of the county. The principal streams are the Mole and Wey, tributaries of the Thames. The soil of the northern half of the county is fertile; in the west and south-west, the land is, to a great extent, covered with heath. The climate is soft and mild in low-lying districts, and is favorable to the production of corn and grass. More than four-fifths of the entire area are under culture. In the north, in the vicinity of London, there are numerous market-gardens, the produce of which is sent to supply the markets of the metropolis. Hops, wheat, and the ordinary crops are raised. The county contains much wood, and the beauty of the scenery, and the facility of communication with London, have attracted many residents to S., which is consequently studded over with mansions and villas. Manufactures are carried on in Southwark and in the other southern suburbs of London, as well as in Croydon, Guildford, Kingston, and Reigate, which are the principal towns. The county returns four members to the House of Commons.

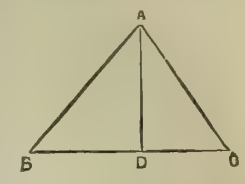
SU'RTURBRAND, a kind of Brown Coal (q. v.) found in the north of Iceland, and there used for fuel. It has a great resem-

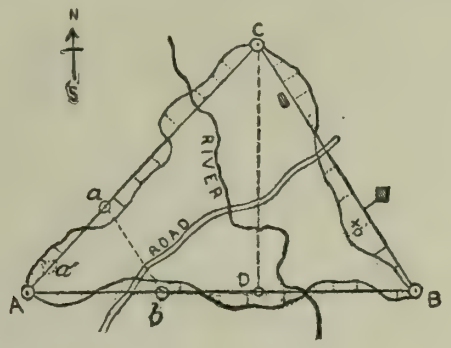
blance to the black oak found in bogs. It is capable of being made into tables and other articles of furniture, but is too brittle to be cut into shavings by a plane.

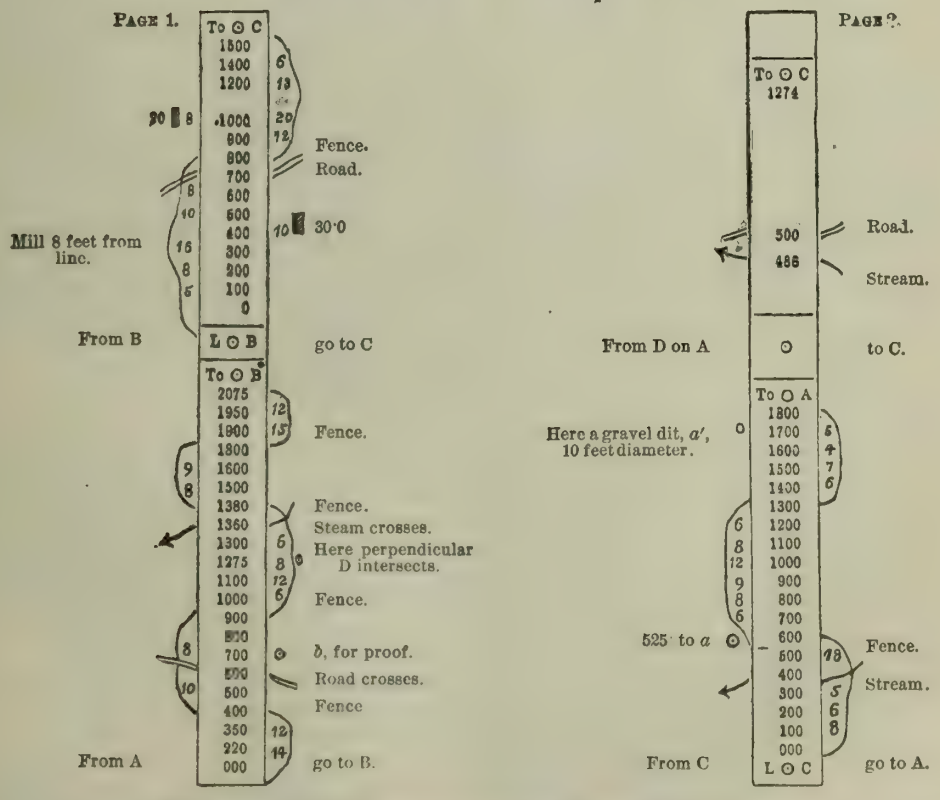
SURVEY'ING. Land surveying may be considered the earliest practicable application of the art of geometry or earth measurement, and must have been in some more or less rude form coeval with agriculture and the division or appropriation of the soil. In Rome, surveying was considered one of the liberal arts, and the measurement of lands was intrusted to public officers who enjoyed certain privileges; and it is probable that the system of measurement practised by them was very similar to our plain surveying with the chain and cross staff of the present day, and has been handed down to us through the feudal period. An examination of ancient records and title-deeds will show that both areas and boundary-lines of the different enclosures forming fields, hundreds, townlands, &c., are often laid down with a considerable degree of accuracy.

Land surveying may be considered under the following heads: (*a.*) Plain surveying with the chain, and without the aid of angular instruments, except the cross staff or fixed angle of 90°. (*b.*) Modern engineering surveying, in which angular instruments are used. (*c.*) Coast and military surveying. (*d.*) Trigonometrical surveying (q. v.).

triangle, ABC, are supposed to be accessible, and are carefully measured on the ground, and then laid down or platted to scale on paper, when an accurate figure of the triangle will be obtained, on which the length of the sides can be marked. To get the area, however, it will be necessary to determine the length of the perpendicular line AD, and this is usually done (when possible) on the ground by means of a simple instrument called a cross, which consists of two sights or fine grooves at right angles to each other, and being placed on the line BC (keeping B and C visible in one of the sights), nearly opposite the angle A, is moved gradually till the angle A is intersected by the other sight. The line AD can be also laid down on the drawing, and its length found by scale, and afterwards verified on the ground, or it may be at once laid down on the ground by the use of the chain alone. An improved reflecting instrument, called an optical square, is also often used for this purpose. Any boundaries along the lines or sides of the triangle, ABC, can be determined by the use of Offsets (q. v.) or insets as they occur on right and left of line. No matter what the form of the surface to be surveyed may be—polygon, trapezium, or trapezoid—it may thus be determined by a judicious subdivision into triangles; and when the survey is







The line *ab* may be similarly booked and platted, and any lines intersecting shown.

The fundamental rule of every description of land surveying, from the humble attempt of the village schoolmaster to lay down an irregular garden plot, to the trigonometrical survey of a large extent of the earth's surface, when the aid of the most refined improvements of modern science is indispensable, is simply to determine three elements of a triangle, and thence to calculate its area.

In plain surveying with the chain, the three sides of the triangle are measured, and the angles are not taken. This is not of a very extended nature or character, and when no serious obstructions exist, chain surveying is both accurate and expeditious, especially if proof or tie lines are properly introduced, for the purpose of testing the accuracy of the work.

In every description of surveying, it is best to make the original triangle as large as possible, and to work from a whole downwards, rather than build up a large triangle by the addition of several small ones. It would be impossible here to lay down

rules to meet the many difficulties which arise in the practice of surveying, and indeed the best test of a good surveyor is the ease with which he will overcome local obstructions, which appear almost insurmountable to a novice, or even to a theoretical surveyor with little field practice.

Where buildings or other impediments are found in the measurement of a straight line, they are generally passed by the erection of short perpendiculars sufficient to clear the obstacles, and a line parallel to the original measured as far as they exist, when the original line can be again resumed. Differences of level, occurring in measuring a line where no instruments are used, are generally compensated or allowed for by the judgment of the surveyor.

In registering the dimensions taken on the ground, such as sides of triangles, offsets, intersections of roads, fences, &c., and everything necessary to make a perfect delineation or plan of the surface, surveyors use what is called a field-book, the mode of keeping which varies very much with individual practice. Some surveyors use hand sketches or rough outlines of the form of the ground, and mark the dimensions on them, while others use the ordinary form of field-book, or a combination of the two methods, which perhaps is the best when any difficult complications happen on the ground, such as the frequent occurrence of buildings, enclosures, water, &c., along the line.

In the ordinary field-book, the center column, commencing from the bottom, represents the length of any line or side of a triangle; and the figures in the column, the distance at which the offsets to the right or left are taken, or where roads, streams, fences, &c. cross the line, or buildings adjoin the same. We give on page 189 the field-book of the assumed survey of the triangle ABC, with the different offsets and insets on its sides, and where roads, fences, streams, &c. cross them, the detail of which can be obtained by subdividing the triangle into smaller internal ones. The figure can thus be laid down from the book, and its area calculated by the formula $\frac{AB \times CD}{2}$ and the offsets and insets calculated, added, or deducted, by the methods given in OFFSETS.

Ponds, plantations, and enclosures of different kinds may be surveyed with a chain, especially if their form be such that they can be conveniently included in the area of a triangle, the correctness of which, being proved by proper tie-lines, the form, area, &c. may be ascertained by offsets, or rather insets from the sides.

SURYA is, in Hindu Mythology, the god of the sun. His wife is, in later mythology, *Sûryâ*, who, in order to escape his embraces, transformed herself into a mare, but nevertheless became the mother by him of the twin *As'wins*, afterwards the heavenly physicians. Besides Sûryâ, he had several other wives, by one of whom, *Sanjnâ*, he begot Yama, the god of death, and the river Yamunâ, or Jumna. By Kuntî, before her marriage with Pân'd'u (q. v.) he had *Karn'a*, who, therefore, was an elder brother of the Pân'd'u princes, but in the conflict between the Pân'd'us and the Kurus, sided with the latter, and was killed by Arjuna. S. became also, by his other progeny, the ancestor of a royal dynasty, called after him, *Sûryavans'a*, or the solar race. S. is represented with a lotus-flower in his hand, on a chariot drawn by seven horses, and conducted by his charioteer Arun'a, the god of the dawn, who is represented without legs.

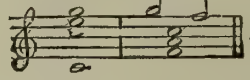
SU'SA (Shushan in Daniel, Esther, &c., derived by some from Shoshan, a lily), probably the modern Sus or Shusn, in lat. 32° 10′ N., and long. 48° 26′ E., situated between the Chapses or Eulæus (Ulai in Daniel), and the Shapur, anciently the capital of Susiana (the *Elam* of Scripture, mod, *Khusistan*), and one of the most important cities of the old world. Its foundation is variously ascribed by ancient writers to Darius Hystaspes, or to Memnon, the son of Tithonus; and its name, together with its ground-plan, is traced on Assyrian monuments at the time of Assur Bani Pal, about 660 B.C. At the time of Daniel's vision 'at Shushan in the palace,' it was under Babylonian dominion, but came, at the time of Cyrus, under Persian rule; and the Achæmenian kings raised it to the dignity of a metropolis of the whole Persian Empire, and as such Æschylus, Herodotus, Ctesias, Strabo, &c. speak of it. At the Macedonian conquest it was still at its height, and Alexander is reported to have found in it vast treasures, together with the regalia. On Babylon becoming the principal city of Alexander and his successors, S. gradually declined, but seems still to have contained enormous wealth at the time of its conquest by Antigonus (315 B.C.). It was once more attacked by Molo in his rebellion against Antiochus the Great; and during the Arabian conquest of Persia it held out bravely for a long time, defended by Hormuzan. The ruins of its ancient buildings, the palace described in Esther among them, cover a space of about three miles. The principal existing remains consist of four spacious artificial platforms above 100 feet high. Traces of a gigantic colonnade were laid bare by Mr. Loftus, with a frontage of 343 feet, and a depth of 244. Cuneiform inscriptions exist, together with many other relics similar to those found at Persepolis (see PERSEPOLIS; compare also CUNEIFORM). The 'tomb of Daniel' shown near S. is a modern Mohammedan building.

SU'SA, a city of Northern Italy, province of Turin, stands on the right bank of the Dora Riparia, at the foot of the Cottian Alps, 32 miles west of Turin. It is an episcopal see, and has a cathedral consecrated in 1028, with a baptistery of one single block of green marble. Among its other notable buildings are the episcopal palace, the town-hall, and the Borgo de' Nobili. The surrounding country produces wines, fruits, mulberry trees, and wood. The road over Mont Cenis, opened in 1810, begins at Susa. Pop. 3300.

S., called by the Romans *Segusio*, is a very ancient city; it was founded by the Celts, and was in the reign of Augustus the capital of the Celtic chief Cottius, from whom the Cottian Alps received their name, and during the empire was the starting-point for crossing Mont Cenis. A triumphal arch, erected by Cottius in honor of Augustus, still remains.

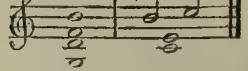
SUSA'NNAH, HISTORY OF, *The Judgment of Daniel*, also *Susannah and the Elders*, are the different titles of a well-known story, which forms one of three apocryphal additions to the Book of Daniel; the other two being *The Song of the Three Holy Children*, and *The History of Bel and the Dragon* (q. v.). It relates how S., the wife of Joiachim, and daughter of Hilkiah, celebrated alike for her beauty and her virtue, was falsely accused of adultery by certain 'lovers' whose advances she had spurned; and how, being condemned to death on their evidence, she was saved by the wise Daniel, who tore the mask from her enemies, and caused them to experience the fate they had designed for her. The question—not a very important one certainly—has been much debated, both in the early and later times of the church, whether or not the story of S. is true; and arguments (of various weight) have been adduced to show that the book is a fabrication, a fable, a legend, and a history. The most probable view, perhaps, is that which regards it as a tradition of something that did happen in the life of Daniel, but which has been moulded into a moral fiction by the hand of a literary artist. The original is believed to have been Greek and not Hebrew. In most MSS. it precedes the first chapter of the Book of Daniel, and so we find it in the old Latin and Arabic versions; but the LXX., the Vulgate, the Complutensian Polyglot, and the Hexaplar Syriac, place it at the end of the present book, and reckon it as the 13th chapter.

SUSPE'NSION, in Music. A note is said to be suspended when it is continued from one chord to another to which it does not properly belong, and to a proper interval of which it must eventually give way. Thus we have here the note G extended from the first chord into the second, in which it is first suspended, and then resolved into the chord FACF:



. This example is a suspension from above,

in which a descent is necessary for its resolution: but a note may also be suspended from below, when it is resolved by an ascent:



SUSPENSION AND INTERDICT, in Scotch Law, is a process by which the suspender, who initiates the proceeding, seeks to stop or to interdict some act, or to prevent some encroachment on property or possession, or in general to stay any unlawful proceeding. The first step is to present a note of suspension and interdict to the Lord Ordinary, who grants *interim* interdict either with or without caution, and orders the note to be answered, or refuses interdict. When the note is answered, the Lord Ordinary passes or refuses the note, and continues or recalls the interdict as the case may be.

SUSPENSION BRIDGES. In these bridges, the roadway is suspended from chains passing over piers or towers, and firmly fixed at their extremities. Fig. 1 is a sketch of an ordinary sus-

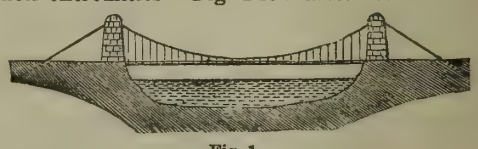


Fig. 1.

pension bridge. When the roadway is equally loaded over its length, the curve of the chain is a parabola. The weight of the roadway being known, the strain upon the chain, and its requisite strength, are readily determined. For example, in Fig. 2, if A be the center of the bridge, and it be required to find the strain upon

the chain at the point B, it is evident that the weight of the roadway between A and B is supported by the chain at B; we have

Fig. 2.

then to find what strain in the direction of the length of the chain will support this vertical load. By the principles of mechanics, if we draw a right-angled triangle BCD, of which the side BC is a tangent to the curve at B, CD is vertical, and BD horizontal; and if the length of CD represent numerically the load on AB, then BC will represent numerically the strain on the chain produced by that load, and BD will be what is called the horizontal component of this strain. This horizontal part of the strain is the same for every part of the curve; it is the total strain on the chain at the center A, and the strain carried over the towers and balanced by the backstays, which are firmly anchored to the ground behind them. In this manner the conditions of strength and stability of a bridge uniformly loaded are easily determined, but when we have a rolling load which is heavy in proportion to the weight of the bridge, as for example a railway train, the case is very different, for when the train only occupies one half of the bridge, the chain will be depressed towards that side, and raised at the center; thus an undulation will be produced in the bridge, which, if the train be moving rapidly, would endanger its stability. Various combinations have been devised to overcome this difficulty.

The most simple, and practically the best, is to stiffen the roadway so that the strain of the passing load is distributed over a considerable length of the chain. In this manner, large railway bridges have been constructed in America; among them is that over the Niagara above the Falls, of which the span is 822 feet, and the height of the platform above the river 250 feet. The great Brooklyn and New York bridge, opened in 1883, is 3500 feet long, has a span of 1600 feet, and is 135 feet above the water. An ordinary suspension bridge is liable to both vertical and horizontal oscillations, the former taking place when a train or other load is passing over it, and the latter being due to the action of the wind. These oscillations cannot be altogether prevented, but can be so reduced as to be harmless, by the use of stays, stretching both from the towers and from points on shore to various parts of the bridge. Suspension bridges are generally used in positions where the span is great, and the rolling loads neither great in proportion to the weight of the bridge itself, nor very rapid in their motion. Many beautiful examples are to be seen in this country; among others, we may instance the Menai Bridge, 580 feet span, and the Clifton Bridge, near Bristol, 703 feet span.

SUSPENSION OF ARMS. See TRUCE.

SUSQUEHA'NNA, an American river, which has its origin in Otsego and Canandaigua Lakes, in western New York, and flowing eastward, receives the rivers Unadilla and Chenango, then, turning south, enters Pennsylvania, where it receives the Pittston, the Tioga, the West Branch, and the Juniata, and empties itself into the Chesapeake Bay, at Havre de Grace, Maryland, 400 miles from its source, and 153 from its junction with the West Branch. It is a shallow, rapid, mountain river, with varied and romantic scenery. A canal follows its course, and great quantities of timber are floated down in the spring freshets. Near the mouth, it is famous for waterfowl, especially the Canvasback Duck, and has important fisheries.

SUS'RUTA is one of the great medical authorities of ancient India. See *Medicine*, under SANSCRIT LITERATURE. His work is called *Ayurveda*, and consists of six books. It was edited by S'rî Madhusûdana Gupta, in 2 vols. (Calcutta, 1835—1836).

SU''SSEX (South-Saxons), a maritime county in the south of England, bounded on the N. by Surrey and Kent, and on the W. by Hampshire. Area, 936,911 acres; pop. in 1871, 417,456, and in 1881, 490,316. The South Downs (see DOWNS) traverse the county from west to east, ending about 20 miles east of Brighton, in the lofty cliff of Beachy Head. The northern escarpment of the Downs is precipitous, but leads down to the fertile and richly wooded district of the Weald (see DOWNS). A remarkably productive tract, from two to seven miles in breadth, extends west from Brighton along the coast to the Hampshire border; and in the south-east of the county the rich marsh lands that line the coast, and which are 30,000 acres in extent, make excellent pasture-grounds. Of the Down-land there are about 50,000 acres, covered with a fine, short, and delicate turf, on which the well-known breed of Southdown sheep, to the number of 300,000, are pastured. Of the Weald district, which formerly was covered with dense forests, there are within the county 425,000 acres; a considerable tract has been brought under cultivation. Irrespective of the less productive districts, there are in the county 120,000 acres of rich arable land; 150,000 acres are occupied by woods, which abound chiefly in the Weald, and in the Forest Ridge in the north-east of S., where are St. Leonard's Forest (10,000 acres), and Ashdown Forest (18,000 acres). The chief rivers are the Arun, Adur, and Ouse, which have their origin in the north of the county, and flow south into the Channel. In the south of S. the climate is mild, and several large towns (see BRIGHTON and HASTINGS) are largely resorted to by those who seek health or relaxation. Seaford and Pevensey Bays are much frequented by vessels, and the east portion of the coast is defended by martello towers. The county has for centuries been divided into the six rapes of Lewes, Pevensey, Hastings, Chichester, Arundel, and Bramber. It returns four members to parl. Capital, Chichester.

SUSTENTA'TION FUND, a fund provided in the Free Church of Scotland for the support of the ministers of the church. The idea of such a fund was probably derived by Dr. Chalmers from the system of the Wesleyan Methodists, and a scheme devised by him was made public before the Disruption, so that arrangements had been made, and a small sum already collected, when that event took place. The scheme was afterwards carried into operation throughout the whole of Scotland, and continues unmodified to the present time. The members of the church are called upon to contribute, according to their own will and ability, to a common fund; of which, after payment of expenses, payments to a fund for widows and orphans, pensions to retired ministers, &c., an equal division is made among the ministers of the church, with a few exceptions, chiefly in the case of newly formed congregations. The amount of the fund has gradually increased from £68,-704 in 1843—1844, to £172,408 in 1880, when 796 out of 1097 ministers received an equal dividend of £160, the surplus being divided among the ministers (780) of those charges whose contributions amounted to a certain average sum per member. Congregations are permitted to supplement the stipends of their own ministers, and if able are expected to do so. The supplement in some congregations in towns much exceeds the dividend from the fund; but in many parts of the country, the whole, or almost the whole stipends of the ministers are derived from it. The question had been much discussed, whether an equal dividend ought to be made, or a proportion established between the liberality of a congregation and the amount paid to its minister. The subject of the Sustentation Fund is of interest, not only to the Free Church of Scotland, but to all unendowed churches.

SU'THERLAND, a county in the extreme north of Scotland, is bounded on the E. by Caithness and the North Sea, on the N. and W. by the Atlantic, and on the S. by Ross and Cromarty. Area, 1,207,188 acres; pop. in 1871, 24,317, and in 1881, 23,366. The coast-line is 60 miles in extent; and the shores, rugged on the north and west, where they are broken by the force of the Atlantic, are comparatively flat on the east. The southern and central regions of S. are the most elevated; and rivers, mostly from the middle of the county, flow east and south-east to the North Sea, and north, north-west, and west to the Atlantic. The principal mountain peaks are Ben More in Assynt (3273 feet), and Ben Clibrigg (3158 feet). The chief rivers are the Oikel and the Shin—which, with other affluents, unite to form Dornoch Firth—the Brora, Helmsdale Water, and Naver. Extensive moors, the haunt of herds of red deer, stretch across the county; and the rivers and lakes, the chief of which is Loch Shin (q. v.), form numerous low-lying valleys or straths. In the interior and western districts, the climate is cold, and the county is often deluged with continuous rains; but in the eastern districts the climate is mild, and the soil very fertile in all agricultural produce. In 1880, there were 30,151 acres under crops, of which 10,309 acres were under corn, 5639 acres green crops, 6517 clover and other artificial grasses, and 7451 acres permanent pasture. The number of cattle in the same year was 12,595; sheep, 235,497; and swine, 1165. Coal, granites of various colors, marble, limestone, &c. are found. In Nov. 1868, traces of gold were found in a burn in S. A number of 'diggers' were attracted to the district, but the gold found, though of excellent quality, was hardly sufficient to repay their labor. The Highland Railway passes through the county. Manufactures are inconsiderable. There are good salmon, herring, and white fishings. S. is well supplied with churches. The schools are well attended, and Gaelic is rapidly giving way to English. Almost the whole of the county belongs to the Duke of Sutherland. The present duke is eminent for the zeal with which he has devoted himself to the improvement of S., spending large sums in the reclamation of land by steam-ploughs, the construction of railways, &c.

S. received its name from the Northmen, who frequently descended upon and pillaged it prior to the 12th c., and called it the Southern Land, as being the limit on the south of their settlements. The condition of the people of S. before 1811, in which year the county began to be opened up by roads, was miserable. Their sustenance dependent mostly upon their half-starved flocks, was very precarious, and would have failed them often had not

charity administered relief. A former Duke of Sutherland effected what are known as the 'Sutherland Clearances,' by compelling such of his tenants as could not support themselves, owing to the unsuitability to agricultural purposes of the districts upon which they dwelt, either to remove to more fertile districts, where they received land at a merely nominal rent, or to emigrate at his expense to Canada.

SU''TLEJ, or SUTLUJ, an important river in the north-west of India, the eastmost of the five rivers of the Punjab, rises in the sacred lakes of Manasarovara and Rawan-Hrad in Thibet, lat. 30° 45′ N., long. 81° 15′ E. At its outfall from Lake Manasarovara, at between 19,000 and 20,000 feet above sea-level, it is a rapid torrent 30 feet broad. It flows northwest for 150 miles, when turning to the south-west it receives the Spiti or Li, a larger stream than itself. The Spiti is 8592 feet above sea-level, when it joins the S., and the scene of the confluence of the two rivers is sublime in the highest degree. Continuing a south-west course, the S. breaks through the mountain-rampart of the Himalaya, and after flowing in all about 850 miles, in the course of which it is joined by the Beas and the Chenab, it falls into the Indus in lat. about 29° N. Its upper course is supposed to be identical with the Hesudrus, and its lower course (in which it is called the Ghara) with the Hyphasis of the ancients.

SU''TLER is a vendor of provisions allowed by the Quartermaster-general to follow an army in the field, for the purpose of supplying the soldiers with such luxuries as they can afford to purchase. Sutlers are under martial law, accompany the baggage on a march, and are narrowly watched, and severely punished if found guilty of any irregularities towards either the soldiers or inhabitants of the country. In the French army a soldier in each regiment is licensed to act as sutler, and is called *vivandier*. See also CANTEEN.

SUTRA (from the Sanscrit *siv*, to sew, literally, therefore, a thread or string) is, in Sanscrit literature, the technical term of aphoristic rules, and of works consisting of such rules. The importance of the term will be understood from the fact, that the *groundworks* of the whole ritual, grammatical, metrical, and philosophical literature of India are written in such aphorisms, which therefore constitute one of the peculiarities of Hindu authorship. The object of the Sûtras is extreme brevity; and, especially in the oldest works of this class, this brevity is carried to such an excess, that even the most experienced would find it extremely difficult, and sometimes impossible to understand these aphorisms without the aid of commentaries, which, however, are fortunately never wanting, wherever a work is written in this style. Though there is no positive evidence as to the cause or causes which gave rise to this peculiarity of Hindu composition, the method of teaching in ancient India—an account of which is afforded in some of the oldest works—renders it highly probable that these Sûtras were intended as memorial sentences which the pupil had to learn by heart, in order better to retain the fuller oral explanation which his teacher appended to them. But it is likewise probable that this method of instruction itself originated in the scarcity or awkwardness of the writing material used, and in the necessity, therfore, of economizing this material as much as possible; for that writing was known and practised at the remotest period of Hindu antiquity, is now placed beyond a doubt, though a startling theory was propounded, some years ago, to the effect that writing was unknown in India, even at the time of the great grammarian Pân'ini. The manner, however, in which, up to this day, the Hindus are in the habit of keeping the leaves of their books together, seems to throw some light on the name given to this aphoristic literature.

The leaves—generally narrow, and even at the present time often being dried palm leaves, on which the words are either written with ink or scratched with a style—are piled up, and, according to the length of the leaves, pierced in one or two places, when, through the hole or holes, one or two long *strings* are passed to keep them together. The name of Sûtra was probably, therefore, applied to works, not because they represent a thread or string of rules, but on account of the manner in which these works were rendered fit for practical use; just as in German a volume is called *Band*, from its being 'bound.' That a habit deeply rooted outlives necessity, is probably also shown by these Sûtra works; for while the oldest works of this class may be called Sûtras by necessity, there are others which convey the suspicion that they merely imitated the Sûtra style after the necessity had passed away, more especially as they do not adhere to the original brevity of the oldest Sûtras; and the Sûtras of the Buddhists (see PIT'AKA), conspicuous for their prolixity, could scarcely lay claim to the term, if compared with the Sûtra of the Brahmanical literature.

SUTTEE' (an English corruption from the Sanscrit *satî*, a virtuous wife) means the practice which prevailed in India, of a wife burning herself on the funeral pile, either with the body of her husband, or separately, if he died at a distance.

The practice of suttee is based by the orthodox Hindus on the injunctions of their S'âstras, or sacred books, and there can be no doubt that various passages in their Purân'as (q. v.) and codes of law *countenance* the belief which they entertain of its meritoriousness and efficacy. Thus, the *Brahma-Purân'a* says: 'No other way is known for a virituous woman after the death of her husband the separate cremation of her husband would be lost (to all religious intents). If her lord die in another country, let the faithful wife place his sandals on her breast, and, pure, enter the fire. The faithful widow is pronounced no suicide by the recited text of the R'igveda.' Or the code of *Vyâsa*: 'Learn the power of that widow who, learning that her husband has deceased, and been burned in another region, speedily casts herself into the fire,' &c. Or the code of *Angiras*: 'That woman who, on the death of her husband, ascends the same burning pile with him, is exalted to heaven, as equal in virtue to Arundhatî (the wife of Vasisht'ha). She who follows her husband (to another world) shall dwell in a region of joy for so many years as there are hairs on the human body, or 35 millions. As a serpent-catcher forcibly draws a snake from his hole, thus drawing her lord (from a region of torment), she enjoys delight together with him. The woman who follows her husband to the pile expiates the sins of three generations on the paternal and maternal side of that family to which she was given as a virgin. . . . . No other effectual duty is known for virtuous women, at any time after the death of their lords except casting themselves into the same fire. As long as a woman (in her successive transmigrations) shall decline burning herself, like a faithful wife, on the same fire with her deceased lord, so long shall she be not exempted from springing again to life in the body of some female animal. When their lords have departed at the fated time of attaining heaven, no other way but entering the same fire is known for women whose virtuous conduct and whose thoughts have been devoted to their husbands, and who fear the dangers of separation.' See for other quotations, H. T. Colebrooke, *Digest of Hindu Law*, vol. ii. p. 451, ff. (Lond. 1801); and his 'Essay on the Duties of a Faithful Hindu Widow,' reprinted from the *Asiatic Researches*, in his *Miscellaneous Essays*, vol. i. (Lond. 1837). But however emphatically these and similar passages recommend a wife to burn herself together with her deceased husband, it should, in the first place, be observed that *Manu*, who, among legislators of ancient India, occupies the foremost rank, contains no words which enjoin, or even would seem to countenance, this cruel practice; and, secondly, that no injunction of any religious work is admitted by the orthodox Hindus as authoritative, unless it can show that it is taken from, or based on, the revealed books, the Vedas (see S'RUTI). An attempt has of late years been made by Râjâ Râdhakânt Deb, to show that, in a text belonging to a particular school of the Black Yajurveda (see VEDA), there is really a passage which would justify the practice of suttee; but in the controversy which ensued on this subject between him and the late Professor H. H. Wilson, it clearly transpired that the text cited by the learned Râjâ is of anything but indubitable canonicity; moreover, that there is a verse in the R'igveda which if, properly read, would enjoin a widow not to burn herself, but, after having attended the funeral ceremonies of her husband, to return to her home, and to fulfil her domestic duties; and it seems, at the same time, that merely from a misreading of a single word of this verse from the R'igveda, that interpretation arose which ultimately led to a belief and an injunction so disastrous in their results. See H. H. Wilson, 'On the Supposed Vaidik Authority for the Burning of Hindu Widows, and on the Funeral Ceremonies of the Hindus,' reprinted from the *Journal of the Royal Asiatic Society*, vol. xvi., in his Works, vol. ii., edited by Dr. Rost (Lond. 1862). That an immense number of widows have fallen victims to this erroneous interpretation of the oldest Vedic text, is but too true.

Some fifty years ago, however, the East India Company took energetic measures to suppress a practice which it was perfectly justified in looking upon as revolting to all human feelings, and which it would have likewise been entitled to consider as contrary to the spirit of the Vedic religion. This practise may now be said to have been successfully stopped; for though, from habit and superstition, even now-a-days cases of suttee occur, they are extremely rare; and all reports agree that the enlightened natives everywhere, except, perhaps, in certain native states, support the action of government to repress this evil of bygone times.

SU''TURE (Lat. *sutura*, a seam) is a term employed both in Anatomy and Surgery. In Anatomy, it is used to designate the modes of connection between the various bones of the cranium and face. A suture is said to be *serrated*, when it is formed by the union of two edges of bone with projections and indentations (like the edge of a saw) fitting into one another. The coronal, sagittal, and lambdoidal sutures (see SKULL) are of this kind. A suture is termed *squamous*, when it is formed by the overlapping of the bevelled (or scale-like) edges of two contiguous bones. There are

also the *harmonia* and the *schindylesis* sutures, the former being the simple apposition of rough bony surfaces, and the latter being the reception of one bone into a fissure of another.

In surgery, the word suture is employed to designate various modes of sewing up wounds, so as to maintain the opposed surfaces in contact. As it may fall to the lot of any person, on an emergency, to have to sew up a wound, the following general rules, applicable to all forms of suture, should be attended to. In passing the needle, the edges of the wound should be held in contact with the fore-finger and thumb of the left hand; and the needle should penetrate the surface at about an angle of 50° (rather more than half a right angle), and should, at least, pass through the whole thickness of the skin at each stitch. The distance from the edge of the wound at which each stitch should enter and leave the skin, must vary with the depth of the wound; but there should never be less than the eighth of an inch between the margin of the wound and the entrance or exit of the needle. Sutures should not include vessels, nerves, muscles, or tendons. The line of the thread should cross that of the wound at right angles. For incised wounds on the surface of the body, when the edges can only be transfixed from the cutaneous surface, or when the opposite margins can both be traversed by one plunge, a curved needle (such as a common packing-needle) is most convenient, whereas a strong straight needle is more convenient for the completely free margins of extensive wounds, such as are left after amputation. Fig. 1 represents various forms of needles used by surgeons; fig. 2 shows the *twisted suture*, as used in the operation

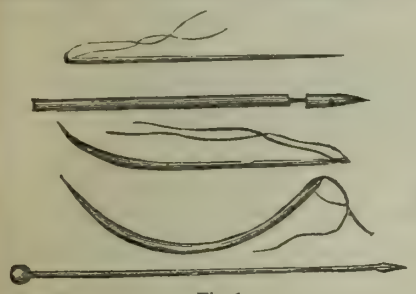


Fig. 1.

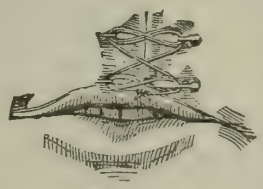


Fig. 2.

for hare-lip, in which the wound is transfixed by pins, around which, beginning with the uppermost, a thread is twisted, in the form of the figure 8.

SUVOROF, Alexander Vassilivitsh, Count, Prince Italiński, a Russian field-marshal, and the most famous of Russian generals, was descended from a family of Swedish origin, and was born in Finland, November 13 (O. S.), 1729. His father, who was an officer of the Russian army, and rose, in after-times, to the rank of general and senator, enrolled young S., at the age of 13, in the Semenof regiment, where he remained till 1754, when he was promoted to the grade of lieutenant. S. was present in the Russian army engaged in the Seven Years' War (q. v.), and for distinguished behavior at Kunersdorf, received the grade of colonel. By a constant succession of eminent services in the Polish civil war (1768), in the war against the Turks (1773—1774), in suppressing internal disturbances, and in subduing the Tartars of the Kuban (1783), he continued to grow in reputation, and rose to the rank of general. In the Turkish war (1787—1792) he was commander-in-chief, for the first time brought the bayonet prominently into use in the Russian army, and decided by it the bloody battle of Kinburn (1787), which would otherwise have been a total rout. At the siege of Otchakof (1788), where he narrowly escaped being made prisoner, the battle of Fokshany (August 1, 1789), which he gained in conjunction with the Austrians, and the decisive victory of Rymnik (September 22, 1789), his headlong bravery, and peculiar system of rapid and repeated attack by overwhelming numbers, secured him complete success. For this last victory, which saved the Austrians under Coburg from annihilation or capture, S. was created, by the Emperor Joseph II., a count of the empire, and from his own sovereign received the title of Count *Suvorof-Rymnikski*. His last great achievement, and the one which has given a predominant coloring to S.'s reputation in Western Europe, was the capture of Ismail (q. v.).

S.'s report of his success was couched in the following terms, 'Glory to God and Your Excellency; the town is taken; I am in it.' He was then appointed (1791) governor of the newly conquered provinces; was afterwards sent (1794) to complete the annihilation of the Polish monarchy, which he effected by repeated victories over the Polish armies, the capture of Praga by storm, and the *repossession* of Warsaw (November 19), where a horrible massacre of the inhabitants took place. The grade of field-marshal, and presents of rare value, rewarded these successes. Under Paul, he fell into disgrace (1798), from his impatience of the emperor's fantastic military regulations, and was deprived of his rank; but being restored through English influence, he commanded the Russian auxiliary army sent to co-operate with the Austrians in Italy. In April 1799, he reached Verona; compelled Moreau to retire behind the Adda with immense loss, including more than 8000 prisoners; entered Milan in triumph (April 29); again defeated the French under Macdonald, after a desperate three days' conflict, at the Trebbia (June 17—19), and a third time at Novi (August 15), depriving them of the whole of Northern Italy. His campaign in Switzerland, which promised to bring him face to face with Massena, then the best general in Europe, was rendered abortive by the tardiness of the Austrians, and the Russians, in spite of S.'s remonstrances, were soon after recalled. His escape from the Schackenthal, where he was hemmed in by the French, is considered by many to be the most brilliant and daring retreat ever executed. While on his return to St. Petersburg, where a brilliant reception was awaiting him, he fell dangerously ill in Lithuania, and though, on his recovery, he found himself a second time in disgrace, he continued his route, and arrived privately in the capital, where he died sixteen days afterwards, May 17, 1800. His remains were honored by a magnificent funeral, and the czar Alexander erected a statue to his memory on the Champ-de-Mars.

This most extraordinary man had naturally a weak constitution, but rendered it almost invulnerable by exercise, strict temperance, and the regular use of cold baths. His mode of life was of Spartan simplicity, and though the oddity of many of his habits seemed only calculated to encourage ridicule, they, in combination with his paternal care of his men, gave him a powerful hold on the affections of an army at once so ignorant and so thoroughly national in sentiment as the Russian. S. was inflexible in his resolutions and promises, and of incorruptible fidelity. His skill as a general has often been doubted, on the strength of his favorite remark, that all military tactics could be expressed in three words, *stoupai i bi*, 'forward and strike;' but his career shows him to have been possessed of all needful military knowledge—though he hated idle manœuvring—and to have excelled in promptitude and ingenuity of conception, and boldness and rapidity of execution.

SU'ZERAIN (Fr. from Lat. *supremus*), a feudal lord. According to the feudal system, as developed in Northern Europe, every owner of Allodial (q. v.) lands was compelled to acknowledge himself the vassal of a suzerain, and do homage to him for his lands. The term was applied less to the king than to his vassals, who had sub-vassals holding of them.

SVENIGORO'DKA, a town of Russia, in the government of Kiev, 150 miles south from Kiev, on an affluent of the Southern Bug. Pop. (1880) 11,375.

SWALE. See Yorkshire.

SWALLOW (*Hirundo*), a Linnæan genus of birds of the order *Insessores*, and tribe *Fissirostres*, now divided into a number of genera, which form the family *Hirundinidæ*. This family consists of birds which prey on insects, catching them in the air, and have

Swallows:
1, Common or Chimney Swallow (*Hirundo rustica*); 2, Sand Martin (*H. riparia*); 3, House Martin (*H. urbica*).

great powers of flight, now soaring to a great height, now skimming near the surface of the ground or of the water, and wheeling with great rapidity. The bill is short and weak, very broad at the base, so that the gape is wide; the wings are very long, pointed, and more or less sickle-shaped when expanded; the legs are short and weak, and in some—the Swifts (q. v.)—more so than those of any other birds. The tail is generally forked. The plumage is close and glossy. The species are very numerous, and widely diffused, being found in almost all countries. Such of them as occur in the colder parts of the world are summer birds of passage, migrating to warmer regions when winter approaches and insects disappear. The family is divided into two groups,

Swifts, which have remarkably long and curved wings, very small weak legs and short toes, the hinder toe generally directed forwards, and *Swallows*—some of which are also called *Martins*—having wings not quite so long nor so much curved, rather stronger legs, and longer toes, three before and one behind. The COMMON S., or CHIMNEY S. (*Hirundo rustica*), exhibits a character common to many other species, in the very long and deeply-forked tail, the two lateral feathers of which far exceed the others in length. The plumage is very beautiful, the upper parts and a band across the breast glossy bluish black, the forehead and throat chestnut, the lower parts white, and a patch of white on the inner web of each of the tail-feathers except the two middle ones.

The whole length of the bird is about 8½ inches, of which the outer tail-feathers make 5 inches. The nest is made of mud or clay, formed into little pellets and stuck together, along with straw and bents, and lined with feathers. It is open and cup-shaped, and is generally placed in a situation where it is sheltered from wind and rain, as a few feet down an unused chimney, under the roof of an open shed, or in any unoccupied building to which access can be obtained. Two broods are produced in a year. The migration of this and other British species of S., now recognized by all naturalists as an unquestionable fact, was formerly the subject of much dispute, and swallows were supposed by many to become torpid in winter, although it was difficult to imagine that if so they should not frequently be found in that state. The geographical range of this species extends over great part of Europe, Asia, and Africa.—The WINDOW S., or HOUSE-MARTIN (*H. urbica*, or *Chelidon urbica*), is another very common British species, glossy black above, white below, and on the rump; the feet covered with short downy white feathers, which is not the case in the Chimney S.; the tail long, but its outer feathers not remarkably so. The nest is built of mud or clay, like that of the Chimney S., but is hemispherical, with the entrance on the side, and is attached to a rock, or, very frequently, to the wall of a house, under the eaves or in the upper angle of a window, to the annoyance of housekeepers who prefer the cleanness of their windows to the lively twitter of the birds, and the opportunity of watching their process of nest-building and their care of their young. House-martins congregate in great numbers, as chimney swallows also do before their autumnal migration, and disappear all at once. The house-martin is among the birds of Lapland and Iceland. The only other common British species of S. is the SAND-MARTIN (*H. riparia*), smaller than either of the preceding, the toes naked, the tail moderately forked, the plumage brown on the upper parts and across the breast, the under parts white. It makes its nest in sandy river-banks, the sides of sand-pits and other such situations, excavating a gallery of 18 inches or two feet, sometimes 3, or even 5 feet in length, and more or less tortuous, in the extremity of which some soft material is placed for the reception of the eggs. This wonderful excavation is accomplished entirely by the bill of the bird. The floor slopes a little upwards from the entrance, so that the lodgement of rain is prevented.

The sand-martin is more local than the other British swallows; but it is distributed over most parts of Europe, Asia, Africa, and North America.—The PURPLE S., or PURPLE MARTIN (*H. purpurea*), is a North American species, which has in a few instances been known to visit the British islands. The general color, both of the upper and under parts, is shining purplish blue; the wings and tail black. It abounds in North America, and is a universal favorite in the northern parts, being hailed as the harbinger of spring, and frequenting even the streets of towns. It is a very general practice to place boxes near houses for the martins to make their nests in, which are very inartificial, consisting merely of dried grass, leaves, moss, feathers, and the like. Boxes nailed to trees are also readily occupied by the RUFOUS-BELLIED S. (*H. erythrogaster*), another North American species. But this species, which very nearly resembles the Chimney S. of Britain, makes a nest of mud and fine hay, in the form of the half of an inverted cone, with an extension at the top, for one of the parent birds to sit in occasionally. The REPUBLICAN S., or CLIFF S. (*H. fulva*), of North America, makes a nest of mud, in form somewhat like a Florence flask, which it attaches to a rock or to the wall of a house. Hundreds sometimes build their nests in close proximity. The FAIRY MARTIN (*H. Ariel*), a small Australian species, also builds a flask-shaped nest, with the mouth below, attaching it to a rock, or to the wall of a house, and numerous nests are often built close together.—Some of the swallows of tropical countries are much smaller than any of the European species.—The East Indian swallows, which make the Edible Nests (q. v.), belong to the section of the family to which the name Swift is given.

SWALLOWING, THE ACT OF, is accomplished by a set of associated movements which have been divided by physiologists into three stages. In the first stage, the food having been previously duly reduced to a pulp by trituration and insalivation, is carried back by the contraction of various muscles until it has passed the anterior palatine arch. See PALATE. So far, the movements are purely voluntary. The second stage now commences, during which the entrance of food into the nasal cavities and larynx is most carefully guarded against by certain reflex (involuntary) actions, which have been only clearly recognized since the introduction of the use of the laryngoscope during the last few years. The tongue is carried further backwards, the larynx rises so as to be covered by the epiglottis, which is depressed, and lies horizontally, so that its upper border touches the posterior wall of the pharynx. Coincident with these movements, the sides of the posterior palatine arch contract by muscular action, and approach each other like a pair of curtains, so as almost to close the passages from the fauces into the posterior nostrils; the closure being completed by the uvula. A sort of inclined plane is thus formed, and the morsel slips downwards and backwards into the pharynx, which is raised to receive it. Very little, if any, voluntary action is here exerted. The third stage—the propulsion of the food down the œsophagus—then commences; and this process is effected in the upper part by means of the constrictor muscles of the pharynx, and in the lower, by the muscular coat of the œsophagus itself. At the point where the latter enters the stomach, there is a sort of sphincter muscle, which is usually closed, but which opens when sufficient pressure is made on it by accumulated food, closing again when this has passed. See Carpenter's *Principles of Human Physiology*.

SWALLOW-WORT. See ASCLEPIAS.

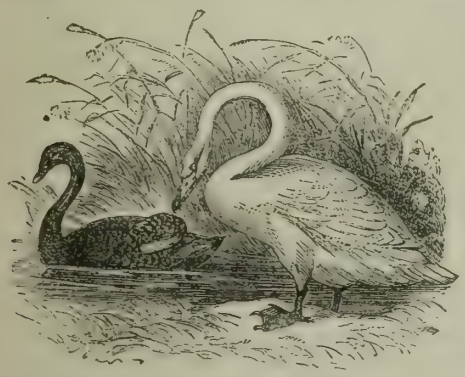
SWAMMERDAM, JAN, a distinguished naturalist, was born at Amsterdam, 12th February 1637. S., almost from his boyhood, showed the greatest eagerness in the study of natural history. Having entered upon the study of medicine, he particularly occupied himself with anatomy, and continued unremittingly to collect insects, to investigate their metamorphoses and habits, and, by the aid of the microscope, to examine their anatomic structure. He took his degree of Doctor of Physic at Leyden, in 1667, and entered upon the practice of his profession, which his bad health, however, soon compelled him to relinquish. He continued to be chiefly engrossed with anatomy and entomology. His treatise on Bees appeared in 1673; a treatise on Ephemera in 1675. It is impossible, however, for us to enumerate his many publications, all of which were first published in Dutch, and afterwards translated into Latin, and many of them into English, French and German. S.'s discoveries were very numerous, both in human and comparative anatomy. His skill in using the microscope was very great, and his manipulation of the most minute subjects extremely dexterous. He succeeded in giving distinctness to the forms of very minute viscera, by inflating them with air; a method of his own invention. It is melancholy to add, that S., who had always displayed strong religious feelings, and expressed them in his writings, was at last carried away by the fanatical extravagances of Antoinette Bourignon (q. v.), began to think all his former pursuits sinful, and relinquished them for a visionary religious life of mere meditation and devotion. His health rapidly declined, and he died at Amsterdam, 17th February, 1680. No man of his time contributed more than S. to the progress of natural history and physiology. He was the inventor of the method of making anatomical preparations by injecting the blood-vessels with wax, and also of the method of making dry preparations of the hollow organs, now generally employed.

SWAN (*Cygnus*), a genus of birds of the Duck (q. v.) family (*Anatidæ*), constituting a very distinct section of the family. They have a bill about as long as the head, of equal breadth throughout, higher than wide at the base, with a soft cere, the nostrils placed about the middle; the neck very long, arched, and with 23 vertebræ; the front toes fully webbed, the hind toe without membrane; the keel of the breast-bone very large; the intestines very long, and with very long cæca. They feed chiefly on vegetable substances, as the seeds and roots of aquatic plants, but also on fish-spawn, of which they are great destroyers. They are the largest of the *Anatidæ*. They have a hissing note like geese, which they emit when offended, and strike with their wings in attack or defence. The common notion, that a stroke of a swan's wing is sufficient to break a man's leg, is exaggerated. The COMMON S., MUTE S., or TAME S. (*C. olor*), is about 5 feet in entire length, and weighs about 30 lbs. It is known to live for at least 50 years. The male is larger than the female. The adults of both sexes are pure white, with a reddish bill; the young (cygnets) have a dark bluish gray plumage, and lead-colored bill. The bill is surmounted by a black knob at the base of the upper mandible, and has a black nail at its tip. In its wild state, this species is found in the eastern parts of Europe and in Asia; in a half-domesticated state it has long been a common ornament of ponds, lakes, and rivers in all parts of Europe. It is an extremely beautiful bird, when seen swimming, with wings partially elevated, as if to catch the wind, and finely curving neck.

The ancients called the S. the Bird of Apollo or of Orpheus, and ascribed to it remarkable musical powers, which it was sup-

posed to exercise particularly when its death approached. It has, in reality, a soft low voice, plaintive and with little variety, which is to be heard chiefly when it is moving about with its young. The nest of the S. is a large mass of reeds and rushes, near the edge of the water, an islet being generally preferred. From 5 to 7 large eggs are laid, of a dull greenish-white color. The female S. sometimes swims about with the unfledged young on her back; and the young continue with their parents till the next spring. The S. is now seldom used in Britain as an article of food, but in former times it was served up at every great feast, and old books are very particular in directions how to roast it and to prepare proper gravy.—The POLISH S. (*C. immutabilis*), of which flocks have occasionally been seen in Britain in winter, differs from the Common S. in its orange-colored bill, in the smaller tubercle at its base, and in the shape and position of the nostrils. The young are also white, like the adults. It belongs chiefly to the north-eastern parts of Europe. Many naturalists regard it as the true wild state of the Common Swan.

The WHISTLING S., ELK S., or HOOPER (*C. ferus*), abounds



Wild Swan, or Hooper (*Cygnus ferus*), and Black Swan (*C. atratus*).

in the northern parts of Europe and Asia. Flocks frequently visit Britain in severe winters, and their migrations extend as far south as Barbary. A few breed in the Orkney Islands, but the greater number in more northern regions. The size is about equal to that of the Common S., and the color is similar, but the bill is more slender, is destitute of knob, and is black at the tip, and yellow at the base. This bird is frequently brought to the London market. The names Hooper and Whistling S. are derived from the voice. The anatomical differences between this species and the Common S. are more considerable than the external, particularly in the double keel of the breast-bone forming a cavity which receives a long curvature of the windpipe.—BEWICK'S S. (*C. Bewickii*), another native of northern Europe, is more rare in Britain, but flocks are sometimes seen. It is about one-third smaller than the Whistling Swan.—The AMERICAN S. (*C. Americanus*) nearly resembles Bewick's Swan. It breeds in the northern parts of North America, and its winter migrations extend only to North Carolina.—The TRUMPETER S. (*C. buccinator*) is another American species, breeding chiefly within the Arctic Circle, but of which large flocks may be seen in winter as far south as Texas. It is rather smaller than the Common Swan.

The ancients spoke of a black S. proverbially as a thing of which the existence was not to be supposed, but Australia produces a BLACK S. (*C. atratus*), rather smaller than the Common S., the plumage deep black, except the primaries of the wings, which are white. The bill is blood-red. It has been introduced into Britain, and breeds freely. It is very abundant in some parts of Australia.—The BLACK-NECKED S. (*C. nigricollis*) is a South American species, as is the DUCK-BILLED S. (*C. anatoides*), the smallest of all the species, white, with black-tipped primaries, common about the Strait of Magellan. It is a curious circumstance that the black color appears more or less in all the species of the southern hemisphere, and in them alone, except in the approach to it made in cygnets.

Swans, according to the law of England, are birds-royal. When they are found in a partially wild state, on the sea and navigable rivers, they are presumed to belong to the crown, and this is one of the prerogatives of the crown, though it may be delegated to a subject. The royal birds generally have a mark on them, and the king's swan-herd once was an important person. A subject is not entitled to have a swan-mark unless he has a qualification of land, and has a grant from the crown, or prescriptive use. But any person may have swans in his grounds in a tame state, and then he has a property in them. Whoever steals or destroys swans' eggs, forfeits 5*s.* for every egg, and whoever steals a marked swan of the crown, or a tame swan, commits felony. In Scotland, there is some trace of the bird having been once treated with royal honors.

SWAN RIVER, a river of Western Australia (q. v.).

SWA'NSEA (Welsh, *Abertawy*) a market-town, municipal and parliamentary borough and seaport of the county of Glamorgan, South Wales, stands on the right bank and at the mouth of the Tawe, 60 miles west-north-west of Bristol. The harbor is formed by means of piers of masonry, projecting from either side of the mouth of the Tawe into Swansea Bay, a wide inlet of the Bristol Channel. The vast resources of the coal-field in the midst of which the town is situated, began to be explored and turned to commercial account about the year 1830; and since that time the progress of S. has been so rapid, that it is now the most important town in South Wales. The houses and public edifices and institutions are of recent erection. A good public hall was erected in 1864, and a spacious and well-arranged infirmary in 1867. Smelting and refining copper is the staple trade of the town, and the chief source of its prosperity. The coal obtained in the vicinity is peculiarly adapted for smelting purposes, and great quantities of ore are brought hither to be smelted, not only from the copper-mines of Britain, but from Cuba and the west coast of South America. In the immediate vicinity of the town, there are smelting works, in which about 185,800 tons of copper, copper ores, silver ores, and zinc ores (equal in value to about £4,000,000) are smelted annually. Of the whole amount of copper manufactured in Great Britain, seven-eighths are smelted at S. and in its immediate vicinity. In 1859, a large floating dock of 13 acres was opened. Its north side is lined with warehouses. In 1881 a new dock was finished at a cost of £300,000. An excellent system of water-works was completed in 1868 at a cost of upwards of £70,000. Patent fuel, composed of a mixture of culm and tar, and compressed into the shape of bricks, is an important article of manufacture and trade. There are extensive potteries, and tin, silver, and china works, breweries, rope-walks, and tanneries.

In 1880, 2345 vessels, of 523,381 tons, entered the port, and 2973, of 696,679 tons, cleared. There are abundant means of communication landward by canals and railways. Pop. (1851) of municipal and parliamentary limits, 31,461; (1861) 41,606; (1871) of mun. bor., 51,702; (1881) mun. bor., 63,739. Of the old castle of S., the ruined remains are used as a military store. S. unites with Aberavon, Kenfigg, Loughor, and Neath in sending a member to the House of Commons.

SWARGA is the paradise of the Hindu god Indra (q. v.). It is the residence of some of the inferior gods and deified mortals, who there rest in the shade of the five wonderful trees—*Mandâra*, *Pârijâta*, *Santâna*, *Kalpavr'iksha*, and *Harichandana;* drink *Amr'ita*, or the beverage of immortality; and enjoy the music of the *Gandharvas*, and the dancing of the heavenly nymphs, the *Apsarasas*.

SWARMING, a peculiar mode of reproduction which has been observed in some of the *Confervaceæ*, *Desmideæ*, &c. The granules which form the green matter in the plant, or in one of its joints, become detached from each other, and move about in the cell with great rapidity. The external membrane swells in one point, and finally bursts there, when the granules escape into the surrounding water to become new plants. At first, they issue in great numbers, but those which remain last, move about within their cell for a long time before they find the way out. Their motion is supposed to be due to cilia. After escaping they continue their movements for some time, and most of them finally become grouped together in little masses on some substance, before beginning to vegetate.

SWATOW, or CHAU-CHOU, a seaport town on the coast of China, in the province of Quang-tung, 212 miles east-north-east from Canton. It is one of the ports which were opened to foreign trade by the treaty of Tien-tsin, and has a resident British consul. The trade is upon the whole increasing. In 1877, the imports were valued at £1,787,000, and the exports at £367,400. Half the total is direct trade with foreign ports. Opium is the chief article of importation, next to which rank cotton and woollen goods, metals, and cotton-yarn. The chief exports are sugar, rice, tea, and paper. S. is pleasantly situated on a sheltered bay.

SWE'ABORG, or SVE'ABORG, a great Russian fortress in Finland, sometimes called 'the Gibraltar of the North,' protects the harbor and town of Helsingfors, from which it is 2 miles distant. The fortifications extend over seven islands, the *Nylandischen Skären*, but the grand central point is the island of Wargöe. The islands are connected with each other by means of bridges, and between two of them lies the single narrow entrance to the harbor, which can hold from 70 to 80 ships of the line. S. has a civic population of about 3000, the greater part of whom are manual laborers, ship-carpenters, and traders, and a garrison of some 5000 men (including women and children). During the Crimean war, the Anglo-French fleet in the Baltic made a reconnaissance of the place, and bombarded it for two days (9th and 10th August 1855), but found the defences too formidable to be reduced by the means at their disposal.

SWEARING, PROFANE, according to the law of England, is an offence for which the party may be convicted by a justice of the peace according to a scale of penalties. A day laborer, a common soldier, sailor, or seaman forfeits 1*s.* per oath; every other person under the degree of a gentleman, 2*s.*; and every person above the degree of a gentleman, 5*s.*—for a second offence, double these sums; for a third, treble, &c. If the cursing take place in presence of a justice of the peace, the latter may convict the swearer then and there, without further proces or evidence; and in all cases a constable may apprehend a profane swearer; and carry him before a justice. On a recent occasion, a man swore a volley of oaths, twenty times repeating the oath, and the justices fined him 2*s.* for each repetition, making in all £2, and this was held a proper conviction. The justices of the peace in Scotland have a similar jurisdiction intrusted to them, to convict of profane swearing, and fine according to the rank of the party.

SWEAT (A.-S. *swat*, Sansc. *svaidas*, Lat. *sudor;* Gr. *hydor*, moisture; Lat *ud(us)* = wet), or Perspiration. The nature, composition, and uses of this fluid in the normal state have been sufficiently noticed in the article SKIN. It may be additionally remarked, in connection with the physiology of sweat, that the composition of this fluid varies materially according to the part of the body from which it is secreted. Thus Funk found the sweat of the feet was richer in fixed salts than that of the arm, in the ratio of 5 to 3; and Schotten found a considerable preponderance of potassium in the former. In the negro, Dr. Copland and other observers have found that both the gaseous exhalations from the skin, and the solid matters contained in the sweat, were much greater than in the white races. It has been shown in the article SKIN that the sweat-glands, like the lungs and kidneys, act as depurating organs, and separate and carry off effete matters from the blood.

This eliminating action of the skin is modified in various diseases; in some cases being diminished, as in the early stage of fevers, in inflammations before suppuration commences, in scurvy, diabetes, sun-stroke, &c., while it is more or less increased in the sweating stage of ague, in acute rheumatism, in Asiatic cholera, in certain adynamic fevers, in the advanced stages of pulmonary consumption, in the formation of matter in internal parts, &c. The sweat is naturally acid in health, but in prolonged sweating the secretion becomes neutral, and finally alkaline. Little is known with certainty regarding the coloring matters of sweat. In cases of jaundice, the sweat sometimes communicates a yellow tinge to the body-linen; and instances of blue, red, and bloody sweat are on record. Cases of sweat of these colors are recorded in Simon's *Animal Chemistry* (Syd. Soc. Trans.), (Lond. 1845), vol. ii., p. 110. Cases of unilateral sweating, stopping abruptly at the middle line, have been occasionally noticed, especially in aneurism of the aorta.—See Gairdner's *Clinical Medicine*, page 557. Dr. Druitt has pointed out the use of hot water as a remedy for profuse perspiration. He has found it serviceable in (1) oversweating in good health and hot weather; (2) undue sweating in special parts of the body, as the hands, feet, or armpits; (3) true hectic; and (4) ordinary night sweats in phthisis not preceded by hectic symptoms. To be of any service, the water must be applied at as great a heat as the patient can possibly bear (see his paper on this subject in the *Medical Times* for March 4, 1865). For a very interesting and learned discussion on our Saviour's bloody sweat during his Passion, the reader may consult Stroud *On the Physical Cause of the Death of Christ*, and Trusen's chapter *Von dem Blutschweisse Christi* in his *Darstellung der Biblischen Krankheiten*, 1843.

SWEATING SICKNESS, THE, is the term given to an extremely fatal epidemical disorder, which ravaged Europe, and especially England, in the 15th and 16th centuries. It derives its name 'because it did most stand in sweating from the beginning vntil the endyng,' and 'because it first beganne in Englande, it was named in other countries the Englishe sweat.'—*The Boke of Jhon Caius against the Sweatyng Sicknes*. It first appeared in August 1485 in the army of Henry VII., shortly after his arrival at Milfort in South Wales from France, and in a few weeks it spread to the metropolis. It was a violent inflammatory fever, which, after a short rigor, prostrated the powers as with a blow; and amidst painful oppression at the stomach, headache, and lethargic stupor, suffused the whole body with a fœtid perspiration. All this took place in the course of a few hours, and the crisis was always over within the space of a day and night. The internal heat which the patient suffered was intolerable, yet every refrigerant was certain death. '*Scarce one amongst a hundred* that sickened did escape with life.'—Holinshed, vol. iii., p. 482. Two lord mayors of London and six aldermen died within one week; and the disease for the most part seized as its victims robust and vigorous men. It lasted in London from the 21st (some authorities say the middle) of September to the end of October, during which short period 'many thousands' died from it. The physicians could do little or nothing to combat the disease, which at length was swept away from England by (as many supposed) a violent tempest on New-Year's Day. The disease did not reappear till the summer of 1506, when it broke out in London, but does not seem to have occasioned any great mortality. In July 1517, it again broke out in London in a most virulent form; it being so rapid in its course that it carried off those who were attacked in two or three hours. Amongst the lower classes, the deaths were innumerable, and the ranks of the higher classes were thinned.

In many towns a third, or even a half of the inhabitants were swept away. On this occasion, the epidemic lasted about six months. In May 1528—the year in which the French army before Naples was destroyed by pestilence, and in which the putrid fever known as *Trousse-galant* decimated the youth in France—the sweating sickness again broke out in the metropolis, spread rapidly over the whole kingdom, 'and fourteen months later, brought a scene of horror upon all the nations of Northern Europe, scarcely equalled in any other epidemic.'—Hecker's *Epidemics of the Middle Ages* (Syd. Soc. Trans.), p. 238. How many lives were lost in this epidemic, which has been called by some historians *the great mortality*, is unknown; but the mere fact that the king (Henry VIII., who, whatever his faults, was never accused of cowardice) left London, and endeavored to avoid the disease by continually traveling, shows the general feeling of alarm that existed. In the following summer (July 25, 1529), having apparently died out in England, it appeared in Germany, first at Hamburg, where it is recorded that 8000 persons died of it, and shortly after at Lubeck, Stettin, Augsburg, Cologne, Strasburg, Hanover, &c. In September, it broke out in the Netherlands, Denmark, Sweden, and Norway, whence it penetrated into Lithuania, Poland, and Livonia. By January of the following year, after an existence of three months, it had entirely disappeared from all these countries. For three-and-twenty years the sweating sickness totally disappeared, when for the last time (April 15, 1551) it burst forth in Shrewsbury. The banks of the Severn seemed to be the focus of the malady, which was carried from place to place by poisonous clouds of mist. There died within a few days 960 of the inhabitants of Shrewsbury, the greater part of them robust men and heads of families. The disease spread rapidly over the whole of England, but seems to have disappeared by the end of September. The deaths were so numerous, that one historian (Stow) states that the disorder caused a *depopulation* of the kingdom. The very remarkable observation was made in this year, that the sweating sickness uniformly spared foreigners in England, and on the other hand, followed the English into foreign countries.

The immoderate use of beer amongst the English was considered by many as the principal reason why the sweating sickness was confined to them. 'By the autumn of 1551,' says Hecker, 'the sweating sickness had vanished from the earth; it has never since appeared as it did then and at earlier periods; and it is not to be supposed that it will ever again break forth as a great epidemic in the same form, and limited to a four-and-twenty hours' course; for it is manifest that the mode of living of the people had a great share in its origin, and this will never again be the same as in those days.'—*Epidemics of the Middle Ages* (Syd. Soc. Trans.), p. 306.

SWE'DEN (*Sverige*), the eastern portion of the Scandinavian peninsula, constitutes with Norway (q. v.) one joint kingdom. It is situated in 55° 20′—69° 3′ N. lat., and 11°—24° E. long., and is bounded on the N. and W. by Norway; on the extreme S.W. and S. by the Cattegat, which separates it from Denmark; on the S.E. and E., as far as 66° N. lat., by the Baltic and the Gulf of Bothnia; and from thence to the extreme N. by Russia. The area is nerly 170,000 sq. m.; and the pop. was, in 1871, 4,204,177. Its length is 969 miles, and its greatest width from 150 to 280 miles. S. is divided into three provinces—viz., Norrland, the largest and most northern; Sweden Proper, or *Svea-rike* (land of the Swedes), in the center; and Götland or *Göta-rike* (land of the Goths), to the south.

Unlike Norway, S. possesses few high mountains, but contains numerous lakes of large dimensions. The coast skirting the Baltic, and the adjoining islands, are for the most part low and sandy, although in some parts, as in the vicinity of the outlet of Lake Maelar into the sea (in about 58° N. lat.), the shores are steep; and on the south and west coast, the generally low, alluvial lands are replaced by more rocky formations.

In the northern parts, the land rises gradually from the Gulf of Bothnia to the Kjölen range, belonging to the great Norwegian Fjeldmark, which constitutes the true watershed and natural boundary between S. and Norway. South of 62° N. lat., the slope is directed southward, attaining its lowest level in the vicinity of the three great lakes of Vener, Maelar, and Hjelmar, which, together with the great Vetter lake, nearly intersect the country from east to west; and south of these great inland waters, the surface is in general level, though ranges of high ground and detached hills occur.

The following are the areas and populations of the 25 läns into which the provinces are subdivided (in 1880 the total pop. was 4,578,901):

Län.	Area in Geog. Sq. Miles.	Population in Dec. 1871.
Stockholm	134·5	131,731
Upsala	94·7	101,731
Södermannland	122·4	136,977
Oestergötland	194·9	257,367
Jönköping	202·2	180,569
Kronoberg	180·7	159,258
Kalmar	209·1	234,597
Götland	57·	54,237
Blekinge	54·7	126,935
Kristianstad	117·9	233,492
Malmöhus	86·8	318,786
Halland	89·3	127,842
Göteborg and Bohus	91·8	233,689
Elfsborg	232·7	286,454
Skaraborg	155·6	254,691
Vermland	306·6	261,716
Oerobro	164·7	169,319
Vestmannland	119·9	115,695
Kopparberg	528·7	176,946
Gefleborg	351·	150,374
Vesternorrland	447·5	136,939
Jemtland	921·2	71,338
Vesterbotten	1122·5	93,154
Norbotten	1931·8	77,328
	8078·8	4,065,665
City of Stockholm	....	138,512
Total population		4,204,177

In 1878 S. ceded her only colony, St. Bartholomew (q. v.), to France (to which country it once belonged) on payment of the purchase-money agreed on.

S. may be considered to be divided into three distinct parts—viz., the northern or alpine region, the central or lake district, and the southern or mining district. The extreme south includes the only level and fertile tract, in which wheat can at all times be advantageously and extensively cultivated. The lakes of S. have been computed to cover nearly ⅛th of the entire area of the country. The largest are Lake Vener (q. v.); Lake Vetter (q. v.); and the Maelar Lake (q. v.). The rivers are generally short and rapid, and only made navigable by art. The largest is the Angermann Elv, which flows into the Gulf of Bothnia. The Cattegat is connected with the Baltic by means of an admirable system of canals, &c.

Temperature, Natural Products, &c.—The differences of climate in S. are necessarily very great, considering that its most northern parts are more than 2° within the polar circle, and its southern extremity 11° south of it, besides which many districts are so nearly surrounded by seas and lakes as to have the conditions of an insular position. Great extremes of temperature are common in different parts of S.: thus, while Stockholm has a mean annual temperature of 42°·2 Fahr., and Götteborg 46°·3, the summer temperature of the former is 60°·4 Fahr., and that of the latter 62°·13; and the winter temperature of the former only 25°·8, and that of the latter 31°·5 Fahr.

The heat of the summer, which is scarcely separated from the cold of the winter by either spring or autumn in the extreme northern districts, enables the inhabitants to cultivate barley, which is reaped within two months of the time of its sowing, although even the hardier cereals, as oats and rye, will not ripen above the parallel of 66° N. lat. Indeed, the climate of S. generally is unfavorable to the growth of grain, the annual yield of which frequently falls short of the wants of the population. The principal articles of cultivation are, in addition to the various cereals, potatoes, hemp, flax, tobacco, and hops, which are generally grown in sufficient quantities for home consumption. The forests are of great extent, covering nearly one-fourth of the entire surface, and rising at some spots to an elavation of 3000 feet above the level of the sea. The birch, fir, pine, and beech are of great importance, not only for the timber, tar, and pitch which they yield, but also from their supplying charcoal and firewood. Above the parallel of 64°, stunted bushes, berries, dwarf-plants, and lichens are the only forms of vegetation to be met with. The common fruit-trees, as cherries, apples, and pears, grow as far north as 60°, but the fruit seldom comes to great perfection except in the southern provinces; cranberries and other berries abound, however, in all parts of the country. Bears and beavers, which were formerly often met with, are becoming scarce; but wolves, lynxes, foxes, martens, squirrels, eagles, reindeer in the Lappmarks, &c., are still common; while the elk and deer are found in some of the forests, which abound in hares, woodcocks, blackcock, and various other kinds of small game; and Lemmings (q. v.) occasionally descend from the mountains in large numbers, and lay waste the low country. The lakes yield a great abundance of fish, 88 different kinds of sea and freshwater fish being brought to market. In 1880, there were in S. 466,000 horses, 2,240,800 horned cattle, 1,504,000 sheep and lambs, 112,000 goats, and 417,000 swine.

The mineral products of S., which are extremely rich, include some gold and silver (which, however, do not pay the cost of working), copper in abundance, iron of the finest quality, alum, vitriol, marble, sulphur, lead, plumbago, cobalt, nickel, zinc, and some coal of very inferior quality.

Next to agriculture, mining constitutes the most important branch of national industry, and in some provinces is the principal employment. The Danemora mines, in Upsala Län, yield a metal which is capable of being converted into the finest steel, and which is for the most part purchased for the English market. At Gellivare in South Lapland, enormous quantities of iron ore of superior quality have recently been extracted from mines, which promise to rival those in Upsala.

Ship-building forms an entensive branch of local industry. The merchant-sailing marine numbered, in 1880, 4327 vessels, with a tonnage of about 544,000; the number of vessels that cleared the Swedish ports in 1880 was 14,753, with a tonnage of about 2,537,500, of which half belonged to Sweden.

Exports and Imports.—The chief articles of export are, in the order of their value, timber (beams, deals, masts, spars, pit-props), iron and steel, oats and barley, butter, lucifer matches, cattle, sheep, swine, paper, wood-pulp, copper and zinc-blende. The imports are mainly coal, coffee, sugar, rye and flour, woollen manufactures and wool, dressed skins, herrings, mineral oil, machinery, pork, salt, spirits and tobacco. About half the total exports go to Great Britain, the countries next in order being France, Denmark, Germany, Belgium, Norway, Holland, Russia. About a fourth of the imports come from Great Britain, Germany sending nearly as much; next come Denmark, Russia, Norway, Holland, Belgium, United States, and France. The total value of the exports from S. between 1870 and 1880 ranged from £8,500,000 to £13,000,000; of the imports, from £8,000,000 to £17,000,000. Accounts are kept in *kronor*, each worth about 1*s*. 2*d*.

Revenue, &c.—The revenue is derived from direct and indirect taxation, state property, railways, customs, &c. The budget for 1881 gave the annual receipts at 74,995,000 *kronor*, or about £4,166,400, and the expenditure at the same figure; of which about 55 million *kronor* were for extraordinary expenses. The frequent surplus of expenditure, which is almost invariably due to the prosecution of national and public works, is formally sanctioned by the diet, which annually provides means for covering the deficit by the appropriation of certain state funds for the purpose, and by the levying of a general income-tax. In 1880, the national debt of S. was £12,238,700, nearly ⅘ths of which are held by foreigners.

Army, Navy, &c.—The Swedish army, which is nominally rated at about 170,000 men, has a special and peculiar organization, as it consists, in addition to the Värfvade or enlisted troops, of the 'Indelta,' or cantoned militiamen, who are maintained at the cost, and on the property, of the landed proprietors: each estate being mulcted according to its value or extent to maintain one or more men, and provide them with 'torps' or cottages, a certain portion of land, and a fixed rate of payment. In return, these reserve soldiers, who are for the most part married men, serve the proprietor as field-laborers in times of peace, except during the four weeks of each year in which they are called out for drill. In case of war, they can be sent with the companies in which they are enrolled into active service, and they are then paid by the crown. The rest of the army is made up of volunteers, who serve for six years, every Swede between the age of 20 and 25 years being moreover bound to serve in the *beväring* or National Guard. In addition to these corps, companies of volunteer free-shooters were created in 1861 for the general defence of the country. Including volunteers, the total military force of S. in 1881 was 202,785 men. The fleet consisted, in 1881, of 140 vessels (of which 56 were steamers), carrying in all about 360 guns. There are on an average 7800 men engaged in active service; while in time of war, a coasting merchant fleet of 3200 vessels can be called into requisition, together with a reserve of 25,000 men. The principal fortresses are Karlssten, Karlskrona, and Vaxholm near Stockholm. The military and other orders are the Seraphim, the Sword, the Northern Star, and the order of Vasa. The order of Charles XIII. embraces the highest rank of freemasons in Sweden.

Form of Government.—S. is a hereditary and constitutional monarchy, based on the fundamental law of 1809, by which it was decreed that the succession should be in the male line; that the sovereign should profess the Lutheran faith; and have sworn fi-

delity to the laws. The diet, which meets every year, and remains sitting for three or four months, is composed of two chambers, which are both elected by the people. The first chamber consists of 127 members, who receive no payment, and are elected for nine years, their number being, however, dependent upon the amount of the population. They must be possessed of an income of about £225, and have attained the age of 35. The second chamber is composed of 194 members elected for three years, on a lower scale of qualification as to property and age; and receiving payment for their attendance during each session of the diet, and for their traveling expenses. Election to both chambers is by ballot. The diet exercises a strict control over the expenditure of the revenue, fixes the budget, and has power to take cognizance of the acts of the ministers and crown officers. The king's person is inviolable, and he can exercise a veto on the decrees of the diet. He is the supreme head of the law courts, nominates to all appointments, can declare war, make peace, and conclude foreign treaties. He is assisted by a council of state composed of ten members, who are responsible to the diet.

Law, &c.—The administration of the law is independent of the state, and presided over by the chancellor of justice, *Justitie Kanslar*, appointed by the king, and an attorney-general *Justitie Ombudsmann*, appointed by the diet. There were 587,591 cases brought before the courts in 1870, the large proportion of which were merely for slight offences against the law. The expenses incurred annually for the support of the poor are about six million rixdalers, which is nearly covered by the regular income obtained by the rates imposed for the purpose.

S. is divided administratively into 25 läns, presided over by länsmen, or chief magistrates, and subdivided into 117 fögderin, and 517 länsmans districts. There are 90 chief towns (städer), only a limited number of which have the right of trading with foreign ports, and 19 market-towns (köpingar). Beside Stockholm, the capital (q. v.), only one town, Göteborg (71,000 in 1877), has a population of more than 50,000. Next in rank come Malmö, with 34,439; Norköping, with 27,226; Gefle, with 18,137; and Karlskrona, with 17,787 inhabitants. Upsala, a cathedral and university town, which is the most interesting spot in the kingdom, as the original seat both of Christianity and of the ancient Odinic faith, has a population of only 13,446.

Religion, &c.—The predominant form of religion in S. is the Lutheran; the official tables of the census for 1870 showing only 6440 persons who belonged to other forms of faith, of whom 1918 were Baptists, and 1836 Jews. The affairs of the church are administered by 1 archbishop (of Upsala) and 11 bishops, whose collective dioceses include about 2500 parishes, with about 3500 pastors.

Education, &c.—Education is universally diffused among the Swedes by the agency of *Fasta* (regular) and *Flyttanda* (ambulatory) schools in all the country districts. There were, in 1869, 2303 of the former, and 1206 of the latter kind, together with 3410 infant schools, which were attended in all by 679,128 children, and instructed by 5030 male, and 2115 female teachers. Public instruction is compulsory for all children, and the cost is defrayed by the nation. Ample means are supplied for a higher form of instruction in the Lärovärk or Gymnasia of the towns, and at the universities of Upsala and Lund. The Karolingska Institute at Stockholm is the medical college of S.; and there are numerous technical, military, and other special collegiate institutions in the principal towns of the kingdom. The transactions of the two learned societies, the 'Svenska Vetenskaps Selskap,' and the 'Svenska Akademie,' afford honorable testimony to the advanced condition of scientific inquiry in Sweden. The Royal Library of Stockholm, and those of Upsala and Lund, number about 100,000 volumes each. That of Upsala is contained in a special building, *Carolina Rediviva*, to which is attached a botanical garden arranged on the Linnæan system.

Roads, Railways, &c.—There were, in 1878, 12,000 English miles of highroads in S., and nearly double that length of way in parish and by-roads. In 1880, a length of 3570 English miles of railway had been opened. About two-thirds of the total mileage belongs to private companies, and one-third to the state. The number of passengers annually conveyed is about 2,000,000, and the receipts are about £500,000. In 1880, the telegraphic lines measured 5200 English miles, and besides the government telegraph-stations, there were more than 350 stations in connection with railways and belonging to companies; about 1,000,000 messages were transmitted, of which number about 550,000 were inland telegrams; and the receipts were, for the same year 1,205,000 kronor. There passed upwards of 60,000,000 letters through the post-offices of S. in 1880, when the receipts were near 5,000,000 kronor. There are 1800 post-offices in S.

History.—The legendary history of S. forms part of Scandinavian history. When we first hear of S., the country was inhabited by numerous tribes, kindred in origin, but politically separate. Two principal groups, however, are recognizable—*Goths* in the south, and *Swedes* in the north. These possessed in common a national sanctuary, the temple at Uppsala, which laid the basis of a later unification, for gradually the royal chieftains of Uppsala extirpated the inferior princes, the Härads and the Fylkis. Ingiald Hrada, the last ruler of the old royal family of the Ynglingar, who drew their origin from Njord, sought to establish a single government in Sweden, and perished in the attempt. To the Ynglingar followed, in Upland, the dynasty of the *Skioldungar*, which claimed to be descended from Skjold, son of Odin. Erik Edmundsson, who belonged to this dynasty, is said to have acquired the sovereignty of the whole of Sweden about the end of the 9th century. The dawn of Swedish history (properly so called) now begins, and we find the Swedes constantly at war with their neighbors of Norway and Denmark, and busily engaged in piratical enterprises against the eastern shores of the Baltic. See NORMANS and RUSSIA. Efforts to introduce Christianity (see ANSGAR) were made as early as 829 A.D., but it was not till 1000 A.D. that Olof Skötkonung, the Lap-king, was baptized, nor did the struggle between heathenism and the new religion cease till the burning of the temple of Upsala in the reign of Inge (1080—1112).

In 1155, Erik, surnamed the Saint, gave a powerful impetus to the diffusion of Christian doctrines, by building churches and founding monasteries. He undertook a crusade against the pagan Finns, and having compelled them to submit to baptism, and established Swedish settlements among them, he laid the foundation of the union of Finland with Sweden. Erik's defeat and murder in 1160, by the Danish prince, Magnus Henriksen, who had made an unprovoked attack upon the Swedish king, was the beginning of a long series of troubles, and during the following 200 years, one short and stormy reign was brought to a violent end by murder or civil war, only to be succeeded by another equally short and disturbed. At length, in 1389, the throne was offered by the Swedish nobles to Margaret, Queen of Denmark and Norway, who, having gladly availed herself of the opportunity thus opened to her of uniting the three Scandinavian crowns into one, threw an army into S.; defeated the Swedish king, Albert of Mecklenberg, who, on the deposition of his maternal uncle, Magnus, had been called to the vacant throne; and by the union of Calmar, in 1397, brought S. under one joint sceptre with Denmark and Norway. In 1523, S. emancipated itself from the union with Denmark, which, during the reigns of Hans and his son Kristian II (see DENMARK), had become hateful to the Swedes, and rewarded its deliverer, young Gustaf Vasa (see GUSTAVUS I.), by electing him king, and declaring its independence of Denmark. Gustaf Vasa found an empty treasury, a kingdom exhausted by war, a haughty nobility and clergy (who arrogated the right of electing the sovereign, and who claimed exemption from all imposts), and a people overburdened with taxation and bad government, and divided in regard to religion. On his death, in 1560, he left to his successor a hereditary and well-organized kingdom (in which the power of the nobles had been circumscribed, and that of the clergy broken, by the abrogation of Catholicism, and the firm establishment of the Reformed Church under the jurisdiction of the state), a full exchequer, a standing army, and a well-appointed navy. Trade, manufactures, arts, learning, and science owed their advancement in S. to this patriotic king.

The colossal labors of the great Vasa, in raising a semi-barbarous state to an honorable place among the civilized monarchies of Europe, were rendered almost useless by the crimes and misfortunes of his son and successor, Erik XIV., whose high intellectual powers were clouded by a wayward and revengeful nature, leading him finally to insanity. His cruelties and excesses led to his deposition in 1568, when his younger brother Johan ascended the throne, which he occupied for nearly a quarter of a century, dying in 1592, after a stormy reign, stained by the cruel murder of his unfortunate brother Erik, and distracted by the internal dissensions arising from his attempts to force Catholicism on the people, and to carry on war with the Danes, Poles, and Russians. Johan's son and successor, Sigismund, who had been elected king of Poland through the influence of the relatives of his Polish mother, after a short and stormy reign of eight years, which were spent in attempting to restore Catholicism in S., was compelled by the diet to resign the throne in 1599 to his uncle Karl, the only one of Gustaf Vasa's sons who inherited any share of his legislative and administrative talents. The policy of Karl IX. was to encourage the burgher classes at the expense of the nobility; and by his successful efforts to foster trade—in furtherance of which he laid the foundation of Göteborg and other trading ports—develop the mineral resources of the country, and reorganize the system of Swedish jurisprudence, he did much to retrieve the calamitous errors of his predecessors. The deposition of Sigismund gave rise to the Swedo-Polish war of succession, which continued from 1604 to 1660; and on the death of Karl in 1611, his son and successor, the great Gustavus Adolphus, found himself involved in hostilities with Russia, Poland, and Denmark. By the ability of his minister, Oxenstierna, the young king was soon enabled to conclude treaties of peace with his northern neighbors, and to

SWEDEN
& NORWAY
Geographical Miles, 60 = One Degree.
0 20 40 60 80 100 120 140
Swedish Miles, 40.41 = One Degree.
0 5 10 15 20
English Miles, 69 = One Degree.
0 50 100 150
Railways thus
NORTH SEA
SKAGERRACK
BALTIC SEA
GULF OF BOTHNIA
GULF OF FINLAND
Longitude East from Greenwich
2 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36
70 68 66 64 62 60 58 56
6 8 10 12 14 16 18 20 22 24 26 28
NORWAY
SWEDEN
FINLAND
RUSSIA
DENMARK
TRONDHJEM
BERGEN
CHRISTIANIA
STOCKHOLM
GOTTLAND
ÖLAND
Esthonia
Livonia
Courland
Wilna
Lapland
ARCTIC CIRCLE

place the internal affairs of his kingdom in order (see GUSTAVUS II.); and although he justly ranks as one of the greatest military commanders of his age, the extraordinary number of benefits which he conferred on every department of the administrative system of S., entitle him to still greater renown as the benefactor of his native country. His death in 1632, on the field of Lützen, would have proved an irreparable calamity to S., had not the able administration of Oxenstierna, during the minority of Gustavus's daughter Christina, maintained the renown of the Swedish arms abroad, and the political reputation of the country among other states. The reign of Christina (q. v.) was disastrous in every act but that of her abdication.

The short reign of Karl X. was occupied in generally unsuccessful wars against Poland and Denmark; while the minority and long rule of his son, Karl XI.—from 1660 to 1697—was characterized by success abroad, and in the augmentation of the regal power, which was declared by an act of the diet to be absolute. His son Karl, known to us as Charles XII. (q. v.), succeeded, at the age of 15, to the power and dominions which his father's abilities had consolidated, but which, notwithstanding his own brilliant genius, he so deeply imperilled by his insatiable ambition, that at his untimely death in 1718, at the siege of Frederikshald, after a brilliant career of glorious but chequered military achievements, he left his country overwhelmed with debts, and disorganized by prolonged misrule. With him the male line of the Vasas expired, and his sister and her husband, Frederick of Hesse-Cassel, were called to the throne by election, but were the mere puppets of the nobles, whose rivalries and party dissensions plunged the country into calamitous wars and almost equally disastrous treaties of peace, and, under the leadership of the two great factions of the 'Hats,' or French party, and the 'Caps.' or Russian party, demoralized all ranks of society. The weak Adolphus Frederick of Holstein-Gottorp, who was called to the throne on the death of Frederick in 1751, and died in 1771, did little to retrieve the evil fortunes of the state; but his son, Gustavus III. (q. v.) (1771—1792), skilfully turned to account the general dissatisfaction of the people with the nobles, to destroy the factions of the Hats and Caps, and to recover the lost power of the crown. His extravagance, dissoluteness, and insincerity detracted, however, from his merits as a ruler, and raised up numerous enemies against him, through whose agency he was assassinated in 1792.

His son and successor, Gustavus IV. (q. v.), lacked the ability to cope with the difficulties of the times, and after suffering in turn for his alliance with France, England, and Russia, was forcibly deposed in 1809, and obliged to renounce for himself and his direct heirs the crown in favor of his uncle, Charles XIII., who saw himself compelled at once to conclude a humiliating peace with Russia by the cession of nearly a fourth part of the Swedish territories, with 1½ million of inhabitants. The early part of the reign of Charles, who was childless, was troubled by domestic and foreign intrigues to regulate the choice of an heir to the throne; and when, under the erroneous idea of conciliating Napoleon, the dominant party in S. elected General Bernadotte to the rank of Crown Prince, the latter assumed the reins of government, and by his steady support of the allies against the French emperor, secured to S. at the congress of Vienna, the possession of Norway, when that country was separated from Denmark. Under the able administration of Bernadotte, who, in 1818, succeeded to the throne as Charles XIV., the united kingdoms of S. and Norway made great advances in material prosperity and political and intellectual progress; and although the nation at large entertained very little personal regard for their alien sovereign, his son and successor, Oscar (1844—1859), and his grandsons, the late king, Charles XV., and the present king, Oscar II., who came to the throne in 1872, have so identified themselves with their subjects, that the Bernadotte dynasty has secured the loyal affections of every section of the united nations of S. and Norway.

SWE'DENBORG, EMANUEL, was born in Stockholm, January 29, 1688, and died in London, March 29, 1772. His father was Jesper Svedberg, subsequently Bishop of Skara. S.'s lifetime divides itself into two distinct periods; the first, ending with his 55th year, was given to business, science, and philosophy; the second, of nearly 30 years, was consecrated to theology and spiritualism. S. was educated at Upsal, and traveled for four years in England, Holland, France, and Germany. On his return to Sweden, he was appointed by Charles XII. to an assessorship of mines; and rendered some service to that monarch as military engineer. The S. family was ennobled in 1719, and the name changed from Svedberg to Swedenborg. S. is sometimes styled Count and Baron, but erroneously; he was neither, though he had a seat in the Swedish House of Nobles. His mind at this time was busy with mechanical and economical projects. He published short treatises on algebra, giving the first account in Sweden of the differential and integral calculus; on a mode of finding the longitude at sea by the moon; on decimal money and measures; on the motion and position of the earth and planets; on the depth of the sea, and greater force of the tides in the ancient world; on docks, sluices, and salt-works; and on chemistry as atomic geometry. In 1724 he was offered the professorship of mathematics at Upsal, which he declined from a dislike of speculative science. Abandoning his desultory studies, he remained silent for eleven years, and devoted himself to the duties of his assessorship and to a systematic description of mining and smelting, and the construction of a theory of the origin of creation. The result appeared at Leipzic in 1734, in three massive folios, beautifully illustrated, entitled *Opera Philosophica et Mineralia*. The second and third volumes describe the manufacture of copper, iron, and brass, and contain an exhaustive record of the best methods in use in last century.

The first volume, entitled *Principia, or the First Principles of Natural Things, being new Attempts towards a Philosophical Explanation of the Elementary World*, is an elaborate deduction of matter from 'points of pure motion produced immediately from the Infinite.' This was followed in 1734 by a treatise on *The Infinite, and the Final Cause of Creation; and the Intercourse between the Soul and the Body*, carrying the doctrine of the *Principia* into higher regions, and resolving the soul into points of motion, and one in substance with the sun. Dissatisfied with his conclusions, he determined to track the soul to its inmost recesses in the body. His studies in human anatomy and physiology with this end in view, appeared as *Œconomia Regni Animalis*, in two volumes, 1741, and as *Regnum Animale*, in three volumes unfinished, 1744—1745. At this point, his course was arrested, and he entered on his career as seer, by which he is known to fame. The particulars of the transition lay in obscurity until 1858, when G. E. Klemming, royal librarian, Stockholm, discovered S.'s diary, kept in 1744. It contains the record of a variety of dreams, visions, and strange communings. After that date, he professed to enjoy free access to heaven and hell. He resigned his assessorship in 1747, that he might devote himself to his office of seer. In 1749, he made his first public appearance in his new character in the issue in London of the *Arcana Cœlestia*, completed in 1756 in eight quartos. His life henceforward was spent between Stockholm, London, and Amsterdam, in writing and printing a variety of works in exposition of his experience and doctrines. There is little in any of these which is not comprised in the *Arcana Cœlestia*, and a few notes on its contents may serve as a description of the whole. With many digressions, the *Arcana Cœlestia* is a revelation of the inner sense of Genesis and Exodus. The early chapters of Genesis are a fragment of an older Word, preserved at this day in Tartary, and are not historical in a matter-of-fact sense. Adam signifies the most Ancient Church, and the Flood its dissolution; Noah, the Ancient Church, which falling into idolatry, was superseded by the Jewish.

The spiritual sense pervades the Scriptures, with the exception of Ruth, Chronicles, Ezra, Nehemiah, Esther, Job, Proverbs, Ecclesiastes, the Song of Solomon, the Acts of the Apostles, and the Epistles. No fault is found with these books, but inasmuch as they do not possess the internal sense, they are not the Word. The Scriptures are read in heaven in the spiritual sense, but as that sense treats exclusively of God and the human mind, it is void of every reference to earthly scenes, persons, and events. By reason of its symbolism of the inward sense, the letter of Scripture is holy in every jot and tittle, and has been preserved in immaculate perfection since the hour of its divine dictation. The Jewish dispensation having reached its period, God appeared in Jesus Christ. He assumed human nature in its basest condition in the Virgin, wrought it into conformity with Himself, 'glorified and made it divine.' The effluence from the redeemed humanity is the Holy Spirit. In a sense the reverse of Socinian, S. was a Unitarian. He saw God in the Saviour, and regarded Him as the sole object of worship. The Church initiated by the divine advent came to an end in last century, and S. witnessed the Last Judgment effected in the year 1757 in the World of Spirits. Then commenced a new dispensation, signified by the New Jerusalem in the Revelation, of which S. was the precursor, and his writings the doctrine. To the objection, that the doctrine is strange and novel, he replied, that mankind were not prepared for its reception, and that the early Christians were too simple to understand it.

One of the chief ends of his mission was the revival of the lost science of correspondences—the science of sciences in the most ancient times. The law of correspondence is universal; the natural world is the outbirth of the spiritual world, and the spiritual world of the invisible mental world. Unseen evil is manifested in things hurtful and ugly; unseen good, in things useful and beautiful. Man is a summary of nature; nature is man in diffusion; all things, therefore, in nature, in fire, air, earth, and water—every beast, bird, fish, insect, and reptile—every tree, herb, fruit, and flower, represent and express unseen things in the mind of man. The Scriptures are written according to correspondences, and by aid of the science their mysteries are

unlocked. By it, too, the constitution of heaven and hell is revealed. There are three heavens, consisting of three orders of angels: the first distinguished for love, the second for wisdom, and the last for obedience. All angels have lived on earth; none were created such. They are men and women in every respect; they marry, and live in societies in cities and countries just as in the world, but in happiness and glory ineffable. All in whom love to God and man is the ruling principle, go to heaven at death. Between heaven and hell, a perfect equilibrium is maintained. As there are three heavens, there are three hells, and every angelic society has an infernal opposite. Hell, as a whole, is called the Devil and Satan; there is no individual bearing that name. All in whom self-love is the ruling motive, go to hell. There is no resurrection of the earthly body. Every one passes to his final lot at death, some making a short sojourn in an intermediate state, designated the World of Spirits, where the good are cured of their superficial infirmities and intellectual mistakes, and where the evil are stripped of all their pretences to good.

S. professed to enjoy a numerous acquaintance with departed celebrities, and some of his verdicts on character are appalling; for example, he describes King David and St. Paul as amongst the lost, while Louis XIV. and George II. are distinguished angels. Nor did he confine his intercourse to ghosts from earth, but extended it to souls from the moon and planets, with the unfortunate exceptions of Uranus, Neptune, and the Asteroids. For these visions, enjoyed whilst sitting in his chamber, he had this explanation: although in the spiritual world there are *appearances* of space, there is nothing of the objective reality which here divides London from Melbourne. If one spirit desires to see another, the desire instantly brings them together. A good man is, as to his mind, in heaven, and an evil man in hell; and supposing the spiritual sight of either was opened—that is, if the eyes of the spiritual body, which transfuse and animate the material ones, were disengaged from their fleshly vesture—he would see his spiritual companions and the country where he would abide after death.

The grand and distinctive principle of Swedenborgian theology, next to the doctrine of the Divine Humanity, is the doctrine of life. God alone lives. Creation is dead—man is dead; and their apparent life is the Divine presence. God is everywhere the same. It fallaciously appears as if He were different in one man and in another. The difference is in the recipients; by one He is not received in the same degree as another. A man more adequately manifests God than a tree; that is the only distinction. The life of devils is God's presence perverted in disorderly forms. 'All things, and each of them to the very uttermost, exist and subsist instantly from God. If the connection of anything with Him were broken for a moment, it would instantly vanish; for existence is perpetual subsistence, and preservation perpetual creation.' By this law of life is explained man's self-consciousness, freedom, and personality. All these sensations are communicated from God to man. He dwells in man so cordially, that He gives him to feel that he lives of himself, even as He lives.

S. made no attempt to establish a sect. When he proclaimed the Christian Church at an end, his expectation was, that a new church would be raised up among the Gentiles; but towards the close of his life he was silent as to that hope, and spent his energies in attacking Protestant theology, as if bent on the conversion of Northern Europe. All his works were written in Latin, and received little attention from his contemporaries. Apart from his visions, there was nothing peculiar about Swedenborg. He was shrewd in worldly affairs, affable in society, and discussed politics and finance in the Swedish diet like a man of the world. He was never married. In diet he was a vegetarian.

Swedenborgians, or, as they designate themselves, 'The New Church signified by the New Jerusalem in the Revelation,' were first organized as a separate body in 1788 by Robert Hindmarsh, a printer in Clerkenwell, London, who was elected by lot to baptize and to ordain his comrades in the ministry. The Swedenborgians accept S.'s voluminous theological writings as nothing less than revelations from heaven. The body has not had a prosperous existence. The number of its registered members in Britain is little over 4000, divided into 58 congregations. These are chiefly in the large towns and in Lancashire; four are in Scotland, but none in Ireland. At one time, there were reputed to be a number of receivers of the doctrines of S. among the clergy of the Church of England. The translator of the *Arcana Cœlestia* was the Rev. John Clowes, rector of St. John's, Manchester, for sixty-two years. He died in 1831, and in the pulpit and numerous publications made no secret of his faith. In the United States, the Swedenborgians have nearly 100 societies, and about 5000 members. They chiefly exist in the northern states; and their largest congregation is in Boston. In France, Germany, Sweden, and Russia, there are Swedenborgians, but few and scattered. There is a Swedenborg Society, established in 1810, for printing and publishing S.'s works, with a house in London, and an income of about £200 a year. See the Life of S. by White (London, 1867), and various *Documents*, published by Prof. Tafel (ed. 1875).

SWEDISH LANGUAGE AND LITERATURE. See SCANDINAVIAN LANGUAGE AND LITERATURE.

SWEEPS, on Shipboard, are oars of great length used in large vessels during a calm, to enable the ship to obtain steerage-way.

SWEETBREAD, the Pancreas (q. v.) of an animal, used as food; it is highly esteemed as being both delicate and nutritious.

SWEET-BRIAR. See ROSE.

SWEET FLAG. See ACORUS.

SWEET GUM. See LIQUIDAMBAR.

SWEET-MEAT, a general term applied to such articles of food as consist chiefly of sugar.

SWEET PEA. See LATHYRUS.

SWEET POTATO. See BATATAS.

SWEETS, a term applied in England, and by the Board of Inland Revenue, to home-made wines, for the sale of which a special licence is granted. It is also a term in far more general use for lozenges, comfits, and other preparations of sugar well known to children: they are the *confitures* of the French.

SWEET SOP (*Anona squamosa*), a fruit of the same genus with the Custard Apple (q. v.). It is produced by a small bush, with lanceolate leaves, a native of the warm parts of America, and much cultivated in Brazil, the West Indies, and generally in tropical countries. The fruit is greenish, and resembles an artichoke in size, in form, and in its scaly covering. The pulp is soft, somewhat mealy, sweet, and luscious; with a musky aromatic odor and flavor. It is much used both in the East and West Indies, generally raw, but sometimes cooked. Notwithstanding its foreign origin, it has proved the staff of life to the people of Hindustan in seasons of famine. The seeds are acrid, and the powder of them is used to destroy insect vermin.

SWEET WILLIAM. See PINK.

SWEET WOOD. See CASCARILLA.

SWELL, in Music, a set of pipes in an organ with a separate key-board, and forming a separate department, which are capable of being increased or diminished in intensity of sound by the action of a pedal on a series of shades or shutters overlapping each other like Venetian window-blinds, within which the pipes in question are enclosed. On a well-constructed swell, a practiced performer can imitate not only a gradual *crescendo* and *diminuendo*, but also a *sforzando*, a very small opening sufficing to make an immediate burst on the ear; while, when the shutters are closed, an imitation of an echo is produced.

SWIETE'NIA. See MAHOGANY.

SWIFT (*Cypselus*), a genus of birds of the Swallow family. The distinctive characters of the group, of which the true Swifts are the type, are noticed in the article SWALLOW. The Swifts, like

Common Swift (*Cypselus apus*).

the swallows, are widely distributed, and some are only found in tropical countries; others are birds of passage, and spend the summer in colder parts of the world. Many of the S. group are often popularly called swallows, as that which produces the edible nests of the East Indies. In the genus *Cypselus*, as now restricted, the tail is generally forked, the legs and toes feathered, and very small and weak, all the four toes directed forwards. The birds of this genus pass most of their time in the air, and even copulate on the wing. The wings are longer than in any other bird; and the internal structure, even of the skeleton, is peculiarly adapted to prolonged flight. The anatomy more resembles that of humming-birds than of true swallows.—The COMMON S. (*C. apus*) is common in almost all parts of the north of Europe and of Asia in summer, retiring to tropical or subtropical regions in winter. It occurs even in Lapland. Its residence in its summer quarters is much shorter than that of swallows; and it is worthy of notice, that the S. is seldom to be seen along with any of the

swallows or martins, the different kinds choosing different localities, even although very close together.

The S. is easily recognized in its flight by the remarkably sickle-shaped wings, and its slight scream is very different from the twitter of the swallow. It is black, with a white throat. It makes its nest in holes of rocks or of walls, often in those of houses. The nest is formed of bits of straw, dry blades of grass, and bents, feathers, and other such substances, which are apparently glued together by a mucous secretion. The S. sometimes builds in hollow trees. Swifts, like swallows, seem to return to the same place to make their nest, year after year, and repair the old nest, instead of making a new one.—The ALPINE S., or WHITE-BELLIED S. (*C. alpinus*), is rarely seen in Britain, but is common in the more southern countries of Europe. It builds in high rocks, sometimes in steeples. It is larger than the Common S., and is the largest of the British *Hirundinidæ*. Its wings are even longer in proportion than those of the Common Swift. Its voice is sweet, not a scream like that of the Common Swift.—The AMERICAN S. (*Chætura pelasgia*) has the hind-toe directed backwards, and the tail-feathers stiff and pointed, as in woodpeckers. It is a small bird, not above 4¾ inches in entire length, but 1 foot in extent of wing. The general color is brownish black, with greenish reflections, the throat grayish white, the under parts grayish brown. The nest is made of small dry twigs, which the bird breaks off from the tree, and carries away in its feet; and they are attached by means of the saliva, to the rock, wall, or hollow tree where the nest is made. From its frequently building in chimneys, this species is known as the *Chimney Swallow* in North America. Great numbers often build together, sometimes choosing for this purpose an unused chimney in a town.

SWIFT, JONATHAN, the greatest of English satirists, and the most original writer of his age, was born in Dublin, but of English parents, on the 30th of November 1667. He was a posthumous child, reared amidst circumstances of abject poverty and dependence, the recollection of which galled his proud irascible spirit, and embittered much of his future existence. He was supported by relatives, and educated at Kilkenny school and Trinity College, Dublin. He proved a negligent and turbulent student, more intent on personal satires and political rhymes than academical honors; but he remained at college about seven years. He then removed to England, visited his mother in Leicestershire, and by her recommendation was admitted into the house of Sir William Temple, who had long known the Swift family. He seems at first not to have conciliated the regard of the retired minister, for in the following year (May 1690), Temple made an offer of the services of his protégé to Sir Robert Southwell (then about to proceed to Ireland as Secretary of State), recommending him as diligent and honest, qualified either to wait on Sir Robert as a gentleman, or to write under him as a clerk. No appointment followed; S. remained with Temple, studying hard, till 1694, when he went to Ireland, took orders in the church, and obtained a small living, which he threw up in two years, and returned to England, in consequence of Temple, who missed his society and assistance, urging him to come back. Temple died in 1698, and S. in the following year, published his posthumous works, after which he again repaired to Ireland, obtaining from Lord Berkeley some church preferments, including the vicarage of Laracor, worth in all about £400 per annum, which was all the professional income he enjoyed till he was appointed Dean of St. Patrick's, in his 46th year. Before this, he had written the wildest and wittiest and most powerful satirical work of the 18th c., *The Tale of a Tub* (1704), also a few essays on ecclesiastical subjects, some inimitable ridicule of astrology under the name of Isaac Bickerstaff, and poetical pieces possessing a peculiar vein of humor and description.

In 1710, he went over to the Tories, conceiving himself neglected by the Whig ministers, and exerted himself strenuously in behalf of his new allies, Harley and Bolingbroke. He wrote papers in *The Examiner* (1710); a *Letter to the October Club* (1711); *The Conduct of the Allies* (1712); *The Barrier Treaty* (1712), and innumerable pasquinades against the Whigs, whom he 'libelled all round.' He had become, as it were, a great and formidable power in the state, yet could extort no higher preferment for himself than the deanery of St. Patrick's. His party was overthrown by the death of Queen Anne; and in 1714, S. 'commenced Irishman for life,' with strong reluctance and disgust. In time however, he took interest in Irish affairs, and identified himself with Irish feelings and prejudices. Hatred to Walpole and the English government quickened his activity; and his resistance to Wood's copper coinage—a scheme for supplying Ireland with copper money by an English patentee—raised him to the highest pinnacle of popular favor. His *Drapier Letters* (1724) produced quite a ferment in Ireland, and compelled the government to abandon the scheme of the coinage. Two rewards of £300 each had been offered for the unmasking of the Drapier, but not a traitor, as he says, could be found to sell him. The triumphant author made his last visit to England in 1726, and published his *Gulliver's Travels*, the most universally popular of all his works. He next joined with Pope, Arbuthnot, and Gay in publishing three volumes of *Miscellanies*, after which he returned to Ireland (October 1727), and never left it again. He was subject to fits of giddiness and deafness, which increased in frequency and intensity as he grew old; he brooded over the anticipated madness which he foreboded would be his future lot; his temper always irritable and gloomy, became more violent and morose, the effect of cerebral disease, and his memory and other faculties gave way. There was also a deep and secret grief: the fate of two ladies, known as Stella and Vanessa, had been inseparably entwined with his own destiny; both had sacrificed for him all but honor, and had sunk under disappointed hopes and blighted affection.

We cannot here trace the painful story, which is still involved in mystery, but for a time the retribution of S. was terrible. He rallied, however, and wrote some of his best minor pieces after this period. Among these are *The Grand Question Debated; On Poetry, a Rhapsody; The Legion Club; Verses on the Death of Dr. Swift;* and that extraordinary prose tract, *The Modest Proposal*, a masterpiece of irony, in which he proposes to relieve the distresses of the poor Irish by converting their children into food for the rich. The last three years of S.'s life were passed in almost total silence in the hands of keepers. He died October 19, 1745.

It would be superfluous to attempt in our brief space to characterize the genius of the immortal Dean of St. Patrick's. Shakspeare alone among English authors has received a greater amount of criticism and annotation. From Johnson to Thackeray, the most brilliant critics and biographers have employed themselves in elucidating his strange and sad history, and in estimating his writings. As a consummate master of ridicule and irony, possessing great powers of wit, invention, illustration, and analogy; possessing also the dramatic faculty that enabled him to assume and portray varieties of character; and as writing a pure, perspicuous English style, unsurpassed for strength and simplicity, S. must ever be a model in our language and literature. His misanthropy, or degradation of human nature—his Yahoos, Strulbrugs, daring irreverence, and indelicacy, are of course indefensible. He had a total incapacity, as De Quincey remarks, for 'dealing with the grandeurs of the human spirit, with religion, with poetry, or even with science, when it rose above the mercenary practical.' His business was with the world—with the follies, vices, and absurdities of men. And his poetry is the same as his prose; it may come under his definition of a good style, 'proper words in proper places,' applied to ordinary topics, but is wholly wanting in passion, elevated feeling, and imagination. A complete edition of his works, in 19 vols., was published by Sir. W. Scott (1815). See also Roscoe's edition (1853), and *Life* (unfinished), by John Forster (1875).

SWI'LLY, LOUGH, an inlet of the Atlantic on the north coast of Ireland, in the county of Donegal, enters between Dunaff Head on the east, and Fanad Point, on which there is a light-house, on the west. It penetrates the country in an irregular, but generally south direction, is about 25 miles in length, and at its entrance, where it is widest, it is 3¾ miles broad. On the eastern shore is the small town of Buncrana, much resorted to for sea-bathing; and in front of which is a roadstead, capable of accommodating the largest men-of-war.

SWIMMING. The art of swimming is so exceedingly useful, not only as a bracing summer exercise, but as a means of preserving life, that it should be acquired by every young person. Considering the numerous risks run by all human beings, especially by the inhabitants of maritime countries, of being accidentally plunged into the water; and how greatly the chances of being saved are increased by the power of keeping one's self afloat for even five minutes, it is surprising that the art of swimming does not form an essential element of education among all classes. With our limited space, it would be needless to attempt giving directions that would be of any practical value. In many cities, there are now swimming-schools, where professional instruction may be had. When these are not available, any acquaintance who can swim will give his aid until the elementary movements and the necessary confidence are required. Even without help, by keeping in safe water, and by perseverance, the art will be acquired as by instinct.

SWI'NBURNE, ALGERNON CHARLES, one of the first of living English poets, is the son of Admiral Charles Henry Swinburne, by Lady Jane Henrietta, daughter of the third Earl of Ashburnham, and was born in London on April 5, 1837. He entered as a commoner at Balliol College, Oxford, in 1857, but left the university without graduating. His first literary venture, a volume published in 1861, containing two plays, *The Queen Mother and Rosamund*, attracted little attention; but *Atalanta in Calydon*, a tragedy, which appeared in 1865, at once established his reputation. Afterwards came *Chastelard*, a tragedy (1865); *Poems and Ballads* (1866); *A Song of Italy* (1867); *Siena* (1868); *Songs before*

Sunrise (1871); *Bothwell*, a tragedy (1874); *Erechtheus* (1875); and a new series of *Poems and Ballads* in 1878. S. belongs to what has been aptly called the 'fleshly school' of poetry, and even those who most admire his power of poetical expression, richness of coloring, and happy lyrical effects, must deplore the sensuous tone of his muse. He has also been severely animadverted upon for the wanton violence with which he attacks the most sacred beliefs of his fellow-men. His *Songs of the Springtides* appeared in 1880. A collection of his *Essays and Studies* was published in 1875; his *Note on Charlotte Brontë* in 1877; *A Study of Shakspeare* in 1879; *Songs of the Springtides* (1880); *Studies in Song* (1881). *Mary Stuart, a Tragedy*, (1881), taken in connection with *Chastelard* and *Bothwell*, completes a noble dramatic trilogy. In *Tristram of Lyonesse and other Poems* (1882), S. has drawn inspiration from the old Arthurian fountain; but the work is the most varied volume of verse that S. has produced.

SWI'NDON, an old market-town of Wilts, 77 miles west of London, with a large corn exchange. A mile north of the town is Swindon Junction, the great central establishment of the Great Western Railway Company. A considerable town has risen around the station, called the New Town, and consisting mainly of dwellings for the employés of the railway. There is a large and beautiful church, a public park, library, and mechanics' institution. Pop. of Old Town, (1881) 4696; of New Town, 17,669.

SWI'NEMÜNDE, a maritime and fortified town of Prussia, province of Pommern, is situated on the island of Usedom, at the entrance of the narrow channel of Swine, which connects the Grosses Haff (into which the Oder flows) with the Baltic. S., as in some sense the port of Stettin (q. v.), carries on a considerable commerce, and has also valuable fisheries, but it is chiefly noted for its excellent sea-bathing. The lighthouse of S. has a tower 200 feet high. Pop. of S. (1875) 8045.

SWING, a cognomen assumed by senders of threatening letters during the period when the irritation of the agricultural laborers of England against their employers was at its height—viz., from 1830 to 1833. The cause of this misunderstanding arose from a widespread belief on the part of the laborers, that the use of machinery would greatly lessen the demand for labor, and consequently produce a general reduction of wages; it was also intensified by the savage severity with which the game-laws were enforced, and by other hardships to which the laboring-classes in the country considered themselves unjustly subjected. As any inattention on the part of landlords or farmers to the demands contained in these threatening letters was almost invariably followed by the burning of stacks, farm-buildings, &c., the employers of labor became so terrified that implicit obedience was paid to the dictates of 'Captain Swing.' It is not to be wondered at that, with such encouragement, 'Swings' became numerous, and their demands more insolent; but the apprehension and punishment of a number of them gradually brought about a cessation of the outrages.

SWITHIN, SAINT, an English ecclesiastic of the 9th c., who was chaplain to King Egbert, and tutor to his son Ethelwulf, under whom, when he came to the throne, he held the office of Chancellor. He had the charge of the education of King Alfred, whom he accompanied to Rome. In 852, he was consecrated Bishop of Winchester. According to William of Malmesbury, he was 'a rich treasure of all virtues, and those in which he took most delight were humility and charity to the poor.' He adds, that he built several churches, and traveled through his diocese with his clergy on foot, and for the most part by night, in order to avoid the appearance of ostentation. The origin of the tribute called 'Peter-Pence' (q. v.) has been often assigned to S., and he is said to have procured an act of the Wittenagemote, enforcing, for the first time, the universal obligation of paying tithes. S. died on 2d July 862, and was buried, according to his own desire, in the churchyard of Winchester. A century later, he was canonized; and the monks, not considering this a fitting place of sepulture for a saint, exhumed his body, for the purpose of depositing it in Winchester cathedral; but this translation, which was to have taken place on the 15th July, was delayed in consequence of violent rains, which continued without intermission for forty days. Out of this circumstance arose the still current belief, that if rain fall on the 15th July, it will continue to rain for forty days. Experience certainly shows, that when a period of wet weather sets in about the summer solstice, it generally proves of considerable duration; and we find a similar superstition popularly attached in different countries of Europe to the festivals of various saints, which occur about the same period of the year. In France, the watery saints' days are those of St. Médard (8th June), and St. Gervais and St. Protais (19th June), the meteorological canon being—

> S'il pleut le jour de Saint Médard,
> Il pleut quarante jours plus tard ;
> S'il pleut le jour de St. Gervais et de St. Protais,
> Il pleut quarante jours après.

The rainy saint in Flanders is St. Godelièvе, and in Germany there are three saints' days to which this belief attaches, one being that of the Seven Sleepers.

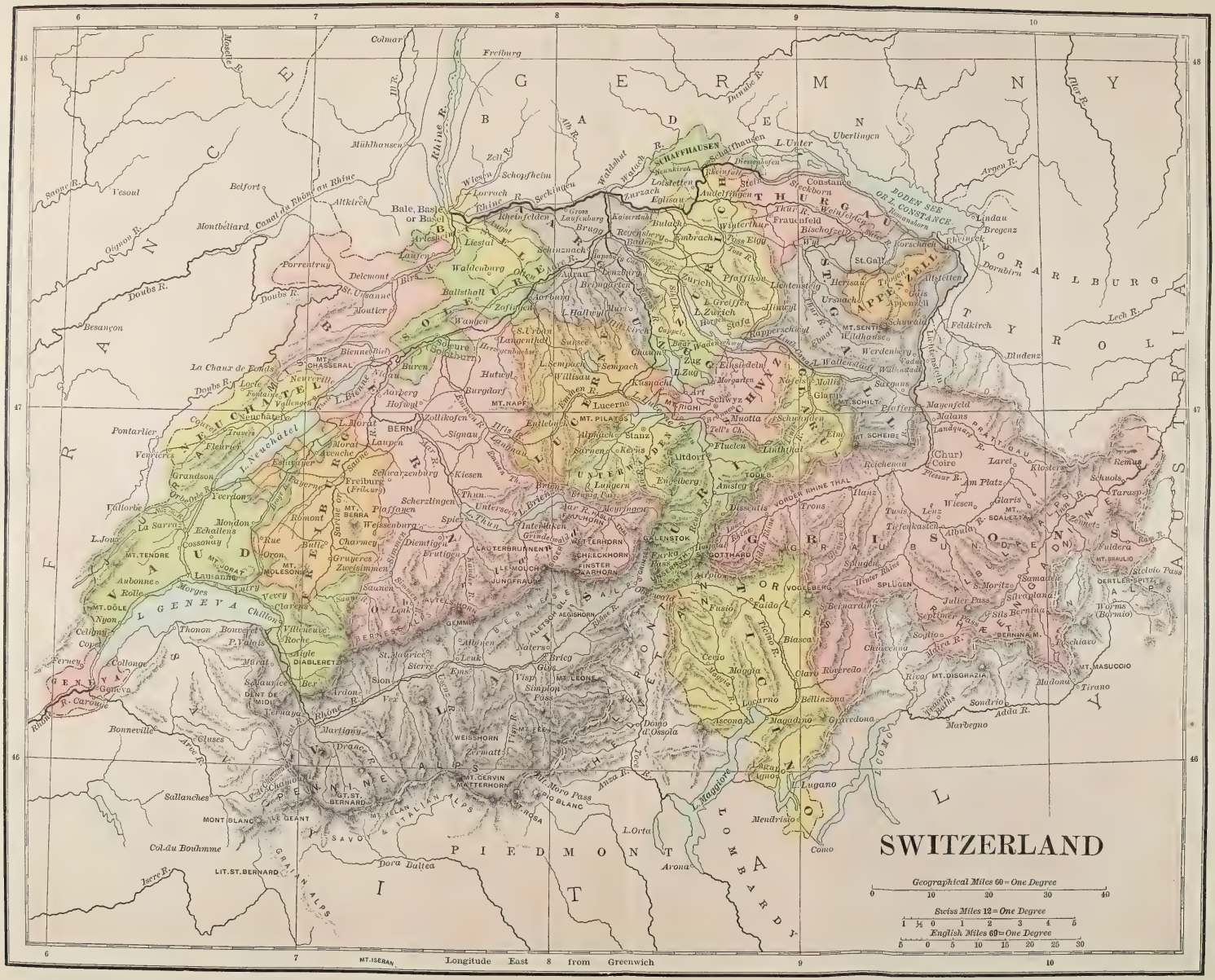
SWI'TZERLAND (Ger. *Schweiz;* Fr. *Suisse;* It. *Svizzera*) is an inland country of Europe, situated between 45° 48′—47° 49′ N. lat., and 5° 55′—10° 30′ E. long. Its greatest length from east to west is 180 miles, and its greatest width from north to south, 130 miles. Its superficial area, without including lakes, is 15,233 sq. m., or one-fourth that of England and Wales. In 1880, the population of S. was 2,831,787. The following table gives the results of the census of 1870:

CANTONS.	Area in Eng. Sq. Miles.	Pop. Dec. 1870.
Zürich	659	284,786
Bern	2,615	506,465
Lucerne	480	132,338
Uri	418	16,107
Schwyz	358	47,705
Unterwalden (Upper)	186	14,415
" (Lower)	112	11,701
Glarus	265	35,150
Zug	91	20,993
Freiburg	632	110,832
Soleure	292	74,713
Basel (Town)	15	47,760
" (District)	166	54,127
Schaffhausen	118	37,721
Appenzell (Exterior)	102	48,726
" (Interior)	61	11,909
St. Gall	781	191,015
Grisons	2,706	91,782
Aargau	538	198,873
Thurgau	384	93,300
Tessin, or Ticino	1,082	119,610
Vaud	1,226	231,700
Valais	2,016	96,887
Neufchatel	308	97,284
Geneva	110	93,239
Total	15,721	2,669,147

Surface.—S. is the most mountainous country of Europe. Its principal chains are the Alps (q. v.) and the Jura (q. v.). The former run from east to west along its southern or Italian frontier. Their ramifications fill more than one half of the country, and terminate along a line which may be traced from Vevey, on the Lake of Geneva, to Mount Moleson and Mount Napf, across Lake Zug, to the southern shores of the lakes of Zürich and Wallenstadt, and Sargans on the Rhine. The mean elevation of the highest chain is from 8000 to 9000 feet. The Jura run north-east from the western corner of Switzerland. They consist of a series of parallel ridges enclosing long and narrow valleys, and their mean elevation does not exceed 4000 feet. In the angle formed between them and the Alps, lies the plain of S., a tableland 100 miles in length, and from 20 to 30 miles in width, with a mean elevation of about 1400 feet above the sea. It is not absolutely level, but covered with elevations, which seem very unimportant, however, when contrasted with the huge masses of the Alps and Jura. It has been described, and not inaptly, as a corner of Southern Germany, penetrating like a wedge between France and Italy. The communication between the plain of S. and the German valleys of the Danube and Rhine is not, however, continuous. The plain on the east terminates in a third hilly tract—the Thur hill-country, which lies between the lakes of Zurich and Constance, and which, to some extent at least, forms a barrier between the plain of S. and Germany. The Jura, the plain, and the hill-country are, then, the great divisions of Northern Switzerland. The divisions of the Alpine region are more strongly marked in nature.

A glance at the map will show that the chains which overspread it radiate from a mountain knot lying to the west of the Grimsel Pass. They isolate and enclose (1) the valleys drained by the Rhone, which connect S. with Southern France; (2) Ticino, drained by streams which descend to the Po, and have at all times brought this country into close communication with Italy; (3) The Grisons, the most sequestered valleys of Switzerland, drained by the tributaries of the Rhine and Danube, and shut out by mountains from the lower basins of these rivers; (4) The Bernese Oberland, which slopes towards the western extremity of the Swiss plain; (5) The district of the Forest Cantons—Schwyz, Uri, and Unterwalden—surrounding the Lake of Lucerne, and which slope towards the eastern extremity of the plain, and seem a great mountain fortress erected in the very heart of Switzerland, to protect the plain against German invasion.

Geology is of little importance in explaining the general geog-


SWITZERLAND
Geographical Miles 60 = One Degree
0 10 20 30 40
Swiss Miles 12 = One Degree
1 ½ 0 1 2 3 4 5
English Miles 69 = One Degree
5 0 5 10 15 20 25 30
Longitude East from Greenwich
6 7 8 9 10
48 47 46
GERMANY
FRANCE
ITALY
AUSTRIA
Bale, Basle or Basel
Geneva
Lucerne
Zurich
Berne
Lausanne
Neuchâtel
Fribourg
Soleure
Schaffhausen
Constance
Coire
Altdorf
Sion
Martigny
Chamonix
Mont Blanc
Lugano
Como
Lake of Geneva
Lake of Constance
Lake of Lucerne
Lake of Zurich
Lake of Neuchâtel
Lake of Maggiore
Lake of Como
Lake of Lugano
Rhine R.
Rhone R.
Aar R.
Reuss R.
Ticino R.
Inn R.
Adda R.
Doubs R.
Aare R.
Saane R.
Mt. Pilatus
Mt. Rigi
Mt. Napf
Mt. Chasseral
Mt. Tendre
Mt. Moleson
Mt. Dôle
Mt. Berra
Mt. Schilt
Mt. Scheibe
Mt. Braulio
Mt. Masuccio
Mt. Leone
Mt. Fée
Mt. Cervin Matterhorn
Mt. St. Bernard
Mont Blanc
Le Geant
Mt. Rosa
Weisshorn
Finsteraarhorn
Jungfrau
Schreckhorn
Wetterhorn
Lauterbrunnen
Grindelwald
Gemmi
Aegishorn
Diablerets
Dent de Midi
Dent du Midi
Splugen
Vogelberg
Julier Pass
Septimer Pass
Bernardin
Bernina M.
Lit. St. Bernard
Mt. Iseran
Col du Bonhomme
Mont Cenis
Simplon Pass
Mt. Moro Pass
Grand St. Bernard
Gotthard
Furca
Oberalp
Lukmanier
Splugen
Maloja
Bernina
Ortler-Spitz
Stelvio Pass
Tonale Pass
Tirano
Sondrio
Chiavenna
Bellinzona
Locarno
Ascona
Domo d'Ossola
Arona
Menaggio
Varenna
Lecco
Bormio
Worms
Meran
Trent
Brixen
Innsbruck
Landeck
Feldkirch
Bregenz
Lindau
Ulm
Freiburg
Colmar
Mulhausen
Belfort
Vesoul
Besançon
Pontarlier
Montbéliard
Porrentruy
Delemont
Moutier
St. Ursanne
La Chaux de Fonds
Neuveville
Biel
Solothurn
Aarau
Zofingen
Olten
Langenthal
Burgdorf
Huttwyl
Sursee
Sempach
Willisau
Wolhusen
Entlebuch
Sarnen
Stanz
Alpnach
Kerns
Engelberg
Meyringen
Brienz
Interlaken
Thun
Spiez
Frutigen
Kandersteg
Gemmi
Leuk
Brieg
Visp
Naters
Sierre
Sion
Martigny
Bex
Aigle
Villeneuve
Vevey
Montreux
Lausanne
Morges
Rolle
Nyon
Coppet
Geneva
Carouge
Ferney
Gex
Bellegarde
Bonneville
Cluses
Sallanches
Chamonix
Argentière
Tête Noire
Col de Balme
Col du Bonhomme
Col de Seigne
Col du Grand St. Bernard
Col de Fenêtre
Col de Ferret
Col de Bonhomme
Col de Balme
Col de Forclaz
Col de Jaman
Col de Pillon
Col de Mosses
Col de Sanetsch
Col de Torrent
Col de Cheville
Col de Bretaye
Col de Susten
Col de Grimsel
Col de Furka
Col de Nufenen
Col de Gries
Col de Bernina
Col de Maloja
Col de Splügen
Col de Lukmanier
Col de Oberalp
Col de Furka
Col de Grimsel
Col de Susten
Col de Brünig
Col de Surenen
Col de Klausen
Col de Pragel
Col de Ruppen
Col de Panix
Col de Segnes
Col de Flüela
Col de Ofen
Col de Umbrail
Col de Stelvio
Col de Tonale
Col de Aprica
Col de Mortirolo
Col de Gavia
Col de Tonale
Col de Aprica
Col de Mortirolo
Col de Gavia

raphy of Switzerland. It may, however, be stated that in the Southern Alpine region, the rocks are crystalline; that in the Northern Alpine region, they belong to the Jurassic and other Upper Secondary strata; and that in the plain and a great part of the hill-country, they consist of loose Tertiary sands and clays, which supply the best agricultural soils of Switzerland. Those rocks and formations in which mines and coal chiefly abound are absent.

Climate.—In S., the climate chiefly varies with elevation above the sea-level. At a height exceeding 9500 feet, the mountains are covered with perpetual snow, which descends along the hollows in Glaciers (q. v.) to a much lower level, and in this way covers the elevated part of the country with a vast sea of ice. Below the level of perpetual snow, the surface of S. has been divided into a series of belts, characterized by different climates and productions. The highest of these, lying between the snow and the level of 6900 feet, has been called the Upper Alpine Region. In it, the glaciers fill the valleys, but plants clothe the scanty soil of the ridges. The second or Lower Alpine belt descends to 4800 feet. It is a country of pastures, in which shrubs, but no trees make their appearance. The Righi Pass, the Grimsel Hospice, and the Splügen are included in it. The third belt descends to 4350 feet. The meadows still abound in it, but forests of firs and maples in many parts replace them. It includes Urfenthal and Oberengadin. The fourth belt sinks to 3000 feet. The forests still abound, the beech being the prevailing tree. The meadows are excellent, and rye and barley are successfully cultivated. It includes Weissenstein, Grindelwald, and Engelsberg. The fifth belt lies above 1800 feet. In it the oak and walnut are the characteristic forest trees. Spelt and the best wheat are cultivated. It includes Bern, Coire, and St. Gall. The last belt sinks to 750 feet. In it the chestnut is the characteristic tree; the mulberry and the vine are extensively cultivated, and wheat is the grain chiefly grown. This belt includes the greater part of the Swiss plain, and sinks to its lowest level in the Valley of the Rhine, between Constance and Basel, and the banks of Lake Zürich and the Lago Maggiore. In the last district, the vegetation is that of Northern Italy. At a higher elevation than 6400 feet, S. is only inhabited by herdsmen during the summer months. At this limit, however, permanent abodes begin to make their appearance; and at 4000 feet there are many villages. The most populous part of S., however, lies between 1250 and 2150 feet. The temperature of this region is fairly represented by that of Zürich, which we will compare with that of London. The temperature of Zürich is in winter 30·34°; in spring, 47·25°; in summer, 64·15°; in autumn, 49·05°; for the year, 47·95°. The temperature of London is in winter, 38·22°; in spring, 48·34°; in summer 61·74°; in autumn, 50.29° for the year, 50·50°.

Productions.—In S., where good coal is not to be had, and where the houses are built of wood, the forests, which cover one-sixth of the whole surface, acquire very great importance. Wood-cutting is one of the chief employments of the people. The trees cut down in the highlands are deprived of their branches, and shot with inconceivable rapidity over the slopes to the valleys below, whence they are removed by rafts, not only to different parts of S., but to France and Germany. It is, however, the mountain-pastures and the meadows, forming two-fifths of the whole surface of the country, that supply the chief occupations of the people—those of herdsmen and shepherds. During the summer, the cattle are driven into the mountains, and tended by herdsmen, who take up their abode in the rude wooden huts known as *châlets*, and there the butter and cheese are made. In summer, it is estimated that there are in S. upwards of a million of horned cattle, one-fourth of which consists of milch cows. The produce of the dairy annually is valued at between one and two millions sterling. The best breeds of cattle are those of Saanen and Simmenthal in Bern, Gruyères in Freiburg, Schwyz, Zug, Entlebuch, Pralligau in the Grisons, and Glarus. The best cheese is made at Emmen, Saanen, Simmenthal, Gruyères, and Ursern. The sheep of S. are of inferior breed, and their wool is short and coarse; but the goats are numerous and fine. More than two-thirds of S. does not supply corn enough to feed its inhabitants. The plain, however, is a fertile agricultural country. In Vaud and Neufchatel, the cultivation of the vine is the chief occupation of the people; and in the Thur hill-country, more particularly on the shores of the Lake of Constance, there are extensive orchards, in which are prepared cider and *kirschwasser*, the latter being a liquor largely consumed in Switzerland. It will give some idea of the extent to which S. is cultivated to state, that out of every 100 sq. m. of surface, 30 are occupied by rocks, glaciers, and water; 20 by hill-pastures; 17 by forests; 11 by arable lands; 20 by meadows; and 1 by vineyards. In the uncultivated part of the country, the bear, the wolf, and the larger birds of prey are still met with; and the Chamois (q. v.) is hunted. The rivers and lakes abound with fine fish, and more especially with trout.

Manufactures.—The manufacturing districts are not scattered over the whole surface of the country; they are met with only on the northern frontier. The chief manufactures are: at Zürich, silk-stuffs, to the value of £1,600,000 annually, and cottons; at St. Gall and Appenzell, cottons; in Aargau and Glarus, cottons, linens, silks, and hosiery; at Basel, silk-stuffs to the value of £1,400,000, leather, paper, and tobacco; in Aargau and Lucerne, straw-plaiting; in Neufchatel, watch-making and cotton-printing; in Geneva, watch-making and jewelry. Although S. is inland, its commerce in proportion to population has long exceeded that of any other continental country. The chief imports are corn, salt, salt-fish, raw silks, and cotton, fruits and tropical produce, and the metals employed in watch-making. The exports are wood and charcoal, cattle, tallow, cheese and butter, silks and cottons, watches and jewelry. Internal communication has long been facilitated in S. by excellent roads, and every advantage has been taken of the lakes to introduce steam-navigation. The plain is now overspread from one end to the other with a network of railways, which in many directions send ramifications into the Alpine valleys, thus connecting closely all parts of the country.

Government.—Hitherto, the Swiss have been very much split into distinct communities by the great mountain-chains which separate the cantons. One of the results has been the weakness of the central power. Each valley has been entrusted with the making of its own laws, and the management of its own local affairs. The cantons are, in fact, to this day in a great measure separate states. They are divided into two classes, absolute democracies and representative democracies. In the former, the chief power belongs to the *Landesgemeinde*, an assembly of the whole adult male population, which meets once a year, to pass laws, and to regulate the taxes and expenditure of the canton. Url, the Unterwaldens, Appenzell, and Glarus have constitutions of this kind.

In the Grisons and the Valais, the people may be said to possess similar powers, as all measures must be approved of by them. In the other, the representative cantons, a great council is elected by the people, and to it are deputed most of the powers of the Landesgemeinde. These local assemblies produce a remarkable effect on the Swiss people. Their debates have an importance far beyond that of an English town-council, or even of a colonial parliament, for their power is infinitely greater, and the population are more immediately interested in them. To the interest they excite is no doubt to be attributed in a great degree the intelligence and public spirit of the Swiss. Their greatest disadvantage lay in the power they formerly had to levy war against each other, and to resist the general government in conducting the foreign policy of the country. But these defects have been to a great extent remedied by the constitution of 1848, which forms the basis of the present constitution, which dates from 1874. It handed over the control of the army, the conduct of foreign affairs, the settlement of disputes between the cantons, and the management of the police and post-office, to a federal assembly (*Bundes Versammlung*) representing all the cantons. How far this assembly is entitled to interfere with the legislative action of the cantons, has not been very distinctly defined, but the tendency of legislation since its formation has been rather to trench than otherwise on their prerogatives. The federal assembly consists of two chambers—1st, the State Council (*Stände Rath*); 2d, the National Council (*National Rath*). The former is composed of 44 members, 2 representing each canton; the latter, of 135 members, elected by the cantons in the proportion of 1 to 20,000 inhabitants. These bodies depute the executive authority to the federal council (*Bundes Rath*), consisting of seven members, and holding office for three years. The president is merely one of the council, and he has none of the quasi-royal privileges of the American president. There is also a court called the federal tribune (*Bundes Gericht*), which acts as a high court of appeal, and consists of 9 members elected by the federal assembly.

Different systems of law still prevail in the different cantons, which to some extent resemble each other, the most of them having grown out of the old German codes. Except in a few frontier cantons, the Roman law has not been much regarded. Until 1874, the law of the Catholic cantons prescribed, for certain offences, various degrees of corporal punishment, exposure on the pillory, and public penance in the churches; but in that year capital and corporal punishment was abolished throughout the confederation. In 1879 the cantonal governments were granted the right to restore capital punishment. In S., property is much subdived; of 485,000 heads of families, about 465,000 possess landed property.

There is no standing army in S., but every citizen is obliged to serve as a soldier, and military drill is taught at all the schools. The swiss regular force numbers 120,000; the reserve, 95,000. The imports from the surrounding countries, France, Germany, Austria, Italy, have an annual value of about 500,000 francs; while the exports to these countries amount in value to about 8,000,000 francs. The estimated national revenue amounted (1880) to 40,599,000 francs, and the expenditure to 40,782,000 francs.

Language and Religion.—In the sequestered valleys of the Grisons, two-thirds of the population still speak a Latin dialect known as the Romaunsh; Italian dialects have penetrated up the valleys of Ticino; French patois has invaded Western S., by the Rhine and the valleys of the Jura, to Laufen, the frontier of Soleure, Lake Morat, the Upper Saane, and Siders in the Valais. In the rest of S., the dialects are German. Of every 1000 Swiss, 702 speak German, 226 French, 55 Italian, and 17 Romaunsh. The Swiss Reformation spread chiefly from Basel, Bern, and Geneva, and the chief Protestant districts are the countries communicating with these towns. The Alpine region is almost entirely Roman Catholic, the seven Catholic cantons being Lucerne, Zug, Schwyz, Uri, Unterwalden, Valais, and Ticino. Out of 1000 Swiss, 411 are Roman Catholics, 587 Protestants, and 2 Jews.

Education.—In no country is elementary instruction more widely diffused. Parents are compelled to send their children to school or have them privately taught, from six to twelve. There are universities on the German model at Basel, Bern, and Zürich, and on the French plan a university at Geneva and academies at Lausanne and Neufchatel. The number of clubs for scientific and literary, musical and social purposes, is most remarkable. There are few scholarly pursuits which are not represented by societies in Switzerland. The local political assemblies and other public meetings give ample employment to the newspaper and periodical press. In S. there are 500 journals and reviews, 250 of which are political journals, and the remainder are devoted to literature and science. There are 40 daily papers. This active intellectual life is chiefly confined to the Protestant cantons.

History.—S. was in Roman times inhabited by two races—the Helvetii, supposed to have been Celts, on the north-west; and the Rhætians (of whose origin we know nothing), on the south-east. After the conquest of Gaul, both races adopted the language and habits of Rome. When the invasions took place, the Burgundians settled in Western S.: while the Alemanni, another Germanic tribe, took possession of the country east of the Aar. A third Teutonic people, the Goths, entered the country from Italy, and took possession of the country of the Rhætians, which nearly corresponded with the Grisons. The Burgundians adopted Christianity in the end of the 5th c.; the Helvetti retained their old pagan creed until the 7th c., when they were converted by Irish monks, who founded abbeys and churches, which survive to our own time. S., in the early part of the middle ages, formed part of the German Empire, and feudalism sprang up in the Swiss highlands even more vigorously than it did elsewhere. During the 11th and 12th centuries, the greater part of S. was ruled on behalf of the emperors by the lords of Zähringen (q. v.), who did much to check civil wars, and to promote the prosperity of the towns. They, however, became extinct in 1218, and then the country was distracted by wars, which broke out among the leading families. The great towns united in self-defence, and many of them obtained imperial charters. In 1273, Rudolf of Hapsburg, a Swiss nobleman who had favored the independence of the towns, became emperor. After doing so, he continued the same policy; but his son, Albert I. (q. v.), took another course. He attacked the great towns, and was defeated.

The leading men of the Forest Cantons, which for ages had yielded a merely nominal recognition of the empire, and had acknowledged no feudal superior, met on the Rütli meadow, on 7th November 1307, and resolved to expel the Austrian bailiffs or landvögte. See TELL. The war terminated in favor of the Swiss at Morgarten in 1315. Schwyz, Uri, and Unterwalden, with Lucerne, Zürich, Glarus, Zug, and Bern, eight cantons in all, in 1352, entered into a perpetual league, which was the foundation of the Swiss Confederation. Other wars with Austria followed, which terminated favorably for the confederates at Näfels (q. v.) and Sempach (q. v.). In 1415, the people of the cantons became the aggressors. They invaded Aargau and Thurgau, parts of the Austrian territory, and annexed them; three years later, they crossed the Alps, and annexed Ticino, and constituted all three subject states. The Swiss were next engaged in a struggle on the French frontier with Charles the Bold of Burgundy. They entered the field with 34,000 men, to oppose an army of 60,000, and yet they were successful, gaining the famous battles of Granson and Morat in 1476. In 1481, the towns of Freiburg and Soleure were admitted into the confederacy. In 1499, the Emperor Maximilian I. made a final attempt to bring S. once more within the bounds of the empire. He sought to draw men and supplies from the inhabitants for his Turkish war; but in vain. He was defeated in six desperate engagements. Basel and Schaffhausen (1501), and Appenzell (1513) were then received into the Confederation, and its true independence began. The abbacy of St. Gall, the cities of St. Gall, Mühlhausen, and Bienne became associated states, with a vote at the Diet. Geneva, Neufchatel, Valais, and the Grisons, also became associated states, but without a vote.

New troubles sprang up with the Reformation. Zwingli began to preach in the beginning of the century; and Zürich, in 1523, adopted his opinions, and was followed by Bern and other cantons of the north. The Forest Cantons remained attached to the Church of Rome. War broke out in 1531, between the Catholics and Protestants, and the former were successful at Cappel, where Zwingli was slain. This victory to some extent settled the boundaries of the two creeds in Eastern Switzerland. In 1536, however, Bern wrested the Pays de Vaud from the Dukes of Savoy, and annexed it to their own territory. In the same year, Calvin settled at Geneva, and the Reformed doctrines spread throughout Western Switzerland. During the Thirty Years' War, Bern, which had become, since the conquest of Vaud, the leading canton, and Zürich, contrived to maintain with great skill the neutrality of S.; and in the treaty of Westphalia, in 1648, it was acknowledged by the great powers as a separate and independent state. At this period, the Swiss, in immense numbers, were employed as soldiers in foreign service, and the record of their exploits gives ample evidence of their courage and hardihood. Internally, there was great stagnation. The constitution of the larger cantons became more aristocratic, that is to say, the mass of the people lost their power over the governing bodies. In Zürich, Schaffhausen, and Basel, the governing councils were elected by the corporations; and in Bern, Freiburg, Soleure, and Lucerne, a few families had acquired permanent rule. At the end of last century, there was widespread discontent with this state of matters; but the French Revolution broke out, and wars followed, which left no time for its manifestation. In 1798, S. was seized by the French. At the peace of 1815, its independence was again acknowledged. The new Confederation was divided into 22 cantons, each of which was represented in a Diet, which was appointed to hold its annual meetings alternately at Bern, Zürich, and Lucerne.

The old abuses which had crept into the constitutions of the cantons were revived, and representation in most of them became based on property qualifications. Officials, the aristocracy, and the clergy joined to oppose innovations, and succeeded in doing so until 1830, when the French revolution broke out. Armed demonstrations were made against the towns, and universal suffrage was generally conceded. Basel town, however, held out; but the difficulty was settled by the separation of the town and country districts—the former remaining conservative, the latter becoming democratic. Geneva and Neufchatal retained their old constitutions. The result of the changes was, however, that ⅘ds of the whole population were allowed to take part in public affairs. The consequences were not what had been expected by the liberals, who found that they had not yet the means of strengthening the central power. In 1839, at Zürich, where Dr. Strauss had been appointed a professor of theology, a mob of peasants, headed by the Protestant clergy, overturned the government. In Aargau, a struggle took place between the liberals and the Ultramontane party, which was settled, after long discussion, by an unsatisfactory compromise. In Valais, where universal suffrage had put power into the hands of the reactionary party, a war took place, in which the latter were victorious. They then ruled with a strong hand, and actually forbade the celebration of Protestant worship within the canton. In Lucerne, the headquarters of the Jesuits, the Ultramontane party acted even more extravagantly; they so persecuted their political opponents, that the latter were compelled to leave the canton. These measures caused the greatest discontent.

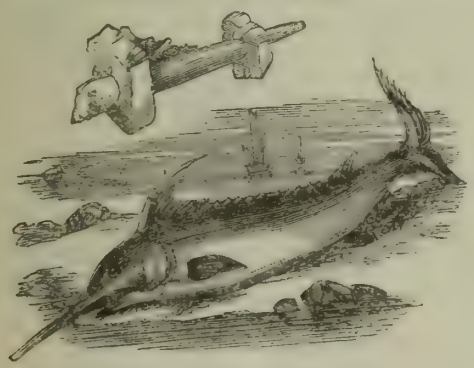
In 1844, a proposal was made in the Diet to expel the Jesuits; but that body declined to act. The radical party then determined to resort to force; they organized bodies of armed men, called the Free Corps, which invaded the Catholic cantons; but they were defeated. Changes favorable to them took place in some of the cantons. The Catholic cantons then formed a league, named the Sonderbund, for defence against the Free Corps. There was a general clamor for its suppression; but in the Diet, only 10½ votes were in favor of that measure. The ruling party in Geneva had been with the majority, and this conduct led to a revolution in that city. One vote was thus gained against the Sonderbund. St. Gall added another; and a majoriety in the Diet, in 1847, declared the illegality of the Sonderbund, and decreed the expulsion of the Jesuits. In the war which ensued between the federal army and the forces of the Sonderbund, the former were victorious at Freiburg and Lucerne. The leagued cantons were made liable in all the expenses of the war, the Jesuits were expelled, and the monasteries were suppressed. An attempt was made by diplomatic notes to intimidate the Swiss government, but the revolution of 1848 broke out, and prevented further interference. In the same year, the radical party, convinced of the necessity of a more powerful central government, carried the constitution of 1848. Subsequently, a rebellion took place against the king of Prussia, as Prince of Neufchatel. The canton was declared a republic, with a constitution similar to that of the other Swiss states. The king of Prussia protested in vain; but in 1857 he withdrew all opposition, and remained satisfied with the bare title of Prince of Neufchatel, which he still retains. The new federal constitution

adopted in 1874 confers greater power on the federal body at the expense of the several cantons.

SWI'VEL, is a gun constructed, as regards its carriage, to turn on a pivot, or on two concentric iron rails. Its use is on shipboard or in a fortress.

SWORD, a well-known weapon of war, the introduction of which dates beyond the ken of history. It may be defined as a blade of steel, having one or two edges, set in a hilt, and used with a motion of the whole arm. Damascus and Toledo blades have been brought to such perfection, that the point can be made to touch the hilt and to fly back to its former position. In last century, every gentleman wore a sword; now the use of the weapon is almost confined to purposes of war. In the British army, all officers and sergeants, with troopers of cavalry, wear swords for cutting and thrusting. In the navy, all officers wear similar swords; and the men, in time of action, heavy-backed swords, called *cutlasses*. In the French service, nearly all troops wear a combination of the sword with the bayonet, called a sword-bayonet.—For various sorts of swords and their uses, see RAPIER, CUTLASS, BROADSWORD, SCIMITAR, SABER, &c.; FENCING.

SWORD-FISH (*Xiphias*), a genus of fishes of the family *Scombridæ*, having the upper jaw remarkably elongated and compressed, in the form of a sword or dagger. The body is rather of a long shape, and covered with very small scales. There are no teeth. There is one long dorsal fin. The tail-fin is large and forked. There are two genera, *Xiphias*, destitute of ventral fins; and *Histiophhorus*, which possesses ventral fins. The common S. (*Xiphias gladius*) is plentiful in the Mediterranean, and in the warmer parts of the Atlantic; sometimes, but rarely, seen on the British coasts. It is bluish black above, and silvery white on the belly, the one color passing gradually into the other. It is highly esteemed as an article of food, especially when young. It is harpooned by the fishermen of the Mediterranean, and is powerful enough to drag a boat about for many hours after being struck. It has been said to attack the whale with its sword, but this is extremely improbable. Its food consists in great part of squids and cuttle-fish. The use of the sword is unknown. Instances not unfrequently occur of ships' bottoms being perforated by the sword of the S., but there is no good reason to think that an intentional attack is ever made.—Other species of S., belonging to genera closely allied to *Xiphias*, are found in the seas of different parts of the world.



Sword-fish (*Xiphias gladius*):
With section of a ship's timbers perforated by the 'sword.'

SY'BARIS, and CRO'TON or CROTONA, two celebrated Greek colonies in Magna Græcia (q. v.). The former—founded 720 B.C., by Achæans and Trœzenians—was situated in the south of the Lucanian territory, between the rivers Crathis (*Crati*) and Sybaris (*Coscili*), about 3 miles from the Tarentine Gulf; and the latter—founded 710 B.C., by Achæans—about 50 miles south-south-east on the coast of Bruttium. All that is certainly known concerning these cities before the destruction of the former is, that they both rapidly increased in size, wealth, and power, extending their dominions across the peninsula, and founding other colonies, at the same time preserving the most friendly terms with each other. S. is said to have been 6 miles in circumference, and Croton 12 miles; the former being notorious for the excessive and fastidious luxury of its inhabitants (hence the term Sybarite), and the Crotoniates celebrated for the perfection they reached in athletic exercises—the famous athlete, Milo (q. v.), having been a native of Croton. Somewhere between 540—530 B.C., Pythagoras (q. v.) settled at Croton, and exercised very considerable influence over the aristocratic government. About 510 B.C., a democratic leader, Telys, deposed the oligarchy of S., banished 500 of the leading citizens, and assumed the tyranny of the city. The banished citizens having taken refuge in Croton, Telys demanded their surrender, and on being refused, declared war against that city. The Sybarites, with an army said to have amounted to 300,000, met 100,000 Crotoniates, commanded by Milo, at the river Træis, were completely routed, and their city obliterated by the latter changing the course of the Crathis, so as to sweep it away. About 443 B.C., Thurii was founded near the sight of Sybaris. After the destruction of S., Croton appears to have gradually declined, suffering much from internal convulsions (see PYTHAGORAS), as well as from the disasters which befell it in its wars with the Locrians, Rhegians (480 B.C.), and Bruttians, and also in those of Dionysius (q. v.) of Syracuse and Pyrrhus (q. v.). Its ruin was completed in the second Punic war; and although, in 194 B.C., it was colonized by Roman citizens, it never again rose to be a place of any importance. Croton, in the time of Herodotus, and at a later period, was famous as a medical school.

The modern town of Cotroné, standing very near the site of the ancient town, has a population of 6878.

SY'CAMINE, a tree mentioned in Scripture, and supposed to be the Black Mulberry (q. v.).

SY'CAMORE, or SYCOMORE (*Sycomorus*), a genus of trees of the natural order *Moraceæ*, regarded by many botanists as a mere sub-genus of *Ficus* (see FIG), and differing from the true figs only in the elongated, straight, thickened, and club-shaped stigma.

Sycamore (*Acer pseudo-platanus*), showing leaves, flowers, and fruit.

The species are chiefly African, but the geographical range extends also into the west of Asia. Some of them attain a large size and a great age. The EGYPTIAN S. (*S. antiquorum*, or *Ficus sycamorus*), supposed to be the S. of the Bible, is a large tree, very abundant in Egypt and in some parts of the west of Asia, often planted near villages for the sake of its shade, its wide-spreading head sometimes covering a space 40 yards in diameter. The figs are top-shaped, and grow in clustered racemes on the trunk and oldest branches. They are sweet, well flavored, and somewhat aromatic. The wood is light, porous, and of little value. It has been supposed that the cases of Egyptian mummies are made of it, but this is disputed. Other species are found in Abyssinia, South Africa, &c.

The sycamore tree of Britain is a species of Maple (q. v.). In some parts of North America, the same name is given to the Plane (q. v.) of that country, *Platanus occidentalis*.

SY'DENHAM, a chapelry in the parish of Lewisham, county of Kent, with a station on the London and Croydon Railway, 8 miles south of London. It has become of world-wide celebrity in connection with the Crystal Palace, which was erected here in 1854, chiefly from the materials of the building of the Great Exhibition (1851). The cost of the erection and appointment of the Crystal Palace amounted to nearly £1,500,000. The building is 1600 feet long, 380 wide, and at the center transept 200 feet high. The chief arts and sciences illustrated by the collections within the Palace and grounds, are Sculpture, Architecture, Painting, and Photography, Mechanics and Manufactures, Botany, Ethnology, Palæontology, Geology, and Hydraulics. There are two concert-rooms, within the larger of which, performances have taken place at which there were 5000 vocalists and instrumentalists. The park and gardens occupy nearly 200 acres, and are adorned with sculptures, stone balustrades, &c., and fountains which are perhaps the finest in the world.

SYDENHAM, THOMAS, a great English physician, was born of good parentage, in 1624, at Winford Eagle, Dorsetshire, and was educated at Magdalen Hall, Oxford. According to the well-known French surgeon, Desault, he afterwards studied at Montpellier. He graduated at Oxford as Bachelor in Medicine in 1648. Through the interest of a near relative, he obtained a fellowship of All Souls College, and there continued to prosecute his

medical studies. He left the university without taking a Doctor's degree, which, indeed, he did not obtain till some time afterwards at Cambridge. He settled as a practitioner at Westminster, and practised so successfully that, when only 36 years of age, he already enjoyed the reputation of being one of the first physicians of the period. In his later years, he was much afflicted by gout, which at length carried him off on December 29, 1689. He was buried in St. James's Church.

S. was not profoundly accomplished as a man of science; even in his own age, deficient as it was in the advanced development to which the researches on which medicine is based have now attained, he was inferior to several of his contemporaries; but in sagacity of observation and accuracy of diagnosis he was unsurpassed. His skill and his philosophic cast of mind secured him the admiration and friendship of Locke; and his contributions to the literature of his profession received the praise of Haller and Boerhaave. His writings have been often republished both in England and on the continent, the edition entitled *Opera Medica*, which appeared at Geneva in 1716, being the best. Fevers were the department of medicine on which he first bestowed his attention; and before he had been many years in practice, he published, in 1666, his celebrated treatise entitled *Methodus Curandi Febres Propriis Observationibus Superstructa*. This was afterwards reprinted in 1675, with the observations accumulated in the interval. His treatment of the then destructive malady of smallpox was especially felicitous, substituting, as he did, for the stimulating regimen in vogue, the antiphlogistic method of cool air and salines. The most scholarly translation of his works into English is that of Dr. R. G. Latham, published in the Sydenham Society's series, to which he gives its name.

SY'DNEY, the capital of New South Wales, and the oldest city in Australia, is situated on the southern shores of Port Jackson, in lat. 32° 52′ S., long. 151° 11′ E. The first party of British settlers that reached New Holland were landed at Botany Bay on January 20, 1788. The spot which they here selected being found ineligible, it was abandoned a few days afterwards, and the infant settlement was transferred to a point about seven miles further to the north, to the place where S. now stands. The choice of the new locality was chiefly determined by the circumstance of a stream of fresh water being found there, flowing into the deep inlet known as Sydney Cove, one of the numberless bays into which the basin of Port Jackson is divided. This last-mentioned magnificent expanse of water, completely land-locked, and admitting vessels of the largest size, extends for some 20 miles inland, ramifying in every direction. Its bold and rocky shores present a succession of picturesque and beautiful landscapes. The cliffs which form the general outline of the harbor often rise to a height of from 200 to 250 feet. In other points, the coast presents a lower level, consisting of a series of terraces and smooth sandy beaches. Perhaps there are few positions on the habitable globe more obviously suitable for the foundation of a great metropolis. Situated at a distance of about 8 miles from the sea, the whole circumference of the bay round which it is built forms a series of natural wharfs, where vessels of 2000 tons burden can be moored within a distance of 20 yards. The narrow entrance of Port Jackson—through what is called the 'Heads'—might easily be made inaccessible to any hostile fleet; whilst the central position of S. makes it necessarily the permanent emporium of the greater number of the British dependencies in the southern hemisphere. The immense coal formation of East Australia extends north and south for some 500 miles, with a breadth of from 80 to 100 miles. S. stands nearly in the center of this great carboniferous basin; and at various points within a radius of from 30 to 100 miles, large quantities of coal are raised for colonial consumption as well as for export. The sandstone rock upon which the city is erected affords a valuable material for building.

Since the abolition of transportation, the growth of S. has been rapid, the pop. in 1862 amounting to 93,596, and in 1881 to 220,427, including the suburbs. For many years, S. enjoyed a monopoly of the commerce of these antipodean regions. It has now formidable rivals in Melbourne, Adelaide, and the settlements of Queensland. It must, however, continue the exclusive outlet for the productions and commerce of extensive pastoral and mineral districts on the north-west, west, and south-west. The eastern shore of Darling Harbor has its frontage entirely occupied with wharves and quays.

The streets in the older parts of the town are narrow and irregular: in the newer portions, care has been taken to avoid these defects; and several of the modern streets, from their breadth and the size and style of the buildings, are not behind those of the principal towns of Europe. The shops, warehouses, and private buildings in George and Pitt Streets present long and compact lines of well-built stone edifices, often assuming a very ornate and ambitious style of architecture. The chief thoroughfares are paved, and lighted with gas, and a system of underground drainage has been carried out at a cost of nearly half a million sterling. There is also an abundant supply of pure water, the source of which is a natural reservoir known as the Botany Swamps. There are numerous parks near the city. The Botanical Gardens, the finest in the colonies, cover 38 acres. S. has one shipbuilding establishment. The Fitzroy Dry Dock, originally intended for vessels of the Royal Navy, can take in vessels of the largest size. Lately, steps have been taken to put the city in a state of defence, and forts and batteries armed with powerful Armstrong guns have been erected. The *climate* of S. is, upon the whole, temperate and healthy.

Amongst public buildings, by far the most important edifice, not only in S., but in the whole of the Australian settlements, is the university, which stands on a commanding height, and in the center of a domain of about 150 acres. The principal façade is 500 feet in length, and is flanked at its western end by the Great Hall, the proportions of which are such that were it in England, it would rank as the third in point of size. Lectures are delivered daily during each term on classics, logic, history, chemistry, natural and experimental philosophy, and jurisprudence. The Museum contains a collection of Greek, Roman, and Egyptian antiquities presented by the former chancellor, Sir C. Nicholson. There are two suffragan colleges in connection with the university—that of St. Paul's, belonging to the Church of England; and St. John's, erected under the auspices of the Roman Catholic community. The university, erected out of public funds, has a permanent endowment of £5000 a year from the Civil List; and each of the suffragan colleges receives aid towards its building fund, and the stipend of the warden and rector. Eighteen free scholarships, of the annual value of £50 each, are established in the university, in addition to several others that have been founded by private benefactors. The university is incorporated under an act of the Colonial Legislature and by royal charter. It is only empowered, however, to confer degrees in arts, law, and medicine; and, so far as the university is concerned, instruction is limited to purely secular teaching. The religious training of the pupils is left to the affiliated colleges. The metropolitan cathedral of St. Andrew is a handsome building in the later perpendicular style of architecture. Many of the churches, upwards of 120 in number, belonging to different religious denominations, are tastefully designed.

Amongst the buildings devoted to secular purposes, the most imposing and effective, in point of size and architectural design, are the residence of the governor, the museum, the exchange, the custom-house, the town-hall, the new post-office, and the public grammar-school. The neighborhood of S., with every nook in the adjacent bays, is studded with elegant villas and snug cottages, surrounded by their park-like grounds, and gardens of orange-trees, bananas, and numberless semi-tropical plants unfamiliar to the English eye of the newly-arrived immigrant. There are numerous manufactories; one with 350 hands makes boots and shoes, and 32 make clothing, one steam joinery employs 250 hands. S. has three theaters, several mechanics' institutes, a large hospital for the sick, an orphan asylum, and other charitable and benevolent institutions. In 1878, 1242 vessels, of an aggregate tonnage of 712,303 tons, entered Port Jackson. In 1879, S. successfully carried out its International Exhibition on a large scale.

SYE'NE. See ASSOUAN.

SY'ENITE, a granitic rock found near the city of Syene, in Egypt. It is composed of quartz, felspar, and hornblende, and differs from true granite in having the mica replaced by hornblende. The felspar is generally red (sometimes it is found of a white color), and the hornblende gives a mottled red and dark green color to the rock.

SY'LLABUB, a culinary preparation, formerly much more used than at present. It consists of sugar and cream flavored with brandy, sherry, and lemon rind and juice, worked into a froth, and served up in that state in glasses.

SY'LLOGISM, a name expressing a principal branch or department of Logic. When we reason, or get at truth by means of inference, we are said to proceed either inductively (see INDUCTION) or deductively. Deductive reasoning, when fully and methodically expressed, takes the form called the syllogism. 'This thing will sink in water, for it is a stone,' is a deductive argument, but not fully stated; the complete form is: 'Stones sink in water; this is a stone; therefore this will sink in water'—which form is called a syllogism.

To a perfect syllogism it is necessary that there should be three, and no more than three, *propositions* (see PROPOSITION); these are the conclusion, or the matter to be proved, and two others that are the means of proving it, called the premises. It is also necessary that there should be three, and no more than three, *terms*, namely, the subject and the predicate of the conclusion, and one, called the middle term, which must occur in both premises, being the connecting link for bringing the two other terms together in the conclusion. The *predicate* of the conclusion is called the major term, because it is in its scope the largest of the three; the *subject*

of the conclusion is the minor term, as being the smallest in scope. The three terms enter into the premises in this manner: the major term and middle term make one premise, called the major premise; the middle term and the minor term make the minor premise. In the syllogism above stated, the terms are, 'a thing that will sink in water' (major), 'this thing' (minor), 'stone' (middle); the premises are, 'stones sink in water' (major), 'this thing is a stone' (minor); the conclusion is, 'this thing will sink in water.'

The form now given, although the regular and fundamental form to prove any affirmative conclusion, is not the only form that an argument may assume. The totality of syllogistic forms is divided into *figures*, and each figure into *moods*, which are the distinct syllogistic forms; the principal of division being as follows. The figure is determined by the position of the middle term; which may be the *subject* of the major premise, and the *predicate* of the minor (1st figure), the *predicate* in both (2d figure), the *subject* in both (3d figure), the *predicate* of the major and the *subject* of the minor (4th figure).

The word 'figure' is borrowed from rhetoric, where it means a departure from plain and ordinary speaking, as metaphor, hyperbole, &c. But, as remarked by Hamilton, only the last three of the foregoing enumeration should be called 'figures.' The first should be considered as embracing the regular forms of reasoning, and the others as properly figures—that is, forms more or less inverted, irregular, or unnatural, although still correctly representing reasonings that actually occur. These forms may be all *reduced* to forms in the 1st figure; their inversions or distortions being, as Hamilton would say, *redressed*, or restored to the primitive and fundamental type, namely, the syllogisms of the 1st figure.

The 4th figure did not belong to the original scheme of Aristotle, and it is usually considered as both unnatural and unnecessary, being only an awkward inversion of the first. There would then be the natural or standard syllogisms (the 1st fig.), and two sets of figurative departures from them (2d and 3d figs.).

The syllogisms of each figure are said to differ in *mood*, or according to the *quality* and the *quantity* of the propositions—that is, according as these are affirmative or negative (quality), universal or particular (quantity).

The entire scheme may be presented as follows: The symbols used are P (predicate of conclusion), major term; S (subject of conclusion), minor term; M, middle term. The general type of the first figure or standard is:

M is P.
S is M.
S is P.

When the quality and the quantity of the propositions are expressed, there arise four syllogisms of this form—two affirmative, and two negative:

All M are P.
All (or some) S are M.
All (or some) S are P. } *Barbara, Darii.*

All matter gravitates.
All (or some) air is matter.
All (or some) air gravitates.

No M is P.
All (or some) S is M.
No S is P; some S is not P. } *Celarent* and *Ferio.*

No matter is destructible.
All (or some) air is matter.
No air is destructible; some air is not destructible.

The general scheme of the *2d figure* is:

P is M.
S is M.
S is P.

There are four syllogisms in all, which we may take in pairs thus:

No P is M.
All (or some) S are M.
No S is P; some S are not P. } *Cesare* and *Festino.*

'No destructible thing is matter,' &c., as in the last form.

All P is M.
No S is M; some S is not M.
No S is P; some S is not P. } *Camestres* and *Baroko.*

In this figure, there is a certain distortion of the previous or regular figure. In the first of the two pairs, the major is, No P is M, instead of the equivalent 1st figure), No M is P. In the first form of the second pair, the minor is, No S is M, instead of the equivalent, No M is S, which should be the major to be regular; the amended premises would then give, in conclusion, No P is S, equal to No S is P.

All matter is extended.
No mind is extended.
No mind is matter. } *Camestres.*

The last form, with a particular conclusion, is exemplified thus:

All matter is extended.
Some things are not extended.
Some things are not matter.

This is a form technically called *Baroko*, which is one of two that are especially difficult to reduce to the standard forms.

This figure proves only negatives.

The scheme of premises in the *3d figure* is

M. P.
M. S.

Six varieties of syllogism come under this figure; we may arrange them in three pairs, the first two pairs having the same major, and the third the same minor:

All M is P.
All (or some) M is S.
Some S is P. } *Darapti* and *Datisi.*

All planets move.
All (or some) planets are heavenly bodies.
Some heavenly bodies move.

No M is P.
All (or some) M is S.
Some S is not P. } *Felapton* and *Ferison.*

No solid body is perfectly transparent.
All solid bodies gravitate.
Some gravitating things are not perfectly transparent.

Some M is P; some M is not P.
All M is S.
Some S is P; some S is not P. } *Disamis* and *Bokardo.*

The first of the two is merely a standard syllogism (Darii), with transposed premises; the second (Bokardo) is more complicated, as in the example:

Some men are not fit to rule.
But all men are liable to have dominion.
Some men, liable to have dominion, are not fit to rule.

In the *4th figure*,

P is M,
M is S,

there are five syllogisms. The mere forms are enough to quote.

All P are M.
All M are S.
Some S are P. } *Bramantip.*

All P are M.
No M is S.
No S is P. } *Camenes.*

Some P are M.
All M are S.
Some S are P. } *Dimaris.*

No P is M.
All M are S.
Some S are not P. } *Fesapo.*

No P is M.
Some M are S.
Some S are not P. } *Fresison.*

The reasons why these syllogisms are true, and why no other of 256 possible combinations of propositions can give true conclusions, are certain laws, called the rules of the syllogism, which repose on first principles of the highest certainty.

Mr. Mill has laid down the following fundamental axioms of the syllogism, as stated in its standard forms in the 1st figure. (1.) 'Attributes coinciding with the same attribute, coincide with one another.' M, the middle term, coincides with P, the predicate; S, the subject, coincides with M; therefore S and P coincide with one another. (2.) 'Any attribute incompatible with a second attribute, is incompatible with whatever that second attribute coincides with.' No M is P; M. is incompatible with P; but S coincides with M, and therefore it also is incompatible with P.

All the syllogisms of the last three figures are reducible to the first, by conversion of propositions and transposition of premises, according to the nature of the case. The symbolic name of each syllogism contains instruction for this process, as well as stating the composition of the syllogism. To aid the memory, these symbols are put together in five Latin hexameter verses of very ancient but unknown origin:

'Barbara, Celarent, Darii, Ferioque prioris.
Cesare, Camestres, Festino, Baroko, secundæ.
Tertia Darapti, Disamis, Datisi, Felapton,
Bokardo, Ferison habet, quarta insuper addit
Bramantip, Camenes, Dimaris, Fesapo, Fresison.'

The first line gives the standard figure, and states the propositions entering into each syllogism. The three A's in Barbara are three universal propositions. The E, A, E, in Celarent, are a universal negative, a universal affirmative, a universal negative; in Darii, A, I, I, a universal affirmative and two particular affirmatives, &c. In the other figures the commencing letter (C, B, &c.) shows which standard syllogism each is to be reduced to (Baroko to Barbara, Cesare to Celarent, &c.). The consonant *s* means simple conversion of the proposition marked by the preceding vowel; *p* means conversion by limitation, or *per accidens;* *m* signifies the transposition of the premises; *k* occurs in Baroko and Bokardo, and denotes that these are to be reduced by supposing the conclusion false, and then showing that on that supposition Barbara would be contradicted—from which it is inferred that the original form is true.

There are some species of deductive arguments that do not fall under the syllogistic figures. Thus, the major may state a conditional proposition, and the minor affirm the truth of the condition. 'If the witness is to be believed, the man is guilty' (major); now 'the witness is to be believed' (minor); therefore 'the man is guilty.' A true conclusion would also be obtained by a minor denying the consequent, 'the man is not guilty.' It would then follow that the witness (who affirms his guilt) is not to be believed. But no conclusion would follow from either denying the condition, 'the witness is not to be believed,' or affirming the consequent, 'the man is guilty;' for, in the first place, the man might be guilty whether this particular witness be credible or not; and secondly, the guilt of the man does not prove the credibility of the witness. This is called the *Conditional* Syllogism.

Again, the major may be what is called a Disjunctive or Alternative Proposition, from which also inferences may be drawn by supplying certain minors. 'This was done by either A or B;' now 'it was not done by A (or by B);' therefore 'it was done by B (or by A).' Should the major be understood to mean that it was done by one, and not by both, there would be two other possible inferences. 'It was done by A (or by B);' therefore 'it was not done by B (or by A).' There are other disjunctive pairs, as for example: 'Either A is B, or C is D;' now 'A is not B, therefore C is D,' &c. This is called the *Disjunctive* Syllogism.

A combination of the Conditional and the Disjunctive makes the *Dilemma*. For example:

> If A exist, then either B or C exists.
> Neither B nor C exists.
> Therefore A does not exist.

The following dilemma was given to refute the practice of torturing witnesses: 'A person able to endure pain will be likely to utter falsehood under torture; one unable will be equally likely; therefore, a person under torture will be likely to utter falsehood.'

A very great enlargement has been given to the doctrine of the syllogism, by Sir W. Hamilton (see QUANTIFICATION), Professor De Morgan, and the late Professor Boole of Cork. They have shown that many more syllogistic pairs can be created, and have invented symbols for the purpose. It is, however, comparatively few, either of the old pairs or of the new, that are assumed by the ordinarily occurring arguments, either in the sciences or in common affairs. By far the most useful part of the syllogism is contained within the limits of the 1st or standard figure, which shows what premises are to be looked out for to prove any conclusion: namely, some *general assertion* of matter of fact, affirmative or negative (major), and a *particular assertion* that a given thing comes under the subject of the general assertion (minor), and therefore falls likewise under its predicate. When an argument is stated in a puzzling or perplexed form, with perhaps the omission of one of its essential propositions, it is well to know how to supply the suppressed premises, and put the argument into regular order: the truth or fallacy of the reasoning then becomes evident at a glance.

SYLPHS, in the fantastic system of the Paracelsists, are the elemental spirits of the air, who like the other Elemental Spirits (q. v.), hold an intermediate place between immaterial and material beings. They eat, drink, speak, move about, beget children, and are subject to infirmities like men; but, on the other hand, they resemble spirits in being more nimble and swift in their motions, while their bodies are more diaphanous than those of the human race. They also surpass the latter in their knowledge, both of the present and the future, but have no soul; and when they die, nothing is left. In form they are ruder, taller, and stronger than men; but stand nearest to them of all the elemental spirits, in consequence of which they occasionally hold intercourse with human creatures, being especially fond of children, and of simple harmless people; they even marry with our race, like the Undines and the Gnomes, and the children of such a union have souls, and belong to the human race.

In common usage, the term sylph has a feminine signification, and is applied to a graceful maiden. How this curious change of meaning occurred, is not quite certain; but it is probably owing to the popularity of Pope's *Rape of the Lock*, which introduced the term into the world of fashion and literature. For although even in Pope, the sylph that guards Belinda is a *he*, yet the poet so refined and etherealized his spiritual agents, that they soon came to be associated with all our ideas of feminine grace and beauty; and this circumstance may have reacted on the popular idea—always loose and inaccurate—of their character and sex, and brought about the change of gender to which we have alluded. See Paracelsus's *Liber de Nymphis, Sylphis, Pygmæis et Salamandris et Cæteris Spiritibus* (Basel ed. of Paracelsus's works, 1590.)

SYLVESTER, the name of two popes, and of a third who was an anti-pope. The pontificate of the first immediately succeeded that of Melchiades in 314, and is memorable for the great council of Nicæa, in which the heresy of Arius was condemned. S. himself did not attend the council, but sent two priests—Vitus and Vincentius—to take his place. His name is also celebrated in connection with the so-called donation of Constantine to the Roman Church, the spuriousness of which (although no doubt had been raised regarding it during many centuries) has long been admitted by critics. He died in 335.—Sylvester II., one of the most learned of the medieval popes, originally called Gerbert, was born at Aurillac, in Auvergne, early in the 10th century. He was educated in the monastery of his native village; but went early to Spain, where he learned mathematics, and afterwards to Rome. He was appointed abbot of the monastery of Bobbio, where he taught with much distinction and success. At a later period he went to Germany as preceptor of the young Prince Otho, afterwards Otho II.; and ultimately became secretary to the Archbishop of Rheims, and director of the cathedral school, which became eminent under his care. The archbishop having been deposed, S. was elected to the archbishopric; but he was afterwards set aside, the deposition of his predecessor having been declared invalid. In the year 998, however, he was appointed Archbishop of Ravenna, whence he was called to the pontifical throne, in the following year, under the name of Sylvester II. He was a man of rare acquirements for his age. He was an adept in mathematics, and in practical mechanics and astronomy, in which department his attainments acquired for him among his contemporaries the evil reputation of a magician. He is also believed to have been acquainted with Greek, and perhaps with Arabic. Of all his works, which were numerous, his letters (printed by Du Chesne in the *Historians of France*) have attracted most notice from their bearing on the history of an obscure period.

SYLVESTER, JOSHUA, was born in 1563. His life was divided between the somewhat incongruous pursuits of merchandise and poetry, in neither of which did he achieve a distinct success. Of his original works, the human memory retains no trace; but in virtue of the great, though fleeting popularity obtained by his English version of the *Divine Weeks and Works* of Du Bartas, from which Milton is thought to have derived some hints, he lives in literary history as a sort of *nominis umbra*. He led a somewhat wandering life, and died at Middleburg, in Holland, in the year 1618.

SYLVI'ADÆ, a family of birds, of the order *Insessores*, and tribe *Dentirostres*, including a very great number of small species, among which are many of the birds most noted for sweetness of song, whilst something of this power is possessed by almost all the family, so that the name *Warblers* is often used as synonymous with Sylviadæ. The bill is sharp, slender, straight, and rather compressed towards the tip; the wings moderately long; the legs slender. To this family belong the Nightingale, the Blackcap, numerous species known by the name of Warbler, the Redbreast, Redstart, Wheatear, Whitethroat, Stonechat, Whinchat, Golden-crested Wren, Hedge-sparrow, &c. The S. are diffused over all parts of the globe; and some of those found in tropical countries possess considerable musical powers, but are generally as silent during the great heat of the day as during the darkness of night, and are chiefly to be heard early in the morning.

SYMBO'LIC BOOKS, in the language of the church, is a phrase that signifies the same as Creeds and Confessions (q. v.). The name is derived from the Greek *symbolon*, a sign or mark by which anything is known—a creed being the distinctive mark or watchword of a religious community.

SYME, JAMES, was born in 1799, in the county of Fife, and received a thorough education in art and medicine, in the University of Edinburgh. In his 19th year he began his anatomical studies under Liston, who appointed him his demonstrator. From 1825 to 1832, he lectured on Surgery in the Edinburgh school, and, while generously refusing to lecture in opposition to his old master in the Edinburgh Infirmary, he established a hospital at his own expense, where he delivered a clinical course for four years. In 1831, appeared his well known treatise on *The Excision of Diseased Joints;* and in 1832, his *Principles of Surgery*, which has since gone through many editions, and which has

established his reputation as a teacher of the first rank. In 1833, he was elected to the chair of Surgery in the university of Edinburgh, which he filled with the highest distinction. In 1847, he gave up his Edinburgh chair to fill that vacated in London by the death of Liston; but collegiate misunderstandings induced him, after six months, to return to Edinburgh. As an operator, Mr. S. had no superior; as a teacher, he had no equal. His innovations in the practice of his art were characterized by so much ingenuity, controlled by scientific caution, that they were adopted by all really great surgeons. The best of his pupils, who are numerous, and scattered over every quarter of the globe, have been heard to declare that their soundest ideas in surgery are derived from Syme. Besides the works already named, he was the author of valuable treatises on Diseases of the Rectum; on the Pathology and Practice of Surgery; on the Urethra and *Fistula in Perineo;* on Incised Wounds; &c. He died June 26, 1870. See the *Memoir* by Dr. Paterson (1874).

SY'MMACHUS, Q. AURELIUS, a distinguished Roman orator, scholar, and statesman, who flourished towards the close of the 4th c., was educated in Gaul, and after holding several lesser offices, became prefect of Rome (384 A.D.). Seven years later he was raised to the consulship. The date of his death is unknown, but we know that he was alive in 404 A.D. The character of S. is a very fine one. A sincere pagan in an age when classic paganism was almost extinct, he proved in his own person a pattern of its choicest virtues, and manfully, if in vain, strove to regain for it a place of honor in the state. S.'s extant writings consist of ten books of letters (*Epistolarum Libri X.*) and the fragments of nine orations. The former were published after his death by his son, and contain not a little that is valuable in relation to the history of the period; but the style is in general a slavish imitation of Livy. The best editions of the Epistolæ are those of Juretus (Par. 1604) and Scioppius (Mainz, 1608). The fragments of the orations were first discovered by Cardinal Mai in a palimpsest of the Ambrosian Library, and were first published at Milan in 1815; afterwards, with some additions, at Rome in 1823, in *Scriptorum Veterum Nova Collectio.* See Morin's *Etude sur la Vie et les Ecrits de Symmaque Préfet de Rome* (Par. 1847).

SY'MMETRY OF ORGANS. Throughout the animal kingdom, a symmetry of organs very generally prevails in the two sides of the body. This is the case in man and in all the *Vertebrata;* more perfectly, however, in the external than the internal organs, the two sides of the body presenting great diversities in the circulating, digestive, and other systems. Even the external organs, although similar on the two sides, are never perfectly so. On comparing the two hands, for example, the veins of the one will be seen to differ from those of the other. In *Mollusca*, the symmetry of the two sides sometimes exists, and is sometimes entirely lost, the one side remaining undeveloped in the growth of the animal. In the *Articulata*, the symmetry is in general as perfect as in the *Vertebrata*, and in the internal structure even more so. In the *Radiata*, the whole type is very different, and a very different kind of symmetry appears, not with reference to two sides, but to the rays into which the body divides.

In the vegetable kingdom, a symmetry is found, more or less perfect, but never completely so, between the two sides of leaves, fronds, &c. In flowers, a symmetry appears in the regular distribution of sepals, petals, stamens, &c., around the center of the flower; and even those flowers which least exhibit it when fully blown, as papilionaceous flowers, possess it in the early stages of the bud as perfectly as others.

SYMPATHE'TIC INK. See INK.

SY'MPATHY (Gr. *sympatheia*, fellow-feeling) may be defined as the assumption by different individuals, or by different parts of the same individual, of the same or an analogous physiological or pathological state at the same time or in rapid succession. The late Dr. Todd (art. 'Sympathy' in the *Cyclopædia of Anatomy and Physiology*) divides all the examples of sympathy which are included in the above definition into three classes; first, sympathies between different individuals; secondly, those which affect the mind, and, through it, the body; and, thirdly, those which are strictly organic, and therefore physical.

As examples of the *first class* may be mentioned the readiness with which the act of yawning is induced in a company, if a single person begins to yawn; the facility with which hysterical convulsions are induced in a female hospital ward by a single case; the fascination of its prey by the serpent, apparently by the power of the eyes; the similar power exerted by so-called electro-biologists and mesmerists, and by which some men can control even the fiercest carnivora. Of these sympathies the only explanation that can be given is that suggested in the article on ANIMAL MAGNETISM (q. v.).

As examples of the *second class*, the following cases may be adduced. Certain odors—as of strawberries, mutton, cats, and other most diverse objects—will induce fainting in some people; the smell of a savory dish will excite a flow of saliva in the mouth of a hungry person; and the excitement of the emotions of pity will produce a copious flow of tears. In these cases, an affection of the mind is a necessary link, but why that affection of the mind should produce its peculiar effect, is a question not easily answered; but it is plain that the portion of the nervous center which is affected in such cases, must have a direct influence upon the parts in which the sympathetic phenomena appear, through commissural (or connecting) fibres, or the continuity of its gray matter with that of the center from which its nerves immediately spring. Examples of the *third class* occur in the pain in the knee which arises from disease of the hip-joint; the pain in the right shoulder from disease of the liver; the pain over the brow on taking a draught of iced water into the stomach; the various spasmodic affections connected with intestinal irritation, or the irritation of teething; the vomiting that occurs on the passage of a biliary or renal calculus, &c. All these cases may be more or less satisfactorily explained by the known laws of the sensory and motor nerves. In some of these cases the explanation, however, cannot be regarded as altogether complete. For example, the pain over the brow from the ingestion of cold water or ice into the stomach, may be referred to irritation of the gastric branches of the pneumo-gastric nerves communicated in the medulla oblongata to the fifth nerve; but why the irritation should be confined to the frontal branch of the first (or ophthalmic) division of the fifth nerve, we are utterly unable to explain.

SY'MPHONY, in Music, a word used in two different senses: 1. The instrumental introduction and termination of a vocal composition, sometimes called *ritornello;* 2. A composition for a full orchestra, consisting of from three to six movements. It is for the orchestra what a Sonata (q. v.) is for a single instrument; but generally of greater length, and its movements more fully and richly developed, the subjects introduced being worked out in broader masses. The most usual though not unvarying order of movements is a brilliant allegro, ushered in by a slow introduction, an adagio or andante, a minuet with its trio, a short sportive movement called a scherzo, and a lively finale. The symphony is one of the highest of musical compositions, and one in which excellence is rare. Haydn, Mozart, Beethoven, and Mendelssohn are among the few successful composers of symphony; and the nine symphonies of Beethoven are generally acknowledged to be the greatest works of their class. The Overture (q. v.) is in form not unlike a symphony, but much shorter; but the terms symphony and overture were at one time used almost synonymously, and several of Haydn's early symphonies are called overtures. At the present day the overture in the composer's score of an Italian opera is called *Sinfonia*.

SY'MPHYTUM. See COMFREY.

SY'MPTOMS (Gr. *sympiptein*, to concur), in Medicine, are the morbid phenomena by which the physician becomes aware that derangements of some kind have taken place in the economy; but it requires a mental effort to convert these symptoms into signs of disease. A symptom thus converted into a sign of some special disease or disordered condition, tends to constitute the *diagnosis*, or recognition of the disease. 'The interpretation of symptoms,' as Dr. Aitken observes, 'can only be successful after a close observation of the patient—often prolonged and repeated for more complete investigation—so as to connect the results arrived at with his previous history. The utmost logical acumen is required for the due interpretation of symptoms. The individual value of each ought to be duly weighed; one symptom must be compared with another, and each with all, while the liability to variation of a similar symptom in different cases of a like kind must not be forgotten. Thus only can the nature of a disease be clearly determined, its severity and dangers fully appreciated, its treatment indicated, and the probability of recovery foretold.'—*The Science and Practice of Medicine*, 3d ed., vol. i., p. 9. Many writers, following the example of Laennec, confine the term *symptom* to the phenomena depending on vital properties; while those phenomena of disease which are more directly physical, they call *signs*. We thus have what may be called *physical signs* and *vital symptoms*. The form, size, color, firmness or softness, heat and odor of a part of the body, the sounds which it yields on percussion or discultation, &c., afford *physical signs;* while *vital symptoms* may be exemplified in pain, uneasiness, altered or impaired sensations, spasm, vomiting, the accelerated pulse and hot skin of fever, the state of the tongue and of the alvine and urinary excretions, &c. The term *semeiology* (literally, *the theory of signs*) has been given by medical writers to the general study of this subject, which is admirably discussed in Williams's *Principles of Medicine*.

SY'NAGOGUE (Gr. = *ecclesia;* Heb. *beth-hakke-neseth*, house of assembly), a Jewish place of worship. The origin of this institution is probably to be traced to the period of the Babylonian captivity, although tradition finds it in the patriarchal times. When, at the time of Ezra, and chiefly through Ezra's instrumentality, the ancient order of things was re-established in Judea, synagogues were established in all the towns for the benefit

of those who could not take part oftener than three times a year, or not even as often as that, in the worship of the temple at Jerusalem, and a special ritual of lectures and prayers was instituted. From the time of the Maccabees, we find them even in all the villages; and Josephus, Philo, the New Testament, the Mishna, and the Talmud, constantly allude to them. Common prayer and religious instruction were the purpose for which the people there met. The Sabbaths and feast-days were the principal times on which the faithful assembled in them; and they contributed more than anything else to the steadfast adherence of the people to their religion and liberty as long as there was any possibility of keeping both intact. At the same time, they gradually undermined the priestly and aristocratic element that gathered round the temple, its gorgeous worship and kingly revenues. Little is known of any special laws respecting the construction of these buildings, save that the faces of the worshipers should be directed towards Jerusalem (*misrach* = eastwards) (see MOSQUE); or that, in accordance with a verse in the Psalms, there should be a slight descent of a step or two on entering it, or that it should stand, if feasible, on a slightly elevated ground, or be somehow or other made visible far off.

Erected out of the common funds or free gifts of the community, it had also to be supported by taxes and donations. All profane doings were strictly prohibited in it. No eating, drinking, reckoning, and the like, were allowed; and even as to dress and other things of general decorum, the reverence due to the place was enforced as rigidly as possible. It represented in miniature the form of the temple, itself an enlarged type of the tabernacle. At the extreme eastern end was the *Aron hakkodesh*, the holy ark, containing several copies of the Pentateuch, from which the periodical readings were chanted. In front of this was the stand of the public reader of the prayers, not far from which was suspended the everlasting lamp (*ner tamid*). On a raised platform in the middle of the synagogue, was the place of the reader or preacher. The women sat separated from the men by a low partition five or six feet high. The affairs of the synagogue were administered by a board of 'ancients' or 'elders,' at whose head stood a chief or principal (*Rosh hakkeneseth=archisynagogos*). This college managed the inner affairs of the synagogue, and had even the power of excommunication. The officiating minister, whose office it was to recite the prayers aloud, was called *sheliach tzibbur*—messenger of the community (*angelos ecclesias*, Rev.). His qualifications, were, among others, to be active, to be father of a family, not to be rich or engaged in business, to possess a good voice, to be apt to teach, &c.

The beadle, or *chazzan*, had the general charge of the sacred place, and its books and implements. He had to present the scroll to the reader, and assist on other occasions. During the week-days, he had to teach the children of the town or village. He too had to be initiated by a solemn imposition of hands. This name of chazzan, however, at a later period, came to designate the officiating minister, and it has retained that meaning until this day. Almoners or deacons, who collected and distributed the alms, possibly the same as the *Batlanim* or 'idle men,' whose office in relation to the synagogue cannot be exactly determined now, but who had always to be ready for the purpose of making up the requisite number of *ten* worshipers, were further attached to the general body of officials. Respecting the prayers used, we have spoken under LITURGY (JEWISH). As to the time of daily worship, we may observe that the third, sixth, and ninth hours of the day were the times appointed for it, and the more special days were the Monday and Thursday, when the judges sat, and the villagers came to town; and the Saturday, on which the forms of some of the prayers were altered according to the occasion.

On the connection between the Jewish synagogue and the Christian church, and their respective rites and modes of worship, we cannot here enlarge. Thus much, however, we may say, that it is obvious to the most superficial observation that the principal practices of the latter belong, with certain modifications, to the former; and it has been conjectured that even the melodies of certain hymns still sung in the Roman churches are to be traced to the temple and the synagogues. It is, moreover, well known that the early Christian churches were entirely organized after the pattern of the synagogues. As to the judicial power exercised by the officers of the synagogue, we refer to SANHEDRIM. They had, there can hardly be a doubt, a kind of authority with regard to religious transgressions; but how far they were allowed to carry this authority, is not so easily determined. Modern synagogues differ but in some minor points—additional prayers and the like—from what we gather to have been the nature of those at the time of Christ, save that there are no more elders, but a simple board elected from the community, without any authority beyond that of, perhaps, a board of churchwardens, and that the chazzan, as we said, has now the functions of the 'sheliach.' See JEWS, JEWISH SECTS, LITURGY (JEWISH), &c. The languages used in the early synagogues of Palestine and Alexandria, were Hebrew, Aramaic, and Greek respectively.

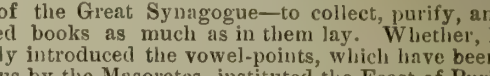
SY'NAGOGUE, THE GREAT (*keneseth haggedolah*), an assembly or synod, supposed to have been founded and presided over by Ezra, consisting of 120 men, said to have been engaged in remodelling the national and religious institutions of the Jews after the return from Babylon. The palpable chronological discrepancies that occur in the early accounts about this synod, together with other doubtful points, have led modern scholars to deny its existence completely. But the fact of Josephus not mentioning it avails very little against the positive assertions of the Talmud, and what is still more important, of the Karaites, the professed adversaries of all tradition. True, Ezra, the contemporary of Artaxerxes, can never have taken his place in it together with Zerubbabel and Joshua, who left Babylon under Cyrus, or with Simeon the Just, who lived at the time of Alexander the Great. These, however, are but apparent anachronisms. The tradition never meant anything else than that the institution founded by Ezra, and which lasted up to the time of Alexander, comprised 120 men, of whom Simeon was one of the last. Anyhow, there is absolutely no reason to doubt that Ezra and Nehemiah did a certain amount of work which they could not have done without being assisted by eminent collaborators. It was this body to which certain vital ameliorations in the administration of justice are ascribed.

They developed public instruction, and fixed and enlarged the Mosaic laws by certain rules of interpretation. 'Be circumspect in judgment; make many disciples; and erect a fence around the law;' are some of the principal sayings ascribed to them. Above all, it seems to have been the office of Erza and his coadjutors—the men of the Great Synagogue—to collect, purify, and redact the sacred books as much as in them lay. Whether, however, they really introduced the vowel-points, which have been handed down to us by the Masoretes, instituted the Feast of Purim, sanctioned the Eighteen Benedictions (see LITURGY, JEWISH), &c., is more than doubtful. They certainly disappeared before the Sanhedrim (q. v.) were instituted, but it may be that their legislative functions were no longer needed at that advanced period.

SYNA'NTHERÆ. See COMPOSITÆ.

SYNCLI'NAL AXIS is the line of curve in the trough of a series of beds from which the strata rise on either side. The ridge-curve is called the anteclinal axis.

SYNCOPA'TION, in Music. Notes which begin on the unaccented part of a measure, and end on the accented, are called syncopated or driving notes. Their effect is to invert the rhythm, and lay an emphasis on the usually unaccented part of the measure, e. g.:



SY'NCOPÉ. See FAINTING.

SY'NDIC (Gr. *syn*, with, and *diké*, justice), a name which has at different times and in different countries been given to various municipal and other officers. In Geneva, the chief magistrate was formerly called the syndic. The syndics of cities in France, under the old régime, were officers delegated by the municipality as agents or mandatories; the various trading companies in Paris and the university had also their syndics; and in the university of Cambridge the same name is applied to members of special committees of members of the senate, appointed by grace from time to time for specific duties. See UNIVERSITY.

SYNE'CDOCHÉ (Gr. literally an 'understanding one thing with another') is a term in rhetoric denoting that mode of expression by which a part is put for the whole, and *vice versâ*; as e. g., a door for a house, a sword for any weapon of war.

SYNE'RGISM (Gr. *synergeo*, to work together with), the name given to a doctrine of theology which teaches that in the work of conversion, the will of man is not wholly passive, but can co-operate, through consent, with the Divine Spirit. About 1557, the question was hotly discussed by the Protestant theologians, Pfeffinger, Flacius, and Strigel, and soon the whole theological world was wrangling over the point. The Wittenberg divines were in favor of, the Mansfield divines against, synergism. Finally, the *Concordien formel*, in its third article, condemned it.

SYNGE'NESIA. See COMPOSITÆ.

SYNGNA'THIDÆ. See PIPE-FISH.

SY'NOD (Gr. and Lat., an assemby) in general signifies a meeting, but it is almost exclusively applied to ecclesiastical assemblies for the purpose of deliberating on doctrinal or disciplinary subjects. In church law, several kinds of synods—called also Councils (q. v.)—are enumerated: (1) ecumenical or general, of the entire church; (2) national—that is, of the church of an entire nation; (3) provincial—that is, of a province; (4) diocesan, or of a single diocese. Of these, the ecumenical council has been

already described. Of the others, little explanation is needed beyond what is conveyed in the names themselves. By the law of the Roman Catholic Church, the decrees of a national or provincial synod must be submitted to the pope, and unless confirmed by him, or at least suffered to pass for two years without condemnation, are not held to have force. The diocesan synod is convened by the bishop, and consists of the members of the chapter, the beneficed clergy having the permanent care of souls, and the heads of the communities of regular clergy. Synods of the English Church are only held by the authority of the crown. A Presbyterian synod consists of only the ministers and elders within the particular district, generally one elder for each congregation. It is subordinate, however, to the General Assembly, when there is a General Assembly.

SYNO'DIC, the epithet applied to the period which elapses between a planet's appearance at one of the nodes of its orbit, and its return to the same node. See NODES and MONTH.

SY'NONYM. When any one of the several words will serve to name or express the same thing, that thing is said to be *polyonymous*, or many named, and the words are called *synonyms* (Gr. names together, or in company). In this wide sense, *man, soldier, general, Frenchman*, might be called synonyms, as they can all be applied to denote the same individual—e. g., Napoleon. See NOUN. But the term is commonly applied in a restricted sense to words having substantially the same meaning, with only slight shades of difference—as *observe* and *remark*. In a settled and matured language, no two words can have exactly the same meaning; in such a case, one of them would be superfluous, and would be silently dropped. Words that were originally identical in application, have become differentiated by usage, each being appropriated to a special variety of the general notion.

The English language abounds in pairs of synonyms like *sharp* and *acute*, of which the one is Anglo-Saxon, the other borrowed from the Latin. It would be difficult to find a case of more exact correspondence of sense than *acutus* in Latin, and *sharp* (Ger. *scharf*) in Teutonic; but *acute* in English has become confined to the metaphorical sense of sharpness of the intellect or of the senses, the only case of its retaining the primary, physical signification being in the technical phrase, an 'acute angle.' *Sharp*, again, is applied both in the physical sense and also in the metaphorical; but metaphorical *sharpness* is not exactly the same thing as *acuteness*. A 'sharp' lad is one quick in apprehension and movement; an 'acute' intellect is one having great power of penetration and discrimination; while in a lawyer of 'sharp' practice, a reprehensible moral quality is implied.

SYNO'VIAL MEMBRANES AND FLUID. In every joint in which a considerable range of motion is required, the osseous segments (or contiguous extremities of bones) are separated by a space, which is called the cavity of the joint. The end of each of the bones entering into the composition of the joint is incrusted by a layer of articular cartilage adapted to its form, and the entire cavity of the joint is lined by a delicate membrane, which is termed the *synovial membrane*, which secretes a peculiar viscid matter, termed *synovia*, or *synovial fluid*, for the purpose of lubricating the inner surface. In its microscopical characters, a synovial membrane so closely resembles a serous membrane, that we shall content ourselves with referring the reader to the article on the latter structures. There are, however, certain points of difference, which are fully described in the article 'Serous and Synovial Membranes' in *The Cyclopædia of Anatomy and Physiology*. Like a serous membrane, a synovial membrane is always a closed bag, like the pleuræ, for example, with an attached and a free surface, the latter being smooth and moist. A very simple form of synovial membrane—anatomically known as a *bursa*—is employed to facilitate the gliding of a tendon of a muscle or of the integument over a projection of bone. It consists of a bag connected by areolar tissue with the neighboring parts, and secreting a fluid in its interior. These bags are sometimes prolonged into *synovial sheaths*, which surround long tendons, such as those of the flexor and extensor muscles of the fingers and toes. In deep-seated Whitlow (q. v.), when inflammation extends to one of the sheaths, and gives rise to the formation of adhesions, the motion of the enclosed tendon is destroyed, and a permanently stiff finger is the result.

The *synovial fluid*, or *synovia*, derives its name from its resemblance to the white of an egg (Gr. *syn*, with, and *oön*, an egg). It consists of water, holding in solution mucin, albumen, extractive matters, fat, and inorganic salts. The analyses of Frerichs show that the composition and quality of the synovia vary essentially according as an animal is at rest or leads a wandering life.

SY'NTAX (Gr. *taxis*, arrangement, *syn*, together) is the part of grammar that teaches the putting together of words for the expressing of thoughts; in other words, it treats of the construction of sentences. The first step is the analysis of sentences—the study of their anatomy and physiology, as it were (see SENTENCE). This important part of the subject is too often altogether overlooked. A clear perception of the mutual relations of the several members of a sentence makes the usual rules of syntax appear self-evident truths, and in most cases superfluous. Most of these rules fall under the heads of (1) Concord and Government, and (2) Order of Words, or Collocation. For details, we must refer to special works on the subject.

SY'NTHESIS (Gr. *synthesis*, making a whole out of parts) is a term employed in chemistry to designate the building up of a more or less complicated product from its elementary constituents. As the synthesis of inorganic compounds is usually very simple, we shall confine our remarks to organic compounds. To take a very common substance as an illustration, there is no difficulty in resolving sugar into its ultimate elements, or, in other words, in ascertaining its composition by analysis. If we heat a little sugar to redness in a glass tube, it leaves a black deposit, which is carbon, while a liquid, which is water, distils over; and on electrolyzing this liquid, we resolve it into hydrogen and oxygen; so that we can thus show that sugar is composed of the ultimate elements, carbon, hydrogen, and oxygen. An analysis of this kind shows that sugar may be represented by the formula $C_{12}H_{11}O_{11}$, and that one atom, or any given weight of it, contains 72 atoms or parts by weight of carbon, 11 of hydrogen, and 88 of oxygen. This pulling to pieces of the sugar is an easy matter, and has been known to chemists for more than half a century; but the putting together of the pieces, or, in other words, the synthesis of sugar, is a very much more difficult task.

We may bring together carbon, hydrogen, and oxygen in the due proportions, and, to use the words of Professor Wanklyn (in a lecture delivered at the Royal Institution, February 12, 1864), 'we may shake them all together, or heat them, or cool them, and yet we shall never get them to combine so as to form sugar. Alcohol consists of 24 parts of carbon, 6 parts of hydrogen, and 16 parts of oxygen; but no alcohol ever results from making such a mixture. Neither sugar nor alcohol can exist at the temperature to which it is requisite to raise our mixture of carbon, hydrogen, and oxygen, in order to get chemical action to set in. At ordinary temperatures, the organic elements will not enter into combination, whilst at high temperatures they combine, it is true, but yield comparatively very few compounds.' There was a general belief that organic products, such as sugar, alcohol, urea, oxalic acid, taurine, leucine, &c., required for their production a mysterious so-called *vital force*, totally distinct from the ordinary forces acting on matter. The first blow to this now obsolete doctrine was struck by Wöhler in 1828, when he discovered that the organic base *urea* might be artificially obtained. See ORGANIC COMPOUNDS. Three years afterwards, Pelouze obtained *formic acid* from inorganic materials. In 1845, Kolbe, by a somewhat complicated process, effected the synthesis of *acetic acid*, and consequently, indirectly, of its derivatives, amongst which may be enumerated *acetone*, the product of the destructive distillation of acetates; *marsh gas*, obtained by distilling an acetate with a caustic alkali, and *ethylene;* and the electrolysis of acetic acid, which Kolbe accomplished a few years afterwards, yielded methyl and oxide of methyl, which latter could be transformed into any other methylic compound.

During the last twelve years, new and simpler methods have been suggested by various chemists, amongst whom Berthelot must be especially mentioned, and enormous additions have been made to the list of so-called organic compounds which have been synthetically constructed. We shall give a description of the mode of producing alcohol synthetically, and shall then show that from it, as a starting-point, an immense number of other organic compounds can be synthetically produced. To obtain this product synthetically, several distinct steps are necessary. The first is the formation of a transparent colorless gas, acetylene, C_4H_2, from carbon and hydrogen in the electric arc; by passing this gas through sub-chloride of copper, acetylide of copper is produced, which, in contact with nascent hydrogen, gives olefiant gas, C_4H_4; agitated with sulphuric acid, olefiant gas produces sulphovinic acid, $C_4H_5O,2SO_3,HO$ (a discovery due to our own chemists, Faraday and Hennell, in 1820). On distilling this acid diluted with water, dilute alcohol comes over, which, on redistillation, in contact with quick-lime, yields pure *vinic or ordinary alcohol*, $C_4H_6O_2$. Having thus obtained ordinary alcohol from inorganic materials only, we may employ it to form by synthesis an immense number of other organic compounds. By means of what is known as 'the process of Mendius,' we can, as it were, step from one alcohol to the next above it. Thus, from vinic alcohol ($C_4H_6O_2$) we obtain *propylic* (or *tritylic*) *alcohol* ($C_6H_8O_2$); from this we obtain *butylic* (or *tetrylic*) *alcohol* ($C_8H_{10}O_2$); from this, *amylic alcohol* ($C_{10}H_{12}O_2$), and so on.

From the propylic alcohol thus obtained, we get by oxidation *propionic acid*, from which *lactic acid*, the acid of sour-milk, may be obtained; similarly, butylic alcohol yields butyric acid, every alcohol, in short, yielding a corresponding fatty acid by oxidation. *Glycerine*, the base of the fats, may also be obtained by a

somewhat circuitous process. By combining glycerine with propionic acid, and with the other fatty acids which may be synthetically formed, we obtain several oils and fats similar to those which occur as natural products. The case of *taurine*, $C_4H_7NS_2O_6$, is even more striking; it is a product of various glandular metamorphoses, but its chief source is the bile, where it exists in conjugation with cholic acid as tauro-cholic acid. This highly complex substance can readily be formed in the laboratory from sulphuric acid, alcohol, and ammonia, each of which is capable of being built up from its constituent elements.

Sugar has been obtained by Berthelot from glycerine, a substance which is obtainable by purely inorganic means; but as he effected the conversion of the glycerine into sugar by the action of putrefying animal tissue, we can hardly regard the sugar thus formed as being of purely inorganic origin, although the animal tissue only acted catalytically, or as a ferment, and did not contribute any actual material to its formation.

There is, however, no doubt that an unexceptional means of producing this important alimentary substance will soon be devised, since bodies strictly allied to sugar have been already obtained.* Another artificial compound of great interest in an industrial point of view, is *toluol*, $C_{14}H_8$, which has recently been obtained from phenele, which can itself be produced synthetically from alcohol. 'Starting,' says Dr. Odling, 'from these two bodies, we may procure all the so-called coal-tar colors, with the brilliancy and variety of which most of us are now familiar. The red base or rosaniline, $C_{40}H_{19}N_3$, the violet base or triethylrosaniline, $C_{62}H_{31}N_3$, and the blue base or triphenylrosaniline, $C_{76}H_{31}N_3$, being producible in this way from their constituent elements, furnish admirable illustrations of the constructive powers of modern organic chemistry.'

We cannot conclude without adverting briefly to the possibility of economically replacing natural processes by artificial ones in the formation of organic compounds. On this subject, one of our most distinguished organic chemists, Dr. Frankland, observes, that 'at present, the possibility of doing this only attains to probability in the case of rare and exceptional products of animal and vegetable life. By no processes at present known, could we produce sugar, glycerine, or alcohol from their elements at one hundred times their present cost, as obtained through the agency of vitality. But although our present prospects of rivaling vital processes in the economic production of staple organic compounds, such as those constituting the food of man, are exceedingly slight, yet it would be rash to pronounce their ultimate realization impossible. A brilliant triumph of chemical synthesis is the successful production of common indigo from phenylacetic acid, at small cost. The method was announced by its inventor, Prof. Baeyer of Munich, in 1878. (See article in *Nature*, 1878.)

See Berthelot's *Chimie Organique fondée sur la Synthèse* (1860) and his lectures on the *Leçons de Chimie professées en* 1860 *et* 1862; to various lectures by Wanklyn, Frankland, and others, delivered at the Royal Institution; to Odling's lectures *On Animal Chemistry* (1865); and to recent works on organic chemistry, such as the new edition by Armstrong and Groves of Miller's *Elements* (1880), and vol. iii. of Roscoe and Schorlemmer's *Treatise on Chemistry* (1881).

SY'NTONIN, or MUSCLE FIBRIN (Gr. *synteinein*, to render tense), contains in 100 parts: carbon, 54·06; hydrogen, 7·28; nitrogen, 16·05; oxygen, 21·50; and sulphur, 1·11. It is the principal constituent and the essential basis of all the contractile tissues. It may be obtained from muscular fibrin in the form of a coherent, elastic, snow-white mass; but whether it exists in the living body in a solid form or in solution, is undecided. Many recent physiological writers hold the latter view, and maintain that the phenomenon of cadaveric rigidity (*rigor mortis*) is due to its spontaneously coagulating after death.

SY'PHILIS is, according to Dr. Farr's system of nosological classification, to be regarded as belonging to the enthetic order of zymotic diseases (see NOSOLOGY and ZYMOTIC DISEASES.) These diseases have the common property of being developed in the system after the introduction by inoculation or implantation of specific poisons. The poisons which produce diseases of this order may be introduced through any abraded cutaneous surface, or through mucous membranes, especially if any solution of continuity occurs. A morbid poison thus introduced into the system produces a specific effect both on the tissue at the place of insertion and on the blood, as soon as the poison begins to become absorbed; or, in other words, it produces both a constitutional and a local change. The absorbed virus seems to undergo the following changes in the living and infected body—viz. (1) Increase, (2) Transformation, and (3) Separation or Excretion.

Taking our illustrations from the disease to which this article is specially devoted, the *increase* is shown by the fact, that the pus from a single syphilitic sore may by inoculation be made to spread the disease a thousand-fold. The *transformation* is indicated by the successive phenomena which supervene during the course of the disease. For example, syphilis is followed, as we shall presently show, by a series of secondary and tertiary phenomena, which follow a tolerably uniform course in different patients. The *separation* or *excretion* of the poison may be accomplished in several ways. While in some of the more intense poisons—such as those of certain serpents—the whole mass of the blood seems rapidly affected, in others, as syphilis, 'a double process of the zymotic-like action seems to take place before the full effects which the poison is capable of producing are completed. The multiplication of the venereal poison, and its effects upon the system, seem to become developed during the existence of the hardening process which surrounds the infecting venereal sore. This is the first zymotic-like process, and is attended with a local papule, and perhaps an ulcer. From this local sore the system becomes contaminated, and in the blood a second process (of zymosis?) appears to be completed, by which the original poison becomes intensified, its pernicious influence more complete, and its specific, secondary, and tertiary effects are more fully developed.'—Aitken's *Science and Practice of Medicine*, 3d ed., vol. i. p. 666.

From this brief sketch of the nature of enthetic diseases, we turn to the consideration of the special disorder known as *syphilis*—a word whose origin is unknown. The terrible ravages of this disease amongst our soldiers and sailors, to say nothing of the fearful misery which it occasions in private life, afford more than sufficient apology for our introducing into these pages some of the most important details regarding this repulsive form of disease* It is almost unnecessary to observe that syphilis is a contagious disease usually propagated by impure sexual intercourse. The following is a brief history of the course of the disease, if its progress is not checked by proper remedial agents.

At an uncertain period, varying from three to ten days, after exposure to the infection, one or more venereal ulcers (commonly known as *chancres*) appear upon the generative organs. These ulcers present many varieties, which have been variously classified. The following arrangement, by Mr. Henry Lee, Surgeon to the Lock Hospital, is an eminently practical one—viz. (1) The Hunterian or indurated or infecting chancre; (2) The non-indurated or suppurative chancre; (3) The ulcerative chancre; and (4) The sloughing chancre. These local affections are so different in their characters, and in their action on the constitution, that each must have a brief separate notice. (1) The *indurated*, or, as it is frequently termed, the *Hunterian chancre*, from its having been first accurately described by John Hunter, is the only one of these local affections that can be associated with constitutional syphilis. Its natural course is thus described by Mr. Lee. 'At an uncertain period, but generally from three to four days after exposure to infection, attention may be drawn to the part by a slight itching. On examination, a red spot, surrounded by a little induration, will perhaps present itself, or a vesicle about the size of a millet-seed will not unfrequently form upon the infected part. The cuticle covering this vesicle is so thin that it usually gives way at a very early period; and this commonly happens before the disease has been carefully examined. The base of the vesicle then becomes indurated, and the induration (whether preceded or accompanied by a pimple or a vesicle, or independent of either of these) assumes a circular form, extending equally in every direction, and terminating quite abruptly in apparently healthy parts. A sore generally follows; this is excavated, without granulations, sometimes glazed, at other times having some adhesive matter on its surface.

'The color of the chancre will depend often upon the amount and character of the substance which adheres to it, and will frequently present a fawn hue, or different shades of brown and red. When this adventitious matter is removed, the sore will usually again assume its original smooth and red glazed appearance.'—'Syphilis' in Holmes's *System of Surgery*, vol. i. p. 400. This variety of sore frequently gives rise to a chronic enlargement of one of the glands of the groin (forming what is termed a *bubo*),

* Carius, a trustworthy chemist, announced some years ago that he had succeeded in forming *Phenose*, a kind of sugar, and possessing all its chemical characteristics, from benzol.—*Ann. d. Chem. u. Pharm.*, Dec. 1865.

* Dr. Aitken observes that 'no statistical nosology gives any idea of the number of men lost to the public service from syphilis. The loss of strength from venereal diseases alone (gonorrhœa being included with syphilis in this term, and forming about 40 per cent. of the cases) is equal to the loss of more than eight days annually of every soldier in the service.' Dr. Balfour in his *Medical, Sanitary, and Statistical Report of the Army Medical Department* for 1860, relates that 'more than one-third of all the admissions into hospital have been on account of venereal diseases (369 per 1000), and the average number constantly in hospital is equal to 23·69 per 1000 of strength (2315 men), each remaining in hospital on an average 23¼ days. Thus the inefficiency is constantly equal to about 2¼ regiments.' In 1861, these diseases caused a loss equal to 8·69 days for every soldier serving at home, there being a daily inefficiency of 2077 men; and the numbers are nearly the same for the succeeding years. The daily loss of service in the navy, in 1862, was about that of 586 men per day. How far these data apply to our civil population, it is hard to say; but it is much to be feared they apply pretty closely. 'It is a question,' says Dr. Parkes, 'whether a large majority of the young men of the upper and middle class does not suffer in youth from some form of venereal disease. In the lower classes, it is perhaps equally common.'—*Practical Hygiene*, p. 453. For a comparison between the amount of venereal disease in our own and other armies, the reader may consult the same work, pp. 502, 503.

which does not involve the skin or the cellular membrane. It is followed by certain constitutional symptoms known as *secondary symptoms*, and requires, both in its primary and secondary forms, mercurial treatment. (2) The *suppurating chancre* usually begins as an abrasion, which, when fully developed, often presents the same appearance as if a piece of skin had been removed by a circular punch. The sore is covered with ill-formed granulations, and extending equally in all directions, maintains its circular form. After continuing three or four weeks, it generally heals, without leaving the hardness which is so characteristic of the Hunterian, infecting or indurated sore. Another important diagnostic difference is furnished by the microscopico-chemical examination of the fluid secreted by the sore. In this suppurating sore, the secretion consists of pus, which, on the addition of acetic acid, exhibits the characteristic compound nuclei; while in the infecting sore the secretion resembles turbid serum, presenting none of the characters of the pus. It does not give rise to bubo, nor is it followed by secondary symptoms.

(3) The *ulcerative chancre* is a ragged worm-eaten ulceration; secreting an ill-formed pus, and presenting an irritable surface. Soon after the appearance of this sore, one of the glands of the groin will become enlarged and painful. This may be preceded by a shivering fit, more or less marked. The enlarged gland or bubo becomes very tender to pressure, and as the swelling increases, the skin becomes red, especially at the center, and the general symptoms of suppuration present themselves. Great relief is afforded by the discharge of the pus. It is never followed by secondary symptoms, and, like the preceding form, requires only local treatment. (4) The *sloughing chancre* is fortunately rare in this country, but in many foreign ports, in warm and hot countries, this form of syphilis commits great ravages amongst our sailors, who have given to it certain characteristic names, such as the *black-pox*, the *black lion*, &c. It does not affect the inguinal glands, and is not followed by constitutional symptoms, and requires only local treatment.

Before noticing the constitutional or secondary symptoms which follow the Hunterian or infecting sore, we shall very briefly describe the treatment required for the last three forms, in which no constitutional symptoms occur. A suppurating sore should at once be thoroughly cauterized, so as to destroy all the tissues which have imbibed the poison. To secure this result, strong caustics are desirable; and as they sometimes extend further than is desired, an antidote should be at hand, which not only checks the further extension of the caustic, but deadens the pain. The agents most used in these cases are caustics and the mineral acids, and the *potassa cum calce*, a combination of potash and lime, which is prepared in the form of small rods for this purpose. The last of these is on the whole the best, as the extent to which it acts may be accurately regulated. When the action is sufficient, the application of a dilute acid will relieve the pain. Nitrate of silver, which is often employed, is not sufficiently energetic in its action to eradicate the disease. In the ulcerative sore, which is often irritable and painful, opium is useful both locally and internally. In other respects the same treatment must be adopted as in the preceding variety. As the various means that have been suggested for preventing the suppuration of the bubo, which always accompanies this sore, are of no avail, it is useless to mention them. If, after the bubo has burst, the remains of an indolent, enlarged gland, incapable of forming healthy granulations, are left, caustic must be applied, so as to cause them to slough away. In sloughing sores, the great object is to check the destructive process; for which purpose, fomentations and poultices are applied locally, and large and repeated doses of opium are given internally. The nitric acid lotion, or a solution of potassio-tartrate of iron (10 grains to an ounce of water), is often an efficient local application in these cases.

We now return to the consideration of the Hunterian or indurated chancre, the only variety of venereal sore that gives rise to secondary or constitutional symptoms. If the patient seeks medical assistance as soon as he perceives the sore, it is possible that the application of a caustic will destroy the poison, and prevent any constitutional symptoms. If, however, four days or more elapse before treatment commences, the best local application is some form of mercury, as mercurial ointment spread on lint, or the application of black wash (see LOTIONS) steeped in the same material. When the poison has once entered the circulation, and become diffused throughout the body, it is desirable to neutralize it, if possible, before the appearance of any secondary symptoms. A very large number of drugs have at different times possessed an anti-syphilitic reputation, and a few are doubtless useful; as, for example, iodide of potassium. 'There is one medicine alone,' says Mr. Henry Lee, one of the highest British authorities on the subject, 'which, through good report and evil report, in spite of the strongest prejudices of some against its use, and the no less adverse influence of others, who have employed it to an unjustifiable extent, has maintained its general reputation.'—*Op. cit.*, p. 418.

In these remarks on the value of mercury (if judiciously given) we fully concur; but the mercurialists and non-mercurialists are almost equally divided. It may be given internally in pills or in solution; or it may be introduced into the system through the skin, in the form of ointment; or lastly, it may be employed in the form of vapor, and thus applied to the skin. Of these three methods, none is equal to mercurial fumigation by calomel vapor, either in the readiness with which it removes the symptoms, or the slight disturbance it excites in the constitution, or in its certainty in preventing relapse. This process is a very simple one. A piece of brick must be heated to a dull red heat, and placed in a pan having a little water at the bottom. A quantity of calomel, varying from 10 to 20 grains, is placed on the top of the brick; and the patient then sits over the pan in a cane-bottomed chair, enveloped from his neck downwards in a large blanket.* The operation is best performed at bedtime; it is complete in a quarter of an hour; and when the patient is sufficiently cool to put on his night-shirt, he should go to bed without disturbing the calomel on the surface of the skin.

It is almost impossible to produce salivation by this means of administering mercury; and all that is requisite is to produce a slight tenderness of the gums. The system must be kept under this gentle influence of the mercury till the induration in the primary sore has disappeared. At a period usually varying from one to two months after the first appearance of the induration (which is regarded by some writers as the first of the secondary symptoms), slight febrile symptoms, usually followed by an exanthematous eruption of the skin, often accompanied by sore throat, will occur. This eruption is a variety of *roseola;* it is of a rose-red color, which disappears on pressure, and is not raised above the surface. It generally disappears in a few days, but if it persist, it will gradually change to a copper color, which is characteristic of all syphilitic eruptions which remain for a considerable time without suppurating or ulcerating. The syphilitic eruptions which usually follow this primary rash may assume the varied forms of lichen, syphilitic tubercule, lepra, and psoriasis; and the best mode of treating them is by applying local mercurial fumigation, and at the same time giving iodide of potassium (in five-grain doses thrice a day) internally. Occasionally in persons with impaired constitutions, syphilitic eruptions assume a postular character. For a description of these eruptions, we must refer to Cazenave's *Manual of Diseases of the Skin*, translated by Burgess. Similarly, there are cases in which, from some constitutional peculiarity, or, as Mr. Lee suggests, from some want of power in carrying out the natural processes of the disease, the syphilitic eruption may be accompanied by an effusion of serum only; or, in other words, may be of the vesicular type. Thus, we hear of syphilitic herpes, syphilitic eczema, &c. These forms must be treated as the others.

Amongst the secondary syphilitic diseases of the mucous membrane, may be especially noticed (1) mucous tubercles, (2) deep ulcer of the tonsils, and (3) syphilitic laryngitis. *Mucous tubercles* appear as small tense eminences inside the cheeks, on the arches of the palate, on the lips, on the generative organs, and on the rectum. A solution of corrosive sublimate applied locally (one or two grains to the ounce of water), or calomel, proves an effective local application. *Deep ulcer of the tonsils* is best treated by corrosive sublimate given internally, in doses of $\frac{1}{12}$th of a grain three times a day, in compound tincture of bark and water; and also used as gargle (in the proportion of 2 grains to a mixture of 7 ounces of water and 1 of honey). *Syphilitic ulceration of the larynx*, commonly known as *Syphilitic laryngitis*, is characterized by pain or tenderness in the region of the thyroid cartilage (see LARYNX), huskiness of the voice, a hacking cough from attempts to expectorate, with occasional expulsion of purulent matter mixed with blood. If the disease is not checked, enervation, night-sweats, and dangerous exhaustion, ensue, and life is often terminated by suffocation.

In noticing the secondary symptoms, *syphilitic iritis* must not be overlooked; its symptoms and treatment are described in the article IRITIS.

Our limited space precludes more than a very brief allusion to the more important *tertiary syphilitic affections*. The most important of these are those which attack the bones and their coverings. They may be included under the heads of acute and chronic periostitis (the latter being very common), nodes and exostosis, inflammation of bone, caries and necrosis; next to these are tertiary affections of the skin and mucous membrane, which consist mainly of intractable ulcerations attacking the face (especially the nose and lips), nails, ears, and mucous membranes of the various openings of the body; and diseases of the glands. In many of these cases, a modified form of mercurial fumigation is most useful; but if mercury, even in this form, is thought inexpedient, in con-

* A simple apparatus for mercurial fumigation, consisting of a kind of tin case containing a spirit lamp, may be procured from Messrs. Savigny and Co., St. James's Street, by those who object to rough bricks and coarse pans. A special fumigating cloak, in place of the blanket, is sold with the apparatus.

sequence of the general debility of the system, iodide of potassium, combined with any of the preparations of sarsaparilla, may be employed. Bark, iron, and the mineral acids are also of service in restoring the strength; and opium, by relieving the nocturnal pains which are so frequently present, will also prove most useful. The reader who wishes to pursue this subject further, may be referred to Aitken's *Science and Practice of Medicine*, in which he will find an account of the tertiary syphilitic affections of the nails, heart, brain, lungs, liver, and tongue.

The SYPHILIS OF CHILDREN is a subject which must not be omitted in an article on this disease. If the constitution of either the father or mother of an infant is saturated with the syphilitic poison, the child may be born with certain symptoms indicating that it is suffering from *congenital syphilis*. Moreover, the child of a mother having a primary sore, but no constitutional symptoms, may be inoculated with syphilis during the act of delivery; or the disease may be communicated in vaccination (if the matter be derived from an impure source); or by contact with syphilitic sores on the persons of wet-nurses or others. All these cases are included in the *infantile* variety of the disease. One of the most striking symptoms of true congenital syphilis is that which is popularly known as the *Snuffles*, in which a discharge collects in the nose, and sometimes blocks it up so completely that the infant is unable to suck for any length of time. The skin presents an eruption of spots, which are usually somewhat coppery, but sometimes of a rose-red tint; while on the soles of the feet and the palms of the hands, the cuticle scales off, and an appearance like that of psoriasis is presented; and flat mucous tubercles occur at the parts where the skin and mucous membrane merge into one another. White ulcers of a crescentic form often occur in the mouth; and with these symptoms there is nearly always observed 'the wizened and shrunken look, the anxious expression, and the dirty hue of the skin (a kind of dirty greenish yellow), which imparts to the infant a peculiarly repulsive aspect of old age.'—Holmes, 'On the Surgical Diseases of Childhood;' *op. cit.*, vol. iv. p. 830. Congenital syphilis frequently causes the death of the fœtus at about the fourth or fifth month; and if a woman is repeatedly delivered of dead children from the fourth to the seventh month, the practitioner may fairly conclude that a syphilitic taint is *probably* present. In other cases, the child is born alive with the 'snuffling' and eruption; but in the majority of cases, the infant when born is apparently healthy, and the disease does not show itself till about six weeks after birth.

When congenital syphilis is diagnosed with certainty, the medical attendant has a very important duty to perform, from which he must not shrink from any feelings of delicacy. He must discover which of the parents is affected, and must prohibit further cohabitation until the secondary symptoms have been completely removed by the treatment which has already been described. 'Neglect of this precaution,' says Mr. Holmes, in his excellent memoir on Congenital Syphilis (contained in the 4th vol. of his *System of Surgery*), 'may not only entail on the couple the misery of a family of deformed, puny, and ailing children, but to the woman at least is fraught with grave personal danger. Whatever may be the case amongst the poor, there is no doubt that, in the better classes, congenital syphilis is usually derived from the father, the mother being unaffected except through the fœtus.' There is scarcely a doubt that a woman carrying a syphilitic fœtus may become thus infected with secondary syphilis by the exchange of fœtal and maternal blood in the placenta; and this explains how it is that women who have never had the primary infecting sore occasionally show all the symptoms of secondary syphilis after living for some years with husbands similarly affected.

Allusion has already been made to the fact, that *infantile* (not *congenital*) syphilis may be communicated by vaccination. There is undoubted evidence that in the year 1861, in a thinly populated district of Piedmont, in which syphilis is virtually unknown, 46 children of various ages were simultaneously attacked with syphilis proceeding from chancres in the arm, and followed by buboes (enlarged glands) in the armpits; and that all these children had been vaccinated directly or indirectly from a single child, who was subsequently proved to have contracted syphilis from a wet-nurse; and further, that these children transmitted the same disease to a number of women, their wet-nurses, mothers, &c., and even to children who nursed and played with them; that the women so infected communicated the disease to their husbands; and finally, that the disease yielded in all cases to the ordinary treatment adopted in syphilis. This, as Mr. Holmes observes, is by far the most convincing instance of the propagation of syphilis by vaccination; but several others are recorded by Mr. Lee (*Lectures on Syphilitic Inoculation*, 1863) and other writers.

Cases in which the nipple of the wet-nurse has been infected by a syphilitic infant are by no means rare, and have in various instances given rise to litigation.

Congenital syphilis and infantile syphilis generally must be treated with mercury—either in the form of inunction, by keeping a flannel band, smeared twice a day with mercurial ointment, in constant contact with the thigh or arm for about six weeks; or internally, by the careful use of Gray Powder (*Hydrarg. c. cretâ*), in doses of a grain and a half or two grains, twice a day; combined with a little compound chalk-powder, if any irritation of the bowels occurs. The snuffles will be relieved by syringing the nostrils with lukewarm water, and then introducing a couple of drops of almond or olive oil.

In a foot-note to an early paragraph of this article, we gave abundant evidence of the appalling prevalence of this disease. In his valuable treatise on *Practical Hygiene*, Dr. Parkes discusses the question of the prevention of this disease amongst soldiers; as, however, his remarks for the most part are applicable to other classes, we shall briefly notice them. The means of prevention which he discusses are—1. *Continence*, which is promoted by (*a*) The cultivation of a religious feeling and of pure thought and conversation; (*b*) The removal from temptation and occasions to sin; (*c*) Constant and agreeable employment, bodily and mentally; and (*d*) Temperance. 2. *Early marriage*. At present, only six per cent. of our soldiers are allowed to marry. 3. *Precautions after the risk of contagion*. In some French towns, the use of lotions and washing is rigorously enforced, with the effect of lessening disease considerably. 4. *Cure of the disease in those affected by it.*

Health-inspections, in special reference to venereal diseases, are made weekly in our army by the surgeon or assistant-surgeon; and although similar inspections of all recognized prostitutes have long been made by legal authority in many parts of the continent, no attempt at legal interference with the disease in women was made in this country till 1864, when the 'Contagious Diseases Bill' was passed, by which, in the neighborhood of certain places (Portsmouth, Plymouth, Woolwich, Chatham, Sheerness, and Aldershot), prostitutes who are found diseased may be taken to a hospital, and there detained till cured. A committee appointed a few years before by government to report upon the best means of checking the disease in the army and navy, in February 1866, issued their recommendations; the most important of which are—(1) The periodic inspection of all known prostitutes in the garrison towns placed under the provisions of the act of 1864; (2) the appointment of a surgeon vested with the necessary powers; (3) punishment for infringement of the act; (4) the extension of its operation to all garrison and seaport towns used by troops or ships; (5) the prohibition of the residence of public women in beer-shops; (6) that the lock hospitals be placed under government control; and lastly, that the police supervision of the women in the streets of such towns be more stringent. The evidence taken seemed to prove that the working of the act of 1864 was useful. (A contrary report was issued in 1882.) For an account of the various plans which are adopted on the continent for the prevention of this disease—such as the registration of brothels and of prostitutes, and the enforcement of periodic examinations at short intervals—the reader is referred to the various works of Parent-Duchatelet, Acton, Sanger, and others on Prostitution; to Lancereaux's *Treatise on S.*; to Lee's *Lectures*; and to numerous articles in the medical and other reviews See CONTAGIOUS DISEASES ACTS.

Without entering into any prolonged details regarding the history of this disease, we may briefly mention that, towards the close of the 15th c., a great epidemic of syphilis pervaded Europe, and that it was supposed to have been imported from the New World; and that, in the 16th c., syphilis was recognized as the result of a specific virus. During last century, the history of this disease is divisible into three distinct periods, in each of which very different views have been prevalent. These may be described as—1. *The Period and Doctrine of Hunter*, who believed that the various forms of syphilis and gonorrhœa depend upon one and the same poison—a view taught by Carmichael in Dublin, Cazenave in Paris, and others. 2. *The Period and Doctrine of Ricord*, who proved that gonorrhœa was quite distinct from syphilis, and that inoculation with gonorrhœal matter will not cause a chancre; and that there are *two* classes of chancres, the *soft* and *hard*, originating from the same source. 3. *The Present Period*, commencing in 1856, in which it is held that, exclusive of gonorrhœa, there are *two* forms of the syphilitic poison. It has been judiciously advised by Mr. Longmore, the Professor of Military Surgery in the Army Medical School, that in accordance with our present knowledge of this disease, the term *syphilis* or *syphilitic* should be restricted to such cases as are believed to be of a specific infecting kind, while the term *local venereal sore*, or *venereal ulceration*, should be applied to those cases which require merely local treatment, and are not followed by constitutional symptoms.

SYPHILIZA'TION is the term used to designate an operation which has the double object of eradicating syphilis already existing in the system, and of securing permanent immunity from any future attacks, by means of repeated inoculations of syphilitic poison. As long ago as the year 1844, a French physician, Auzias

Turenne, undertook a number of experiments, with the view of testing whether John Hunter's view, that syphilis could not be communicated to the lower animals, was correct. After some failures, he succeeded in producing venereal sores (chancres) in monkeys, by inoculating them with the human virus; and he found that rabbits, cats, and horses might be similarly infected from the chancres of the monkey. He likewise found that the chancres produced by inoculation became less and less in each animal, until a period at length arrived at which the poison seemed to have lost all its power, and no further sores could be produced; and he was thus led to believe, that by prolonged inoculation, the system became protected. The subject was next taken up by Sperino of Turin, who inoculated patients suffering from syphilis by virus from a chancre, and repeated the inoculation once or twice a week, till the poison—as in the case of Turenne's animals—ceased to produce any effect; and when this point was reached, all the other sores had healed.

In 1851, Professor Boeck of Christiania, when traveling through Italy, had his attention drawn to the doctrine of syphilization; and from that time to the present, he has devoted himself unremittingly to it, and is now the great authority on the subject. In 1858, Boeck, in consequence of the results he had attained from the practice of S. in cases where no mercurial treatment had been prescribed, alleged that S. might in such cases be regarded as a complete and certain cure. In cases where mercurialization has been practised, the use of iodine has to be persisted in during S. During the summer of 1865, Dr. Boeck visited London, and took active steps to make his views on this subject accurately known in this country, and the surgeons of the Lock Hospital submitted a series of cases to his mode of treatment; and Mr. James Lane, one of the surgeons to that institution, asserted in 1866 that 'hitherto, as far as he had seen, it had effected everything which had been promised for it. The progress of the cases in the Lock Hospital had in almost every detail corresponded to the predictions of Professor Boeck respecting them. In several of those who had been longest under treatment, immunity from inoculation with primary syphilitic matter had been arrived at.' The progress of S. as a remedy for syphilis and as a proof against syphilitic infection, has not been well marked in this country. Most surgeons are agreed as to the correctness of Professor Boeck's views, but the practice itself is offensive, and the length of time necessary for its being effectively carried out forms an objection to its practice. In Sperino's experiments, the treatment extended from 9 to 20 months or more. The practice has been much in vogue in Christiania under Boeck and his colleague M. Bidenkap; but it is unlikely to command attention other than of scientific kind, and as tending to acquaint us with the history of syphilis and with the nature of syphilitic infection.

SY'RA (Gr. *Syros*), the most important though not the largest member of that group of islands in the Ægean Sea known as the Cyclades (see GREECE), lies 13 miles south of Andros. It is about 10 miles long by 5 broad, bare, hilly, and not very fertile. The products are wine, tobacco, grain, citrons, figs, honey, and vegetables; but the greater portion even of the common necessaries of life have to be imported from Greece and foreign countries. Its prosperity is of quite modern growth. During the War of Independence, S. remained neutral, and, in consequence, numerous fugitives flocked thither from other parts of Greece, especially from Chios and Psara, who, besides adding largely to the population, brought with them a spirit of political activity and commercial enterprise, the beneficial effects of which are now strikingly visible. Pop. 26,946. The capital, *Syra*, or *Hermopolis*, is situated on a bay on the east side of the island. It rises terrace-wise from the shore, is well built, and is the seat of government for the Cyclades, and the residence of foreign consuls. It has numerous educational institutions, 4 printing-presses, and 3 weekly newspapers. S. has become the great commercial entrepôt of the Ægean. Nearly one half of all the imports of Greece reach it through this port. It builds more ships than any other town in the Levant, and owns one-third of all the Greek merchantmen. It has likewise regular steam-communication with all the principal trading-towns in the Levant. Pop. of the town of S. (1879) 4398.

Ancient notices of S. are scanty. Homer praises it in the *Odyssey* as 'rich in pastures, in herds, in wine, in wheat;' but it has no history.

SY'RACUSE, anciently the most famous and powerful city of Sicily, situated on the south-eastern coast of the island, 80 miles south-south-west of Messina, was founded by a body of Corinthian settlers under Archias, one of the Bacchiadæ, 734 B.C. The original colonists seem at first to have occupied nothing more than the little isle of Ortygia, about one mile long, and half a mile broad, which lies near the shore. It rapidly rose to prosperity, and was enabled to establish sub-colonies of its own: Acræ (664 B.C.), Casmenæ (644 B.C.), and Camarina (599 B.C.). Nothing definite is known of the early political state of S.; but before 486 the political power had passed into the hands of a few leading families, or perhaps *clans*, who constituted an oligarchy, while the great body of the citizens formed a malcontent democracy. In that year a revolution took place. The oligarchic families—*Geomori* or *Gamori*, 'landowners;' probably the descendants of the original colonists, like the patrician *gentes* of Rome—were expelled, and the sovereign power was transferred to the citizens at large. Before a year passed, however, Gelon (q. v.), 'despot' of Gela, had restored the exiles, and at the same time made himself master of Syracuse. He was a great ruler, and under him the city increased in size and wealth. It is believed to have been in Gelon's time that the adjoining mainland was first built upon.

The locality of the new settlers was the slopes and heights of Achradina, or the 'outer city,' a triangular table-land north of the island of Ortygia, and subsequently connected with it by a mole. It ultimately became the most extensive and populous quarter of S.—contained the Agora, a temple of Zeus Olympios, the Prytaneum, with a splendid statue of Sappho, the fine monuments to Timoleon and the elder Dionysius (q. v.), &c. It may be convenient to mention here the other two quarters of the city, especially as the date of their settlement is not known. These were Tyche—so called, according to Cicero, from an ancient temple of 'Fortune' erected there—occupying a plateau to the west of Achradina; and Neapolis (New City), stretching along the southern slopes of the plateau, and overlooking the marshes of the Anapus and the 'Great Harbor,' a spacious and well-sheltered bay, about five miles in circumference. Neapolis became one of the finest parts of Syracuse. Here were situated the theater, amphitheater, and numerous temples, of which hardly a relic remains, except of the first mentioned. Ortygia contained the castle or citadel which immediately fronted the mainland, and overlooked the docks or *navalia* in the 'Lesser Harbor.'

Reverting to the history of S., which we must touch upon only in the most cursory manner, a noticeable characteristic of the reign of Hiero (q. v.), the successor of Gelon, is his cultivation of the fine arts, and his liberal patronage of men of genius, as Æschylus, Pindar, &c. In 466 B.C., the democracy again got the upper hand—Thrasybulus, a 'tyrant' of the baser sort, being expelled; and for sixty years a free and popular government was enjoyed, under which S. flourished more than it had ever done. During this period occurred its great struggle with Athens (415—414 B.C.), in which it came off victorious, and its renown at once spread over the whole Greek world. But a new power appeared on the stage—the Carthaginian, whose conquests in Sicily, towards the close of the 5th c., threatened the supremacy of Syracuse. Meanwhile, Dionysius (q. v.) restored the 'tyranny' of Gelon, and during a reign of 38 years greatly increased the strength and importance of the city. It was he who constructed the docks in the Greater and Lesser Harbors, and surrounded the city with fortifications. His fierce and victorious war with Carthage (397 B.C.) raised the renown of S. still higher. The reigns of the younger Dionysius (q. v.) and of Dion were unsettled; but after the restoration of public liberty by Timoleon (344 B.C.), a brief season of tranquillity ensued, during which the prosperity of the city rapidly revived. Under Agathocles, however, the despotic form of government was again established (317 B.C.), and continued, with scarcely an interruption, down to the conquest of the city by the Romans (212 B.C.) during the Hannibalic war—the ruler of S., Hieronymus, a rash and vain young man, having abandoned the prudent policy of his grandfather, Hiero (q. v.), broken the alliance with Rome, and joined the Carthaginians.

Under the Romans, S. slowly but surely declined, though it always continued to be the capital and first city of Sicily. Captured, pillaged, and burned by the Saracens (878 A.D.), it sunk into complete decay, and is at present confined to its original limits, Ortygia, which, however, is no longer an island, but a peninsula. Pop. (1881) 23,507. The streets of the modern town are, with few exceptions, narrow and dirty. S. has a cathedral, a museum of classical antiquities discovered in S. and the neighborhood, a public library, with some curious MSS., numerous churches, monasteries, and nunneries, and carries on a trade chiefly with Malta in wine, oil, salt, and salt-fish. It has several remains of ancient and medieval edifices, which are much visited by travelers.

SYRACUSE, a city of Central New York, U.S., at the head of Onondaga Lake on the Erie Canal, and at the junction of the New York Central and Oswego railways, 148 miles west-by-north of Albany. From its central position, it is called the City of Conventions. It contains a handsome court-house, state arsenal, state asylum for idiots, 41 churches, 3 daily and 11 weekly newspapers, 13 banks, schools, and libraries. Here are the largest salt-works in America (producing, in 1874, 6,029,300 bushels of salt), 5 iron-furnaces, 14 machine-shops, manufactories of silver, tinware, sheet-iron, coach and wagon factories, and breweries. Pop. (1880) 51,792.

SY'RIA (Arab. *E'sham*, Turk. *Soristan*), a division of Asiatic Turkey, bounded on the N. by portions of Asia Minor, on the W. by the Levant, and on the S. by Arabia Petræa; on the E. and S.-E., its boundary is rendered indefinite, in great part, by the sands of the desert, but at length becomes fixed by the course of the Euphrates. It is divided into several governments, which frequently change their limits. They are usually named after the principal towns—Aleppo, Damascus, and Beyrout. The area is about 146,000 square miles; pop. about 2,250,000. The whole region is traversed by a double mountain-chain—of which Lebanon (q. v.) forms the highest part—touching in its northern extremities the Alma Dagh (anc. *Mons Amanus*), and in its southern forming the Sinaitic range. The central part of this mountain-system, which in many places exhibits the characteristics of a plateau, presents on the west a steep front towards the Mediterranean, but on the east rolls gradually away into the level uplands of the Syrian wilderness. The most noticeable features of the long *furrow* between the double ridge, beginning at its southern end, the Gulf of Akaba, are, the waterless wady of Arabah, the narrow, deep-sunken region known as *El Ghur*, through which the river Jordan flows, and which embraces the Dead Sea and the Sea of Galilee, and the vale of Cœle-Syria (q. v.), and its great continuation northwards, watered by the Nahr-el-Asy (anc. *Orontes*). The western ridge is broken through in three places: in the north by the lower Orontes; in the middle near Tripolis—where the chain of Lebanon properly terminates—and further south, near Tyre, by the Leontes. South of Tyre, it recommences in the hill-country of Western Palestine (q. v.), which finally passes into the desert plateau of El Tyh, in the Sinaitic peninsula.

The eastern ridge is less sharply defined; its most conspicuous elevations being Anti-Libanos, the mountains of Moab (east of the Dead Sea), and Mount Seir, overlooking the wady Arabah. The principal rivers are the Orontes (q. v.), the Leontes, the Jordan (q. v.), the Barada or Abana, the river of Damascus. The only lakes worth mentioning are the Dead Sea (q. v.) and the Sea of Galilee.

Although S. belongs to the countries comprised within the Asiatic rain-zone, yet in general the climate is excessively dry and hot, differing little from that of Arabia. Drought and scantiness of vegetation characterize almost equally the uplands and the valleys. Only where the mountains are lofty, the streams abundant, and the atmosphere somewhat maritime, as in the terraced slopes of Lebanon, do we find some approach to tropical luxuriance in flower, and fruit, and tree. Forests of evergreens, beautiful grassy pastures, and meadow-tracts are found there; and wheat, maize, rice, &c., are largely produced. The cultivation of the vine, the cotton-tree, the mulberry, and also the finer sorts of fruits, as the olive and fig, is considerable, while indigo and sugar-cane are raised in the valleys of the Jordan and the region round about the Dead Sea. The fauna of S., like its climate and vegetation, is similar to that of Arabia. The camel is of almost as much importance as further south; and the Syrian deserts, particularly towards the north, are the home of gazelles, hyænas, jackals, bears, buffaloes, and other wild animals.

The greater part of the Syrian mountains is limestone; mountain limestone in Lebanon, chalk in Anti-Lebanon, and Jura limestone in Palestine. In the last of these, volcanic formations occur, especially in the region of the Jordan and the Dead Sea, where hot springs, beds of bitumen and sulphur, the shapes of the hills, and the frequent earthquakes, afford unmistakable evidence of volcanic activity. Salt is the only mineral of much consequence, and is exported in considerable quantities; coal, however, is worked near Beirût. Sheep, goats with hanging ears and silky hair, cattle, mules, and asses, form, as in ancient times, a great part of the wealth of the inhabitants.

Silk is the chief article of manufacture—at Aleppo, Beirût, Damascus, &c.—but cotton and woollen fabrics, gold and silver thread-stuffs, glass, earthenware, leather, soap, &c., are also manufactured in different parts of the country. The want of roads is a great hindrance to industrial activity. The first carriage-road was opened in 1863, between Beirût and Damascus. The other roads, with the exception of one or two short carriage-ways in Mount Lebanon, are mere mule and camel tracks. In 1871, S. exported grains, seeds, cotton, galls, wool, &c., to the value of £717,404; and imported cottons, woollens, copper, tin, iron, coals, indigo, pepper, coffee, &c., to the value of £1,338,750.

The *religious* sects of S. are numerous. Most of the people are Mohammedans; but Christians of the Greek Church number 180,000; Maronites (q. v.) and Roman Catholics, 310,000; Jews, 40,000; Druses (q. v.), 90,000; lesser sects about 30,000. The inhabitants are in some sense a mixed people, for the country has experienced many political vicissitudes; but by far the greatest number, whether Christians or Mohammedans, are of Shemitic origin, either Phœnician, Aramæan, or Arabic. Their Turkish rulers, however, and such Turkomans and Kurds as we find settled in the north of S., belong to the Turanian race. Arabic is everywhere spoken, and may be considered the national language, since the old Syriac or Aramaic tongue is wholly dead, except among the Nestorians of Kurdistan.

The *history* of S. stretches far back into remote antiquity. In the time of Abraham (2000 B.C.), Damascus was a city; in the oldest literature of Greece, Sidon figures as the capital of a rich, populous, and civilized state; and in the Hebrew Scriptures, Canaan or Palestine is crowded with towns at the period of its conquest by Joshua; but, like most other so-called nations in early times, S. did not form a single state; it was rather a congeries of independent states whose inhabitants belonged to the same race. Every important city had its king, whose normal occupation was fighting with his neighbors.

Under David and Solomon, something like political unity was achieved; yet it does not appear that these great rulers dispossessed of their territories the princes whom they subdued, but only made them tributary, and after their death things reverted to their previous condition. Rezin, a slave, then made himself master of Damascus, and extended the Damascene monarchy over all Northern and Central S.; but the conquests of Tiglath-Pileser resulted in its becoming a province of the Assyrian Empire. Subsequently, the whole land, including Palestine, became part of the successive empires of Babylonia, Media, Persia, and Macedonia. Then followed the dynasty of the Seleucidæ (q. v.). After their fall, S. passed into the hands of the Romans, who retained it, though not continuously—for on several occasions the Persian Sassanidæ (q. v.) managed to wrest it from them—until the Arab conquest (7 c. A.D.). During the Crusades (q. v.) of the middle ages, several Christian principalities were established here, but endured only for a short period. S. now became a possession of the sultans of Egypt, in whose time it was frightfully devastated by the Mongols. In the 16th c., it was conquered by the Turks, and has ever since formed part of the Turkish Empire.

SY'RIAC VERSIONS. Apart from the Peshito (q. v.), there were other Syriac versions of the Old Testament current among the Syrian Christians, although they did not acquire canonicity among them. These were chiefly translated from the LXX., and the best known among them is one drawn up from the text of the Hexapla (q. v.; compare also ORIGEN), which it follows most slavishly, without any regard for Syriac idiom or grammar. It contains the critical remarks of Origen, and is moreover furnished with numerous variants, fragments from other Greek versions, and exegetical scholia. Bishop Paulus of Tela is supposed to have composed it at the instigation of Bishop Athanasius, 617 A.D. There are now only a few (imperfect) MSS. extant of it—one in Paris, one in the Ambrosian Library (a third, once in the possession of T. Masius, has disappeared), and further portions are found in the Nitrian collection in the British Museum. The greater part of the Biblical books has been edited from it, but in separate publications. A complete edition is still a desideratum. An attempt is now being made towards a more complete edition of the Hexapla itself, by a reconstruction of lost portions of the Greek, through the medium of the parallel Syriac passages preserved in this translation. Two other MSS. in the Paris Library contain fragments of another Græco-Syriac version, by Jacob, Bishop of Edessa, who, in 703 and 704 A.D., composed it from the Peshito and the above translation, which is probably to be understood in the sense of his having made a new recension of Paulus of Tela's work, corrected after the Peshito.

SYRIAN RITE, CHURCH OF, that portion of the oriental church which had its seat in Syria, and which was anciently comprehended in the patriarchate of Antioch, and (after that of Jerusalem obtained a distinct jurisdiction) in the patriarchate of Jerusalem. The Syrian Church of the early centuries was exceedingly flourishing. Before the end of the 4th c., it numbered 119 distinct sees, with a Christian population of several millions. The first blow to the prosperity of the Syrian Church was the fatal division which arose from the controversies on the incarnation. See MONOPHYSITES, NESTORIANS, EUTYCHES, JACOBITES. The Eutychian heresy, in one or other of its forms, obtained wide extension in Syria; and the usual results of division ensued in the corruption and decay of true religion. The Moslem conquest accelerated the ruin thus begun; and from the 7th c. downwards, this once flourishing church declined into a weak and spiritless community, whose chief seat was in the mountains, and whose best security from oppression lay in the belief on the part of the conquerors of their utterly fallen and contemptible condition. Under the head MARONITES has been detailed the most remarkable incident in the later history of the Syrian Church. This branch of the eastern Christianity, although for the most part divided from the orthodox Greek Church by the profession of monophytism, took part with the Greeks in their separation from the west, under Michael Cerularius; and the reunion of the Maronites to Rome had the remarkable result of establishing side by side, within the narrow limits occupied by the Christians under the Moslem rule in Syria, two distinct communities, speaking the

same language, using the same liturgy, and following the same rites; and yet subject to two different patriarchs, and mutually regarding each other as heretics and apostates from the ancient creed of their country.

The chief peculiarity of the Syrian rite, as contra-distinguished from the Greek, consists in its liturgy, and the language of that liturgy, which is Syriac, and with which the people, and in many cases the priests, are entirely unacquainted. The liturgy is known as the Liturgy of St. James. The Syrians agree with the Greeks in the use of leavened bread, in administering communion under both heads, in permitting the marriage of priests (provided they marry before ordination), and in administering the unction of confirmation at the same time with baptism even to infants.

The Christian community of Syria may at present be divided into four classes: the Maronites, the Greeks (who are also called Melchites), the Monophysites, who are called Jacobites, and the primitive Syrian Christians (not Maronites), who are in communion with Rome. This last-named community forms the small remnant of the ancient Syrian Church, which remained orthodox during the controversy on the Incarnation, at the time of the general lapse into Monophytism. To these are to be added the Christians of the Latin rite and a few Protestants. The Maronites number about 160,000; the Greeks are said to be about 180,000; the Jacobites of Syria and of Armenia Proper are said to reckon together about 40,000 families, of whom, however, probably scarcely 10,000 can be set down to the account of the Syrian Church. The non-Maronite Syrians who follow their national rite, but are in communion with Rome, are supposed to amount to about 5000. The resident Latins are chiefly members of the religious orders who from immemorial time possess convents in the Holy Land, and European Catholics, who have settled permanently, or for a time, at Jerusalem, Beirût, and Damascus. None of these can in any way be regarded as belonging to the Syrian Church.

It may be well to add, that the belief, and in most particulars the disciplinary practice of these several classes coincide substantially with those respectively of the same communities in the other churches of the East. All (with the exception of the Maronites and the few United Syrians) reject the supremacy of the Roman see. The Syrians of the Greek communion reject the double procession of the Holy Ghost; and the Jacobites firmly maintain their old tenet of Eutychianism. Among them all are to be found monks and religious females. All enforce celibacy on their bishops, and refuse to priests the privilege of contracting a second marriage, or of marrying after ordination. The practice of fasting prevails among all alike. They receive and practise the invocation of saints and prayers for the dead, and the use of painted, although not of graven images. Many particulars regarding them are to be gleaned from the memoirs of recent missionaries of the several denominations, among which the letters published from time to time by the French Society for the Propagation of the Faith, are particularly full. For the modern Nestorians, and the Syrian Christians of Travancore, see NESTORIANS.

SY'RINGE (Gr. *syrinx*, a pipe), a hydraulic instrument, consisting of a cylinder of metal or glass, having a conical nozzle at one end, and the other fitted with an air-tight piston. The nozzle being inserted in a liquid, the retraction of the piston draws the liquid into the cylinder, on the principle of the pump (q. v.), and by its forward pressure the liquid is expelled from the nozzle in the form of a jet.

SYRRHA'PTÉS, a genus of birds of the Grouse family (*Tetraonidæ*), of which only one species is known (*S. Pallasii*), a native of the deserts of Tartary, abundant in the neighborhood of Lake Baikal. From its peculiar characters, which led Pallas to call it *Tetrao paradoxus*, it has received the somewhat pedantic name of *Heteroclite Grouse*. (A word is called *heteroclite* by grammarians which departs from the ordinary forms of declension.) The legs and toes are short, and densely feathered; and the toes are joined together for the greater part of their length. The bird walks with difficulty, but flies very well, although in general only for short distances. The wings and tail are very long, terminating in remarkably long, slender, pointed plumes.

SY'RTIS MA'JOR AND SYRTIS MI'NOR, the ancient name of two gulfs of the Mediterranean Sea, on the north coast of Africa. The former (now called the *Gulf of Sidra*) lies between Cape Mesurata, in Tripoli, and the table-lands of Barca, and forms the most southern part of the Mediterranean. The latter (now called the *Gulf of Cabes*) lies to the north-west, between Tunis and Tripoli. The shores of both are inhospitable, and abound in quicksands, which, carried by the wind, are said by the ancients to have frequently overwhelmed ships, and the reports of modern travelers to some extent confirm these old traditions. Their waters are (or were) dangerous to sailors, on account of the shallows, sandbanks, and sunken rocks that abound in them.—The name Syrtis is derived from an Arabic word, *Sert*, meaning a desert.

SY'RUP. *Syrup*, *sherbet*, and *shrub* are all derived from the Arabic *srb;* the first through the Latin, the second through the Persian, and the third through the Hindu. Syrup, in its simplest meaning, is a saturated solution of sugar boiled to prevent fermentation; but it also means the juice of fruits saturated with sugar and many flavored liquids, treated in the same way. Generally speaking, the finest refined sugar is used; and every effort is made to get the syrup very clear and free from all feculent matter. Syrups of fruits are much used on the continent to mingle with water for drink, and are very wholesome. They are also used in Britain, but not much, except in medicine—there being many medicinal syrups.

SY'STYLE, an arrangement of classic columns in which the intercolumniation is equal to twice the diameter of the column.

SYZRA'N, a town of Central Russia, in the government of Simbirsk, on the right bank of the Volga, about 150 miles below the town of Simbirsk. It owes its foundation to its advantageous commercial position on the Volga, and in the middle of a district teeming with agricultural produce. From the wharfs of S., 150 vessels, laden with corn, are annually despatched to Rybinsk and St. Petersburg. Pop. (1880) 19,450.

SZA'RVAS, a town of Hungary, in the county of Bekes, in a plain on the Kőrös, 22 miles north east from Csongrad. It has a considerable trade in corn and cattle. Pop. (1880) 22,504.

SZATHMA'R-NEME'THY, a town of Hungary, on the Samos, 60 miles north-east of Debreczin. Pop. (1880) 19,708.

SZE-CHUE'N (Four Streams), a vast province of Western China, and the largest of the eighteen. It has an area four times greater than that of England, but the population is scanty. The Kincha-kiang, or 'Golden Sanded River,' which rises in the southern slopes of the great Tibetan range, flows through S., and after receiving several tributaries, it becomes, before leaving the province, the famous Yang-tze-kiang. In its course, it passes at right angles, and by narrow gorges, through a succession of ranges of hills, which have a direction from north to south. The people of S. cannot always force a subsistence from their stubborn soil. Famines are not uncommon, when whole families are starved to death, and thousands subsist on a mixture of rice, roots, and common earth. Coal is abundant, but of inferior quality; seams of from three to five feet in thickness are laid bare in the gorges cut by the Yang-tze, and gold is found in small quantities.

SZEGEDI'N, till lately the second largest town in Hungary, but almost completely destroyed by a terrible flood in March 1879. In this hardly paralleled catastrophe, of the 7000 houses of the city, only 350 were left standing. The ruin to property was immense; the loss of life was given at 2000. S. stands (or stood) on the low ground where the Theiss is joined by the Maros, 118 miles S.E. of Buda-Pesth. In its normal condition, it manufactures great quantities of soda, tobacco, coarse cloth, &c., has the largest wharfs on the Theiss, and carries on an extensive river-trade in wood and corn with Transylvania. Its markets rank next to those of Pesth and Debreczin. Pop. (1880) 73,675.

SZEGSZA'RD, a town of Hungary, near the right bank of the Danube, 80 miles south-south-west of Pesth. Here excellent red wine is made. Pop. (1880) 11,948.

SZE'NTA. See ZENTA.

SZENTE'S, a market-town of Hungary, 30 miles north of Szegedin, near the left bank of the Theiss. The *commune* contains (1880) 28,712 inhabitants, who are chiefly engaged in the wine-culture.

SZOLNO'K, a town of Hungary on the Theiss, 66 miles east-south-east of Pesth. It contains important salt-magazines, and is the center of the traffic by steamers on the Theiss, and an important railway station. Pop. (1880) 18,247.

T.

THE twentieth letter of the English alphabet, is the sharp or mute of the lingual series, *t*, *d*, *th* (*dh*). It is produced by pressing the forepart of the tongue against the front of the palate. The name in Shemitic (*Tau*) signifies a mark (in the form of a cross). The Shemitic tongues had another *t*-sound, which became the Greek θ (*th*). This aspirated *t* is wanting in Latin and its derivatives; it is also foreign to High-German, although the Gothic and other Low-German tongues (English) possess it. The Gothic *th* has become in High-German *d*. In the *spelling* of High-German, *th* occurs not unfrequently; but it is never pronounced, and the introduction of it being considered by students of the language an aberration, there is a tendency to drop the *h*.

There is evidence that in Latin, at an early period, *t* before *i* was sibilated so as to sound like *ts* or *z*. See letter C. Before *s*, *t* was frequently dropped; as *fons* for *fonts*, *sors* for *sorts*. Final *t* was in Latin pronounced but faintly, and inscriptions show that in popular speech it was often dropped; e. g., *fece* for *fecit*, *vixse* for *vixit*. Thus the modern Romanic languages have inherited the loss of the pronominal ending *t* from their common mother. In French, *t* between two vowels has been elided; as *père*, *mère*, from *pater*, *mater*. In the corresponding words of the allied languages, *t* is often interchanged with other letters. T in Sanscrit, Greek, and Latin becomes *th* in Gothic and English, and *d* in High-German; thus Lat. *tres* (Sans. *trayas*), Goth. *thrais*, Eng. *three*, Ger. *drei;* Lat. *tectum* (Gr. *tegos*), Goth. *thak*, Eng. *thatch* or *thack*, Ger. *dach;* Lat. *frater*, Goth. *brothar*, Eng. *brother*, Ger. *bruder*. In German, the *t* of the English is often represented by *z*, as Eng. *two* = Ger. *zwei;* Eng. *toll* = Ger. *zoll;* while German *t* or *th* becomes Eng. *d*, as Ger. *tag*, *thau* = Eng. *day*, *dew*. A more remarkable interchange is seen it Lat. *lacrima* = Eng. *tear*. See PHILOLOGY.

TABA'NIDÆ, a numerous family of Dipterous insects, of the section *Proboscideæ*, which live by sucking the blood of horses, oxen, and other animals, and are popularly known by the name of GAD-FLY, which, however, is often given also to some of the *Œstridæ* (see BOT). The insects called CLEG (q. v.) are of this family. The proboscis is exserted, and is generally terminated by two lips; the palpi are also exserted; the antennæ are three-jointed, the third joint consisting of a number of rings. The T. fly with

Gad-fly and larva (*Tabanus bovinus*).

a buzzing noise. They are very annoying to cattle in the end of spring and early part of summer; and where they abound, the skins of cattle are often streaked with blood from their bites. The LARGE GAD-FLY (*T. bovinus*) is more common in some parts of the continent of Europe than anywhere in Britain, and is rarer in Scotland than in England. But the British T. are numerous. The species are widely distributed. Some of them inhabit the deserts of Arabia and Africa, and attack camels in prodigious numbers.

TA'BARD (Fr. *tabarre*, from *tabardum*, Low Lat.), a military garment in general use in the latter half of the 15th and beginning of the 16th c., which succeeded the *Jupon* and *Cyclas*. It fitted closely to the body, was open at the sides, had wide sleeves or flaps reaching to the elbow, and displayed the armorial ensigns of the wearer on the back and front, as well as on the sleeves. About the middle of the 16th c., the tabard ceased to be used except by the officers at arms, who have down to the present time continued to wear tabards embroidered with the arms of the sovereign.

TABASHEE'R, a substance sometimes found in the cavities or tubular parts of the stems of bamboos and other large grasses. It consists chiefly of silica, with a little lime and vegetable matter, or sometimes of silica and potash, in the proportions of about 70 parts of silica and 30 of potash. It appears to be formed by extravasation of the juices of the plant, in consequence of some diseased condition of the nodes or joints. It is in high repute among the Hindus as a tonic, and is prepared by imperfect calcination and trituration. The powder is often chewed with betel, in order to renovate the constitution. There are several varieties of tabasheer, one of which, of very rare occurrence, is extremely beautiful, of a delicate azure color by reflected light, and of a faint yellowish hue by transmitted light, easily crushed between the fingers, and of 'an aërial and unsubstantial texture, which we look for in vain in any other solid.' Other varieties are yellowish, white, and much like some varieties of opal.

Tabasheer is very porous, and absorbs water and oil very rapidly; effervescence taking place when it is plunged in water. By absorption of oil, the opaque varieties become transparent. When the greater part of the oil is expelled by heat, the structure of the tabasheer becomes apparent; it is beautifully veined, the veins being sometimes parallel, and sometimes curved. The optical properties of tabasheer are remarkable. Of all known substances, it has the lowest refractive power.

TABBY, or TABBYING, another name for watering fabrics. See MOIRE. It is usually applied to stuffs or worsted cloths instead of silks.

TA'BERNACLE (Heb. *Ohel Moed* = tent of meeting, *scil.*, between God and man; LXX. *Skene*, Vulg. *Tabernaculum Fœderis*), or, more fully, 'Tabernacle of the Congregation,' was the tent first erected by Moses in the desert as a visible symbol of the Divine Presence in the midst of the people. It was the place where he went to receive his inspirations as their representative, when 'they came to seek Jehovah.' A cloudy pillar descended and stood at the door of the Tabernacle while 'the Lord spake to Moses.' The detailed description of the Tabernale contained in Ex. xxv. seqq., xxxvi. seqq., renders more than a brief outline superfluous in this place. Suffice it to mention that it was divided into the 'Sanctuary' proper—which formed the front part, and the dimensions of which were 20 cubits in length, 10 in width, and 10 in height—and the 'Holy of Holies,' which was 10 cubits square, and 10 high. A kind of court-yard, formed by curtains suspended between columns, ran round the Tabernacle, 100 cubits long, and 50 wide. The entrance was towards the east—the rising of the sun—and closed by another costly curtain, into which, like unto the first covering, figures of 'cherubim' were woven.

The surrounding court was much larger on this eastern than on the western side, for here it was that the people assembled for the purpose of worship. Here also stood the altar, made of acacia-wood, upon which a perpetual fire was kept burning, and the brazen laver. The *Sanctuary* contained the gilded table with the showbread to the right, the golden candlestick with the seven branches to the left, and between both the 'golden altar,' or the 'altar of incense,' upon which the high-priest burned incense in the morning and evening. In the Holy of Holies, the holy ark, or Ark of the Covenant, alone was kept: a box of acacia-wood, plaited with pure gold both in and outside, containing the two tables of the Ten Commandments. On the top of it were the two cherubim, their faces turned towards each other; and between them there was the symbolical presence of Jehovah (the Shechinah), to which Moses appealed for guidance.

Only once a year, on the Day of Atonement, the high-priest was allowed to enter the Holy of Holies, while the Sanctuary was the ordinary place of the priests, and the court that of the Levites. The tribe of Levi was also that to which the place nearest to the Tabernacle, around which the twelve tribes were grouped, was assigned, as it also was the duty of its members to convey the building from place to place during the migrations.

The Tabernacle, after the people had settled in Canaan, was erected at Shiloh, where it was still found at the time of Saul, although the Ark of the Covenant itself had been carried away by the Philistines, in the time of Eli, and when restored, placed at Kirjath-jearim. Nor was the Tabernacle of Shiloh the only sanctuary, as it was intended to be. We find other local sanc-

tuaries with priests—at Bethel, Nob, Sichem, Mizpah, &c.—at which even Samuel worshiped, as in legally instituted places. When David is reported to have removed the Ark from Kirjath-jearim to Jerusalem, nothing is said about the Tabernacle of Shiloh; on the contrary, David erected a new one on purpose for the Ark. It seems probable that it was removed at some time or other from Shiloh to Nob, and thence to Gibeon, from whence Solomon seems to have fetched it away, with all its vessels, thus putting an end to the double worship that under David had divided the faithful between Gibeon, where Zadock officiated, and Jerusalem, with Asaph's worship. Nothing is further known of the Tabernacle, which besides being a symbol of God's presence, had also served the purpose of a visible political and religious link between the tribes. As a safeguard against idolatry and unlimited sacrificial worship, however, it did not prove effective enough.

TABERNACLE (Lat. *tabernaculum, armarium*), in the Roman Catholic Church, is the name given to the receptacle in which the consecrated elements of the Eucharist are retained. The name is derived by analogy from the tabernacle of the Old Law, and in form the Roman Catholic tabernacle bears a general resemblance to the Jewish original. By the present discipline, the tabernacle is commonly a small structure of marble, metal, or wood, placed at the posterior part of the altar, and of costly material and workmanship. Even when the exterior structure is of marble or metal, there is commonly an inner receptacle of wood (properly cedar), lined with silk. The tabernacle is appropriated exclusively to the reservation of the Eucharist, and it is prohibited to keep within it any other object, however sacred, as the chrism, relics of saints, the altar-vessels, &c. A lamp is constantly kept burning before the tabernacle, which is ordered to be kept at all times carefully locked, the key being retained by the clergy, to whom it is forbidden to intrust it to any lay person, even the sacristan or other official of the church.

TABERNACLES, FEAST OF (Heb. *Succoth*, LXX. *Heorte skenon*, Vulg. *Feriæ Tabernaculorum*), a Hebrew feast of seven days' duration, beginning on the fifteenth day of the seventh month (Tishri), and instituted principally in memory of the nomad life of the people in the desert, and the booths or tents used on their march. Besides this signification, it also had an agricultural one, like the other two pilgrimage festivals, the Passah and the Feast of Weeks. It was emphatically the Feast of 'Ingathering'—i. e., the close of the labors of the field—the harvest of all the fruits, of the corn, the wine, and the oil. During this feast, the great bulk of the people were enjoined to dwell in booths, which we learn from Nehemiah viii. 15, were made of olive, pine, myrtle, palm, and other branches, and were erected on the roofs of houses, and in the courts and streets. The scriptural injunction, to take trees and 'boughs of goodly branches of palm-trees,' &c., was by tradition explained to mean a bunch made of palm, myrtle, and willow branches, and the esog-fruit, a species of citron, which the faithful carried in procession during these seven days in the Temple; while those who did not visit the Temple only said a benediction over it on the first day. The Sadducees and Karaites, however, demurred to this explanation, taking the passage merely to refer to the construction of the booths. Special sacrifices, and a greater number of burnt-offerings than on any other festival, were offered up on this; and on it also the law was to be read to the people every seventh year. It was emphatically called *the* festival, and was the most joyous of them all.

There was especially, during the time of the Temple, the 'joy of the libation,' consisting of the priest's fetching, during the morning sacrifice of each day, water from the well of Siloah, and pouring it out, with the accompaniment of music and hymns. There was further a grand illumination in the evening in the court of women, which is said to have lighted up the whole city of Jerusalem; and during and after which, dancing and singing took place. On each day the trumpets were sounded 21 times. At the end of the seven days' joy, an eighth day of solemn rest was celebrated, which was perfectly distinct from the other days both in its sacrifices and in its general service. The bunch was laid aside, the booths were relinquished, and a sin-offering—in expiation of transgressions that might have taken place during the hilarity of the previous feast-days—was slaughtered.

Three distinct times we find the inauguration of the Temple celebrated on this important festival, by Solomon, Ezra, and Judas Maccabæus, although with regard to the festival itself, it would seem from Nehemiah viii. 17, that it never had been properly celebrated before the Exile. The observances of the booths and the harvest-bunches are still in force with the strict adherents of traditional Judaism, although the agricultural signification of the festival to them can only be a historical or poetical reminiscence. It has been well observed of old, that no festival could have been more apt to inculcate the fundamental principle of Judaism—viz., the equality of all men, than this, which enjoined that every one should live for a time in primitive dwellings, without distinction of rank or station, or fortune, and should rejoice in the fruits of the last harvest on the hallowed spot, together with the whole people of the land, 'before the Lord.'

TABE'RNÆMONTA'NA. See COW-TREE and FORBIDDEN FRUIT.

TA'BES DORSA'LIS, an affection of the nervous system, now known in medicine as *locomotor ataxy*. T. D. was so named by Romberg of Berlin; but Dr. Todd of London in 1847 first recognized its true nature, and specially insisted on the distinctions to be drawn between T. D. and *Paraplegia* (see PARALYSIS). The name of *locomotor ataxy* was first applied to the affection by Dr. Duchenne of Paris. It is characterized by a want of power in harmonizing the action of certain muscles, the absence of such coordinating power being first apparent in the lower extremities, and the gait in consequence being straggling and unsteady. True paralysis is absent, but sensitiveness is diminished, and neuralgic pains are present in the legs and feet. The loss of power progresses, and the later stages of the malady are marked by such symptoms as disordered vision, incontinence of urine, and exhaustion. The duration of this disease varies. It may run its course in a few months, or be prolonged over years. The *etiology* or *causes* of T. D. are still obscure. Mr. Lockhart Clarke has shown that a peculiar change in the posterior columns of the spinal cord, and in the posterior or sensory roots of the spinal nerves, accompanies this disease. Prolonged exposure to cold and damp, drunkenness, sexual excesses, masturbation, and like causes have been credited with inducing the disease. It is alleged to be more common in males than in females, and subjects between the ages of 30 and 50 are said to suffer most frequently from its attack.

The characteristic movements in T. D. are worthy of note. The patient has an unsteady gait, and walks like a drunken person, but soon recovers his bearing in some degree. A difficulty in carrying out the intents of the will is experienced, and in picking up an object one hand is employed to steady the other. When the eyes are shut, the patient walks with extreme difficulty. T. D. may be distinguished from disease of the cerebellum by the absence of the characteristic pain at the back of the head, and vomiting. The *prognosis* of T. D. is very unfavorable. Its progress may be retarded, but the prospect of ultimate cure is well-nigh hopeless. The *treatment*, as may readily be understood, is limited to the improvement of the general health, rather than to any specific remedies. Warm clothing, nutritious food, and rest are the chief items in the course of treatment prescribed for this disease; whilst opiates are indicated for the relief of the neuralgic pains. Sulphur baths have been prescribed in the earlier stages to relieve the numbness, and attention requires to be paid to the bowels with a view of alleviating constipation.

TABINE'T, a rich kind of cloth, chiefly used for window-curtains. It consists of a warp of silk and a weft of wool-yarn, of the same kind as that used in making poplin. It has the appearance of a fine damask, and is usually enriched with diaper patterns.

TABLEAUX VIVANTS (i. e., Living Pictures), representations of works of painting and sculpture, or of scenes from history or fiction, by living persons. They are said to have been invented by Madame de Genlis, when she had charge of the education of the children of the Duke of Orleans. They have long been common in theaters, and have more recently become an amusement of private circles. In an æsthetic point of view, they are of no value whatever, but rather are of injurious influence, and contrary to just principles of taste.

TABLE-LANDS, or PLATEAUX, are extensive plains at a considerable elevation above the sea, whose boundaries are either ranges of mountains much higher on the side away from, than on the side next to, the table-lands; or steep acclivities, sloping from the level of the plateaux to the surrounding country. They are often traversed by mountain chains, and occasionally even lose the character of plains altogether, being mere conglomerations of hills. The chief table-lands are in Europe, Central Spain; in America, the Oregon territory, the great salt plain of Utah, the north and center of Brazil; in Africa, the interior of Barbary; while in Asia, almost the whole of the south and center of the continent consists of plateaux, which rise terrace above terrace till they culminate in that of Tibet. Of the Asiatic plateaux, the principal are: that of Asia Minor (3280 feet above sea-level), Armenia (7000 feet), Persia or Iran (3000 feet), Mysore (4000—5000 feet), Deccan (1500—2000 feet), Tibet (12,000—17,000 feet), and Chinese Tartary (3000—4300 feet). These table-lands are generelly accounted for by the supposition of a more extensive and uniform action of the upheaving force than that which produced mountains; and satisfactory indications of the former action being quite recent, and long subsequent to the latter, are occasionally discovered.

TABLE-MONEY is an allowance granted to general-officers in the army, and flag-officers in the navy, to enable them to fulfil the duties of hospitality within their respective commands. It

varies according to the locality or importance of the appointment, £3, 3s. a day being the maximum, except under very unusual circumstances.

TABLE MOUNT. See CAPE TOWN.

TABLES, LUNAR, are tabular lists of the values of the elements of the moon's orbit, as planetary tables are those of the elements of the planets' paths; but the term is also occasionally employed to denote the tabulated angular distances of the moon from certain stars at fixed epochs, as given in the *Nautical Almanac* (q. v.). See LATITUDE.

TABLE-TURNING. See ANIMAL MAGNETISM; SPIRITUALISM.

TA'BOR, a celebrated mountain of Northern Palestine, rising solitarily in the north-eastern part of the plain of Esdraëlon, to about the height of 1000 feet, and commanding the most extensive and probably the most magnificent prospect in the Holy Land. Eastward, the eye catches a gleam of the waters of the Galilean Sea, 15 miles distant; while the whole picturesque outline of its deep-sunken basin, of the rolling trans-Jordanic plateau, and the course of the sacred river itself, is clearly traceable; westward stretch away into the dim horizon the rich plains of Galilee, rising up into the dark-green ridges of Carmel, overhanging the Levant; on the north and north-east, the snow-covered heights of Hermon (see LEBANON) glitter pale over the intervening hills; while to the south, the view embraces the fatal heights of Gilboa and the confused landscapes of Samaria. T. itself is at present thickly clad with forests of oak, pistacias, &c., the haunt of wolves, wild-boars, lynxes, and various kinds of reptiles. Its beauty alone would be sufficient to insure it distinguished mention among the mountains of Palestine, but it owes its celebrity even more to its having been regarded from an early period as the Mount of Transfiguration. This opinion, however, is now all but universally abandoned, as there is strong evidence of its summit having been then occupied by a city; and travelers are disposed to look for the scene of this supernatural incident further north, in the neighborhood of Hermon. In the times of the Crusaders, T. was studded with churches and monasteries, relics of which, as well as of Roman and Saracenic structures, still remain.

TA'BORITES (a sect of the Hussites in Bohemia) derived their name from their fortress of Tabor, near the river Luschnitz, an affluent of the Moldau, 49 miles south-south-east of Prague. There is now a small town at the place, which has a pop. of 6717, and carries on some woollen manufactures, &c.—The first leader of the T. was John Ziska (q. v.) of Trocynow. Under him was Nicolas von Hussinecz, who repelled the imperial army from Tabor in 1420. The Calixtines, desirous of the peace of the country, offered the throne of Bohemia first to King Ladislas of Poland, then to the Grand Duke Witold of Lithuania, and afterwards to his brother Coribut. Ziska refused his consent, and thus these parties became completely separated. In the years 1420 and 1421, both of them set forth their creed in a number of articles. The T. absolutely rejected all ordinances of the church not expressly appointed in the Holy Scriptures. Both parties were united by common danger in opposition to a common enemy. In 1422, Ziska defeated the Imperialists at Deutschbrot, and thereafter with uninterrupted success in a number of minor conflicts; and in 1424, Prague was saved from destruction only by submitting to hard terms of peace.

After Ziska's death, Procop (q. v.) the Greater, or Procop Rasa (the Shaver), and Procop the Less were their leaders. In 1427 and 1431, they gained great victories at Miess and Tachau over the mercenary crusaders of the German Empire, and till 1432 their incursions were the dread of the neighboring countries. The Council of Basel, finding them still unconquered in 1433, proceeded to treat with them; and the Calixtines entered into an arrangement, known as the *Prague Compact*, which, however, was despised by the T. and the Orphans, as that section of the T. who considered Ziska as irreplaceable, had come to be termed. The T. and Orphans were completely defeated at Böhmischbrot on May 30, 1434, by the now united forces of the Roman Catholics and the Calixtines. In the treaty of Iglau, in 1436, the Emperor Sigismund confirmed the compact, and promised religious and political liberty. The civil war, however, continued till King Ladislas in the Diet at Kuttenberg, in 1485, established a religious peace, securing both Roman Catholics and Calixtines in their possessions. The T. were eventually lost in the sect of Bohemian Brethren (q. v.) which arose from amongst them.

TA'BOUR, a small drum, played with one stick, in combination with a fife. It was formerly used in war, but has now given place to the kettle-drum.

TABRI'Z (pronounced and frequently written *Tabreez*), a great and ancient city of Persia, capital of the province of Azerbijan, 40 miles east of Lake Urumiah, and on the Aji, which flows south-west into that lake. The town is surrounded by a ditch and a brick wall, pierced by 7 gates. It forms an oblong of gardens and houses, 2¼ miles long; stands 4000 feet above sea-level, but nevertheless has the appearance of being shut in by mountains. The streets are broader and cleaner than in most eastern cities, but they are flanked as usual by the pits from which the earth required for their houses was taken; the houses are infested with noxious insects; and the bazaars are roofed with sticks, and are dark and dirty. Water, however, is comparatively plentiful. The chief buildings of T. are not specially striking. Perhaps the principal architectural feature of the town is the fine ruin, Kabúd Masjid, or 'blue mosque,' about 300 years old, and in part covered with blue tiles beautifully arabesqued. The citadel is a spacious edifice of burned brick, the walls of which, however, have been cracked in many places by earthquakes.

T. is the seat of a varied industry, in which leather and silk manufactures and gold and silver smith's work alone are of importance; recently it has also become the emporium of an extensive trade, the exact value of which, however, is not known, owing to the careless manner in which the custom-house officials transact their business, and to the prevalence of smuggling. Merchandise, to the value of £400,000, is exported through the regular channels from T. to Russia; but it is estimated that, in 1859, a quantity of equal value was conveyed to that country by smugglers. Since 1859, this illicit traffic has very much diminished, although it still exists along the whole Russo-Persian frontier of Azerbijan. The chief imports are cotton fabrics, sugar, woollen cloth, and wines and spirits. The chief exports are cotton cloths (originally from England), drugs and spices, dried fruits, shawls, carpets, and raw silk. The commerce of 1877–8 was very small, mainly on account of the Russo Turkish war, which arrested the trade between Trebizond and T. The imports were in that year valued at £525,500, the exports at only £270,000; while in 1873–4 the collective trade amounted to over £7,100,000. The Anglo-Indian telegraph line passes through the city.

T., the ancient *Tauris*, became the capital of Tiridates III., king of Armenia, in 297 A.D., and was probably at that time an old city. In 791 A.D., it was enlarged and greatly embellished by Zobaidah, the wife of Harûn-al-Rashid. In 858, aad again in 1041, the city was devastated by an earthquake. It was taken and sacked by Timur in 1392, and was soon after seized by the Turkomans, from whom it was taken by the Persians in 1500. In 1721, it was again visited by a dreadful earthquake, and on this occasion 80,000 persons are said to have perished. It has been several times in the hands of the Turks, but was finally taken from them by Nadir Shah in 1730. T. is a city of Turks, and Turkish is the language spoken. Pop. variously estimated at 110,000—180,000.—Eastwick's *Three Years' Residence in Persia* (Lond. 1864), and *Commercial Reports from Her Majesty's Consuls* (1878).

TA'BU, TAPU, or TAMBU, a Polynesian term, denoting an institution found everywhere, and always essentially the same, in the Polynesian islands and in New Zealand. Its primary meanings seem to be exactly the same as those of the Hebrew *to'ebah*. This word, like the Greek *anathema*, the Latin *sacer*, and the French *sacre* (and the corresponding and similar terms in most languages), has a double meaning—a good sense and a bad; it signifies on the one hand, sacred, consecrated; on the other hand, accursed, abominable, unholy. It results from a thing being held sacred, that certain acts are forbidden with reference to it, and from any act being deemed abominable, that it is forbidden; a notion of prohibition thus attaches to the word tabu, and this is, in many cases, the most prominent notion connected with it. The term is often used substantively in the sense of a prohibition, a prohibitory commandment. If a burial-ground has been consecrated, it is tabu; to fight in it is then an act sacrilegious and prohibited, and this also is tabu; moreover, those persons are tabu who have violated its sanctity by fighting in it, and they are, loosely and popularly, said to have broken the tabu. This example illustrates all the uses of the word. It has furnished to the English language the now familiar phrase of being 'tabooed' = forbidden.

The extent to which, among the Polynesians and New Zealanders, things and acts are tabu, must appear almost incredible to Europeans unaware of the facts of savage life. Without much detail, it is impossible to convey any idea of it. The prohibitions, however, divide into two classes: one consisting of traditional rules, binding upon all, acting through religious terror equally upon chiefs and people; the other, of prohibitions imposed from time to time, obviously with the view of maintaining or extending the authority of the chiefs. Those of the first class are by far the most remarkable. Of the most important of them—those bearing upon what are called sacred things, those relating to the person of the chief, and those relating to intercourse between relatives—a few examples may be given.

Any house or piece of ground consecrated to a god is tabu; and thus affords an inviolable shelter to men fleeing from an enemy. *A fortiori*, all temples are tabu. To sit upon or to touch the threshold of a temple, is tabu to all except chiefs of the first order; the

lesser chiefs may stride over the threshold, but common persons pass over it on their hands and knees. It is tabu to eat the plant or animal believed to be the shrine of one's tutelary god. To come in the way of a funeral procession is severely tabu, for it is believed that the gods accompany the procession; if any person were to disregard the warning chant of the mourners, they would rush at him and put him to death. Again, to touch the person of a chief, is tabu to his inferiors; also, to touch anything belonging to him, to eat in his presence, to eat anything he has touched, or to mention his name. And a chief's threshold is as sacred as that of a temple, and must be passed over in the same manner.

It is strictly tabu to touch a dead chief or anything which belonged to him, or any of the clothes or utensils employed in his interment; even those employed in laying out the body pay the penalty of infringing this prohibition. The interdict upon family intercourse varies in extent in different places. In the Tonga Islands, it was tabu to mention the name of father, mother, father-in-law, mother-in-law; also to touch these relatives, to eat in their presence (unless with the back turned, when constructively the person was not in their presence), or to eat anything which they had touched. In the Fiji Islands, generally, it is tabu for brother and sister, first-cousins, father-in-law and son-in-law, mother-in-law and daughter-in-law, brother-in-law and sister-in-law, to speak together, or to eat from the same dish. Husband and wife, too, are forbidden to eat from the same dish. In some places, a father may not speak to his son after he has passed his 15th year. In an immense number of cases, equally extraordinary, the tabu is used to enforce the prevailing ideas of social propriety. It interferes with cooking, eating, dressing, speaking: scarcely anything is too minute to be regulated by it.

The traditional tabu also supplies to some extent the place of laws and a police. In many places, exposed property of some kinds is always under its shelter. In some cases, it appears to have been worked in the interest of the priests; thus, certain foods—for example, turtle—are always tabu, and cannot be eaten until a portion has been set aside for the gods. There is a purely superstitious use of it, too, in relation to common things, as when a canoe is made tabu that it may go more safely.

The chiefs have a large discretionary power of declaring articles or actions tabu; indeed, their power is unlimited, but they are expected to keep within precedent. In many cases, they use it for purely public purposes—thus, when a feast is coming on, they lay a tabu upon pigs and nuts, and other articles, that there may be abundance for the feast. And when a scarcity of anything is apprehended, they place a temporary tabu on its use. Speaking generally, any article of food—fish, flesh, fowl, grain, or fruit—may be rendered tabu. A coast, a river, a hunting-ground, may be declared tabu; and then there is an end of fishing, and sailing, and hunting, until the chief has withdrawn the prohibition. The tabu is obviously a powerful instrument of government; and the chiefs are very adroit in using it for their own advantage.

When a man has accidentally infringed the tabu against touching a chief, or a relative, or things immediately connected with him, he is freed from the state of tabu by a ceremony called *moëmoë;* this consists in pressing, first the palms, then the back of the hands, to a superior chief's foot, and afterwards washing the hands with water. If a man has accidentally eaten food which a relative or chief has left, he goes through a ceremony called *Fota,* which consists in pressing a superior chief's foot against the stomach. Any breach of the laws relating to sacred places, must be atoned for by sacrificing to the offended god. A person, when he is tabu, must not use his hands in feeding himself or in working; were he to feed himself, it is believed that he would die; he must be fed by others until the tabu is removed. In many cases, the tabu can only be removed by time. Thus, a common person, who has touched a dead chief, remains tabu for ten lunar months; a chief for four or five months, more or less, according to the deceased's superiority over him. In several cases, breach of tabu is punished with death; in many, it involves a sort of outlawry—the neighbors of the offender being free to carry off or to destroy his goods.

It is obvious that the effect of breaking a tabu—at any rate, one effect of it—is to produce uncleanness. The offender has done someting unholy, accursed; his hands are not clean; if he has not sinned in the last degree, he must make atonement or undergo purification. The chief, holding a divinely appointed rank, recognized as a semi-divine person, descended from the gods, is the medium of purification; he has authority to loose as well as to bind. The offence consists in a thing having been done displeasing to the supernatural powers, for which, it is believed, they will not fail to take vengeance. It is not, in the general case, an offence against any particular god; nor is the punishment of it looked for from one god more than from another. Tabu is certainly older than most of the Polynesian gods; it must have existed for ages before the mythologies took their present shapes; it might have existed before any name for god had become current. It has no connection with fetishism. The Polynesians do not worship natural objects; their belief that certain plants and animals are the shrines of gods, would naturally lead to the worship of those; but in fact, they merely do not eat the plant or animal which is the shrine of their tutelary god. And though this is enforced by a tabu, the tabu is evidently distinct from the belief in the god's connection with the plant or animal; it is only the means of enforcing that belief—being the customary means used to prevent any act which would provoke a god to anger.

The origin of tabu seems to be a vague fear of superhuman powers; this has become associated with certain things and acts; thus practically, tabu is a system of divinely appointed restraints—religion, in the primary sense of the word. The religious horror has attached itself—or, through the policy of priests and rulers, has become attached—to every prohibition supported by a strong expediency; which it is apt to do among rude peoples, especially where the prohibition relates to the family, or to the relation of tribesmen to their chief. It must have been through a long process of construction, carried on by the governing classes—the chiefs and the priests—that tabu became the system it now is. The extensive political application of tabu is sufficient evidence that the Polynesian chiefs have been adepts in the art of turning the religious feelings of their countrymen to their own account.

TACAHOUT is the name given, in Algiers, by the Arabs to the small gall formed on the Tamarisk tree, *Tamariscus Indica.* Since the discovery of photography, these galls have become of considerable importance as a source of gallic acid, of which they contain a large proportion. The French chemists import considerable quantities; and the same gall, under the name of Mahee, is imported for the same purpose by British chemists from India.

TA'CAMAHAC, or TACAMAHA'CA, a name which, from the number of its applications, has produced considerable confusion in the history of commercial products. No less than four different resins are known under this designation. One, from Mauritius, is obtained from a tree common in India and its islands, called the Poon-wood Tree, *Calophyllum inophyllum.* Another, from South America and the West Indies, is obtained from *Zanthoxylum* (*Fagara*) *octandra*—this is usually called Shell Tacamahac. A third, also from South America, is yielded by a tree called *Icica tacamahaca;* it is supposed to be the Mexican Copel. And the fourth is from North America, and is the produce of the Carolina or Tacamahac Poplar; it is collected in small quantities, and has only a small value for supposed medicinal properties. The others are chiefly used for varnishes.

TA'CCA, a genus of plants of a small natural order called *Taccaceæ,* nearly allied to *Araceæ.* They are large perennials with tuberous roots. The species are few, and are found in maritime places and woods in the South Sea Islands and the warmest parts of Asia and Africa. Some of them (*T. pinnatifida,* &c.) are much cultivated for the sake of their tubers, which are used as an article of food, although they are acrid, and require maceration in water to remove their acridity, on account of which also they are generally eaten with vinegar, or some acid substance. They contain a large quantity of starch, which is wholesome and nutritious, and is imported into Britain as a substitute for West Indian arrow-root. It is known as *Tahiti Arrow-root.* Dr. Seemann says that it is an effectual cure for dysentery, which other arrow-root is not.—The boiled leaf-stalks of the plants of this genus are also used in China and Cochin-China as an article of food.

TA'CIT RELOCA'TION, in the Law of Scotland, is a phrase borrowed from the Roman law, signifying that when a tenant continues in possession of the lands after his lease or term has ended, there is an implied or tacit renewal of the lease, whereby he continues bound to pay the same rent and observe the same stipulations.—The same doctrine exists in English law, though the above phrase is not used.

TACITU'RNITY, in the Law of Scotland, is a mode of extinguishing an obligation by mere silence, and making no claim upon it within a long time. It is a distinct ground, and embraces a shorter period than the ordinary prescription or Limitation (q. v.); for if a creditor never apply for payment or performance of the obligation, a presumption arises either that there never was such an obligation, or that he has abandoned it. Much depends on the circumstances of each case whether such a doctrine is applicable; and, as a general rule, the periods of prescription are adopted as superseding the common law doctrine of taciturnity.

TA'CITUS, Caius Cornelius, the historian. Of his parentage, or of the time and place of his birth, we can only conjecture that his father was probably Cornelius Tacitus, a Roman eques, who is mentioned as a procurator in Gallia Belgica, and who died in 79. From the emperors Vespasian, Titus, and Domitian, he received promotion and other marks of favor; and in 78, he married the daughter of Caius Julius Agricola. In 88, when Domitian was emperor, and T. prætor, he assisted as one of the quindecemviri at the celebration of the *Ludi seculares.* Agricola died in Rome in 83, while T. and his wife were absent; and noth-

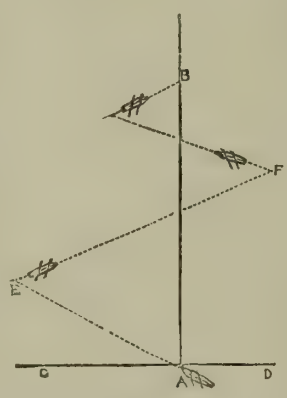
ing further is known of the historian till 97, when, in the reign of Nerva, he was appointed consul suffectus, succeeding T. Virginius Rufus, whose funeral oration he delivered.

T. had already attained distinction as an orator when the younger Pliny was entering upon public life; and both of them were appointed, in Nerva's reign, in 99, to conduct the prosecution of Marius, then proconsul of Africa. T. became one of the most intimate friends of Pliny, of whose letters 11 are addressed to him. The time of T.'s death is unknown, but he most probably survived Trajan, who died in 117. His extant works are: (1) *Vita Agricolæ*, written after the death of Domitian in 96, and universally admired as a masterpiece of noble sentiment and pregnant epigram. (2) *Historiæ*, written after Nerva's death in 98, and before the *Annales*, and embracing the period from the second consulship of Galba in 68 to the death of Domitian in 96. Only the first four books have reached us in a perfect state, but there must have been many more. (3) *Annales*, commencing with the death of Augustus in 14, and closing with the death of Nero in 68. These also have reached us only in an imperfect state. (4) *De Moribus et Populis Germaniæ*. This treatise is trustworthy only as regards those Germans who were best known to the Romans from their proximity to the Rhine. For the provinces beyond that river, it has no value, whether geographical or political. (5) *Dialogus de Oratoribus*, if the work of T. at all, must be his earliest. T. is one of the greatest of historians. In love of truth and integrity of purpose, he is equalled by few; in conciseness of phrase and power of saying much and implying more in one or two strokes of expression, he is rivaled by none. The best editions are those of Orelli and Halm.

TACK, the Scottish law-term synonymous with Lease (q. v.).

TACK, TACKING. The *tack of a sail* is the lower windward corner. The *tack* is the rope employed in hauling down that corner to its proper position. The *tack* of a fore-and-aft sail is its lower forward clue or corner; it also designates the rope for hauling down that corner. A ship is said to be on the *starboard* or *port tack* when she is close-hauled with the wind on the starboard or port side.

Tacking is the practice of beating up against an adverse wind by a zigzag course. If a vessel at A require to sail due north to B, and if the wind be either north, or from any point north of the line CAD, it is obvious that the wind will not carry her directly to her destination. As an extreme case, let the wind be north, or dead against her. By setting her sails obliquely, as at A, it will be possible to beat up in the direction AE. If the master consider that at E he has passed sufficiently from his straight course to B, he will then put his helm a-lee, which brings the ship's head straight to the wind, the tacks of the sails being at the same time set free. The after-sails are then smartly braced over to the opposite side, and the ship's head falls off from the wind in an opposite direction to that previously held, until the course is EF. This process is repeated on each side of the line AB, until at length the ship makes her port, B. The length of each tack, as EF, is called a *board*.



When the wind is straight ahead, as in the above example, the several boards should obviously be equally on each side of the line AB. If, however, the wind were not so direct, it would be necessary that the boards in one direction should be shorter than those in the other. Sometimes, from the nature of the channel, as an estuary, &c., it is necessary to take a long tack one way, say to starboard, and a very short one to port. This is known as 'sailing with a long and a short leg.'

TACKING OF MORTGAGES, in the Law of England, is a practice that sometimes occurs in the course of mortgage securities, when one person acquires more than one mortgage over the same estate. Thus, though mortgages, according to the general rule, rank according to the order of date, yet, if a third mortgagee, who became so without notice of a second incumbrance, purchase the first mortgage even after notice of the second mortgage, so as to acquire a legal title, and if he holds them both in his own right, he can tack the one to the other, and so obtain priority for the third mortgage over the second mortgage. This is on account of an old technicality, scarcely intelligible to other than lawyers.

TACO'NIC SYSTEM, an extensive series of rocks in the United States, described by Dr. Emmonds. They consist of two divisions, the Upper having a thickness of 25,000 feet, and containing Lower Silurian fossils; and the Lower, with 5000 feet of thickness, in which, as yet, no fossils have been found, but which is generally considered to be the equivalent of the Cambrian rocks of Britain.

TA'CTICS, MILITARY. Strategy (q. v.) is the art of manœuvring armies with reference to the objects of the whole campaign—the securing of communications, the cutting off an enemy from his base, throwing him into a position where he must fight at a disadvantage, or surrender, &c. Tactics has regard to the evolutions of an army in the actual presence of an enemy. It is the strategy of the battle-field; the science of manœuvring and combining those military units which drill, discipline, and the regimental system have brought to the perfection of machines. It was admirably described by Napoleon as *the art of being the stronger*—that is, of bringing an overwhelming force to bear on any given point, whatever may be the relative strength of the entire armies opposed.

The earliest records of battles are those of mere single combats, in which the chiefs, fighting either on foot or in chariots, performed great deeds; and the commonalty, who apparently were without discipline, were held in profound contempt. With the growth of democracy arose the organization of the Phalanx (q. v.), the advance of which was irresistible; and its firmness equally so, if charged in front. It, however, changed front with great difficulty; was much deranged by broken ground; and failed entirely in a pursuit, or if attacked in flank. Far lighter, and more mobile, was the Roman Legion (q. v.). Among Roman tactics was also the admirable intrenchment, which they scarcely ever omitted as an additional source of strength for their position.

'Events reproduce themselves in cycles;' and with the decay of Roman civilization came again the mail-clad heroes and cavaliers—mounted this time on horses—who monopolized the honors of battle, while the undisciplined footmen had an undue share of the dangers. Later in the feudal period, this disparity between knight and footmen was diminished by the employment of bodies of archers, whose shafts carried distant death. The adoption of gunpowder for small-arms altogether neutralized the superiority of the armored knight. This change brought infantry into the front place in battle, and threw cavalry into the status of an auxiliary.

The French revolutionary wars tended much to the development of artillery as a field-weapon, and Napoleon employed this terrible engine to its fullest extent, a practice followed by the best modern generals, who never risk a man where a cannon-ball can do the work. Frederick the Great was considered an innovator for fighting with infantry four deep. During the French War, the formation of three deep became general, and still obtains in several European armies. Before the battle of Waterloo, the British leaders had acquired sufficient confidence in their troops to marshal them in a double line. It is doubtful whether the advance in arms of precision will not soon necessitate the formation in a single line, or even in a single line in open order.

It is impossible, in an elementary article of this character, to give even an approach to an essay on modern tactics, which is an intricate science. We can only notice briefly a few of the more important principles.

First, as to the art of being the stronger, which is undoubtedly the highest recommendation in a general, we may cite the example of the battle of Rivoli. In 1796, Napoleon was besieging Mantua with a small force, while a very much smaller army operated as an army of observation. The Austrian commander had collected at Trent a force powerful enough to crush completely the French army, with which he was marching south. Parallel with his course lay the Lake of Garda, and to prevent the enemy escaping up one side, as he marched down the other, the Austrian leader divided his army into two powerful corps, and marched one down each side of the lake. The instant the young French general knew of this division, he abandoned the siege of Mantua, collected every available man, and marched against one body of the enemy. Though far inferior on the whole, he was thus superior at the point of attack, and the victory of Rivoli decided virtually the whole campaign. This corresponded in principle with Napoleon's general plan in battle. He formed his attack into column, tried to break through the center of the enemy's line; and if he succeeded, then doubled back to one side, so as to concentrate the whole of his own force against one half of the enemy's, which was usually routed before the other half of the line could come up to the rescue.

Taken collectively, the tactics of the three arms may be thus summarized: The infantry form the line of battle, and probably decide the day by a general advance over the enemy's ground. The cavalry seek to break the opposing infantry by frequent charges in front, or on any flank which may be left exposed. If a part of the line wavers, a charge of horse should complete the disarray. When the rout commences, the cavalry should turn it by furious onslaught into utter discomfiture. The province of the artillery is to cannonade any portion of the line where men are massed, or where a charge is about to be made; to demoralize cav-

alry, and generally to carry destruction wherever it can best disconcert the enemy.

Adverting now very briefly to the tactics of the several arms individually, we have—

Infantry.—This force has four formations—skirmishers, line, column, and square. The skirmishers precede and flank an advancing line or column, picking off the enemy, whose masses offer good mark, while their own extended order gives them comparative impunity. If resistance be encountered in force, the skirmishers retreat behind their massed supports. The line is a double or treble line of men, firing or charging. For musketry purposes, it is the most formidable formation, and is the favorite British tactic in every case where the officers can depend on the steadiness of their men. For bursting through a line, the deep column is the most effective. It is the favorite French formation, and during the Revolutionary and Napoleonic wars, the British and Russians alone succeeded in resisting it.

At Vimiera, the 50th Regiment, 700 strong, stood in line: it was attacked by a column of 2000 French. The English colonel threw back his left (which was the end attacked), and advanced his right, delivered a volly at point-blank range, charged the column in flank, and utterly routed it before the French could deploy into line to resist the onslaught. The column is therefore the best formation on a march; the line when in actual collision with the enemy. The formation in Echelon (q. v.) to a great extent combines these advantages. See SQUARE.

Cavalry.—The function of heavy cavalry is limited to the charge in line. The light cavalry form in small sections, to scour the country, collect supplies, and cut off stragglers.

Artillery.—No distinct tactics exist for this arm beyond the fact, that a concentrated fire is vastly the most effective, and that the artillery should always have a support of infantry at hand, to protect it from a sudden incursion of hostile cavalry.

Tactics of position depend on the moral energy of the commander-in-chief. Few would dare, as Cæsar did, an invasion in which there was no retreat, if defeated. It is a military maxim not to fight with the rear on a river, unless many bridges be provided for retreat, in case of disaster. A convex front is better than a concave front, because internal communication is more easy. The flank should be protected by cavalry, or preferably by natural obstacles. In battle, a long march from one position to another, which exposes the flank to the enemy, is a fatal error. By such, the French won Austerlitz, and lost Talavera. In a pursuit, a parallel line is better than the immediate route the retreating enemy has taken, as supplies will be more readily procured, and he may by celerity be attacked in flank. This was strikingly exemplified in the Russian pursuit of Napoleon's army retreating from Moscow.

TACTICS, NAVAL. With the advent of steam, iron-plated ships, and rams, the tactics under which Rodney and Nelson fought and conquered have passed away, while the principles of the new warfare have scarcely been sufficiently established for reduction to theory. A glance at the obsolete tactics of bygone times must therefore suffice in the present article.

In ancient naval engagements, where the vessels fought on the comparatively smooth waters of the Mediterranean, and where the use of oars rendered the commanders nearly independent of the wind, the attack consisted of a charge with the beaked prows, followed, if that failed, by the use of balistæ and a hand-to-hand struggle. See NAVIES, ANCIENT. The introduction of gunpowder, with broadside ordnance, necessitated a change, and the great desideratum of each admiral was to present as long a line of broadsides as possible to the enemy, to take care that none of his ships was masked by the intervention of another between it and the foe, and to endeavor in each ship to oppose its broadside to the bow or stern of a hostile ship, so as to obtain the preponderance of force, and to rake his decks. The ships of two decks and upwards formed the line of battle, while frigates and smaller vessels served as look-outs and skirmishers. A fleet in one line would, however, have been of inconvenient length for sailing, and it was usual to sail in three, six, or nine parallel lines while traversing the ocean, the ships of the rear lines tacking into their places in the line of battle on the signal to form for action. The great principle of manœuvring was to get the weather-gage, i. e., to be to windward of the enemy, both for facility of navigation, and because the smoke would inconvenience him most. The standing attempt during the French war was to double the enemy's line (see CLERK, JOHN, of Eldin), by piercing it, or passing it at the van or rear, and then, by tacking in its rear, to place his ships between two fires. This was first practised in Lord Rodney's action of 1782, and was successfully repeated by Nelson at the battle of the Nile.

Under steam, and with ships carrying colossal ordnance, naval tactics have entirely changed. It used to be the object to avoid being raked; it is now to avoid being hit at all. The projectiles used are so tremendous that a few hits involve destruction. Ships are consequently constructed so as to offer the least mark to ordnance; and with the same view, they are kept constantly in rapid motion. Actions are fought, not, as in old time, within pistol-shot, but at a mile or two miles' distance. The loss of life is less; for the battle is no longer decided hand to hand by the cutlass and the boarding-pike, following a furious cannonade; but after a few long shots with ponderous missiles, one or other vessel becomes disabled, and being helpless, yields the victory to her foe. The ships will be steamed end on if they act as rams, and also to offer less mark to shot. Rival fleets have never yet met on a large scale to fight under the conditions of modern war.

TADEMA, LAWRENCE ALMA, a distinguished painter, born 8th January 1836, at Dronryp in the Netherlands. He was educated at Antwerp, but early settled in London, where he was naturalized as an English subject in 1873. His numerous and very popular paintings deal chiefly with antique classical and Egyptian subjects, which, under T.'s handling, have a very vivid air of reality. 'How they amused themselves in Egypt 3000 years ago' (1863), is one of T.'s earlier paintings; 'Cleopatra' (1882), one of his last. T. is an R.A., a member of various foreign academies, a chevalier of the Legion of Honor, &c. There was an exhibition of T.'s pictures in the Grosvenor Gallery in 1882.

TA'DMOR. See PALMYRA.

TA'DPOLE. See FROG.

TAEL, a money of account in China, is equivalent to about 6s. 8d. sterling, or to a thousand of their sole coin, the 'tsëen,' tchen, or 'cash.'

TÆNIA AND TÆNIADÆ. See TAPEWORM.

TAE-PINGS, the name given to the Chinese rebels who made their appearance in 1850, and (see CHINESE EMPIRE) desolated some of the best cultivated provinces of China. After the war of 1860, it became the interest of the English, French, and American governments to re-establish order in China. The repulse of the rebels at Shanghai in August 1860 had been followed by several engagements between them and the imperialists, in which the T. were defeated, mainly in consequence of the re-organization of the imperial army by Ward, an American. In the beginning of 1862 the T. again advanced on Shanghai, and were twice defeated. In that year Ward was killed; and 'Ward's force,' handed over to an English officer, took the name of Gordon's brigade. Permission was also granted to Captain Sherard Osborne to organize in England a small fleet of gun-boats, to ascend the Chinese rivers and re-establish order. Gordon's brigade rendered essential service to the imperial government. The rebels were defeated in upwards of 16 engagements; and in 1864, almost every important city was taken from them. Captain Sherard Osborne's expedition was less successful. He found that the jealousy of the Chinese officials would not permit him to take the steps necessary to discharge properly the duty he had undertaken, and he therefore threw up his commission, and returned to England.

The conduct of the imperial authorities at Su-chow, where a horrible massacre took place, led to the withdrawal of the English military force: but the rebellion had been effectually checked. They were finally dispersed in April 1865, when they were routed by the imperial army at Kia-ying-chou in Kwan-tung. In the same year, the Nienfei, or marauders of the north, began to be troublesome. This was a marauding expedition, without political significance, organized by restless spirits among farmers who had been ruined by the overflowing of the Yellow River, the repair of the embankments of which had been neglected on account of the confusion and expense of the Tae-ping rebellion. The last show of active warfare made by a body of Nienfei was in the beginning of 1866, when, joined by some imperialist regiments whose pay was in arrear, they threatened Hankow; and would have attacked the European Settlement but for the arrival of some English gun-boats. The malcontent imperialists were easily brought back to allegiance, and the marauders were dispersed, and have not been authentically heard of since.

The Mohammedans of the north-west of China give the imperial government trouble from time to time. Their risings are often on political grounds, and they are on this account apt to be confounded with the annihilated Tae-pings. See PANTHAYS.

TA'FFETY (or Taffeta), a term of somewhat general application in silk-mercery. It was formerly applied to all plain silks simply woven by regular alternations of the warp and weft, and is by some writers supposed to be the first kind of silk-weaving known even to the Chinese, from whom it came to us. Modifications have, however, been introduced, by varying the quality of the warp and weft, and by the substitution of various colors for the single one of the original taffety. It has therefore become a sort of generic term for *Plain Silk*, Gros de Naples, Gros des Indes, Shot or Chameleon silk, Glacé, and many others, and even for some combinations of silk, wool, and other materials.

TAFFRAIL, in a Ship, is the rail over the heads of the stern-timbers, extending across the stern from one quarter-stanchion to another.

TA'FIA, a name used in the sugar-producing colonies for a kind of rum distilled from molasses. The term is only in general use in French colonies.

TAFILELE'T (or Tafilelt), one of the four territorial divisions of Morocco (q. v.).

TAGANRO'G, an important seaport of Russia, in the gov. of Ekaterinoslav, on the N. shore of the Sea of Azov, 20 m. N.-W. of the chief mouth of the Don. It was founded by Peter the Great in 1696, was lost to Russia from 1712 till 1774, when it again reverted to the people who founded it, and since that time it has increased in importance yearly. The port of T. is so shallow that large ships cannot approach within half a mile of the quay, and at this distance from shore they load and unload by the help of barges. The harbor is wholly unprotected. Owing to its position on the shore of a very fertile country, it is able to export wheat in large quantities (1,050,156 quarters being exported in 1872), as well as linseed, hempseed, skins, wool, butter, iron, copper, and Russian leather. Of these articles, the last four are obtained from the governments of Perm and Orenburg. The imports are mainly wine, machinery and agricultural implements, tea, fruits, and porter. While the exports have an annual value of about £5,000,000, the value of the imports does not exceed £2,000,000. There are two fairs yearly, and fishery is diligently prosecuted. T., which enjoys a remarkably fine climate, has many handsome public buildings. Pop. (1878) 48,186.

TAGLIONI, MARIE, a celebrated *danseuse*, born at Stockholm, 23d April 1809, of Italian parents, her father (Filipo T., born at Milan, 1777) having been successively ballet-master at several opera-houses in different parts of the continent. Mademoiselle T. made her début in Paris in 1827, where she created a perfect *furor*, and was at once recognized as the first of ballet-dancers. Her success was equally great at most of the other European capitals, London included. She retired from the stage in 1847, and afterwards resided in Italy and in London, where she taught dancing and deportment.

TA'GUS (Span. *Tajo*), the largest river of the Spanish peninsula, rises on the frontier of New Castile and Aragon, between the Sierra de Albarracin and the Sierra de Molina, about 45 miles north-east of the city of Cuenca. It first flows north-west for about 30 miles to its union with the Gallo, at which point it curves to the south-west, and flows in that direction to Toledo, whence it flows west to Abrantes in Portugal. From Abrantes the river flows south-west, and passing Lisbon, enters the Atlantic about 10 miles lower down. At Peralejos, a few miles from its source, it is 1 foot deep, 15 paces broad, and confined between rocky walls 400 feet high. At the city of Toledo, it breaks through a romantic rocky pass, the walls of which are upwards of 200 feet high. From Villavelha, 18 miles within the Portuguese border, the T. is navigable to its mouth, a distance of 115 miles. Above Lisbon, the river widens like an estuary, being in some places 5 miles broad; opposite Lisbon, however, it is only one mile broad. The principal affluents are the Jarama, Guadarrama, Alberche, Alagon, and Zezere from the north, and the Guadiela and Rio del Monte from the south. Total length, 540 miles.

TAHI'TI or OTAHEITE, the chief of the Society Islands (q. v.), is 32 miles long, about 120 miles in circumference, and consists of two peninsulas, connected by an isthmus about 3 miles broad, but which is submerged at high water. Pop. 13,800, of whom more than 13,000 are natives. The chief town is Papiete. In 1880, T. was annexed by France, along with the other Society Islands. For the trade, &c. of T. see SOCIETY ISLANDS.

TAIL, ESTATE, is, in English Law, an estate given to A and the heirs of his body, or A and the heirs-male of his body, or some other class of heirs less extensive than the class of heirs-at-law. It was anciently a question whether in such a case A, the father, could defeat the right of the children, and break the entail. In England, it was early decided that A could, by a sham process, called a fine or Recovery (q. v.), break the entail; while in Scotland it was otherwise, at least since 1685, the Scotch legislature having legalized a mode of securing the entail, and preventing A, or any of his successors, from breaking it. See ENTAIL.

TAILOR-BIRD (*Orthotomus*), a genus of birds of the family *Sylviadæ* (q. v.), with a long graduated tail, the feathers of which are narrow. The species are numerous, natives of the East Indies and of the Indian Archipelago, and haunt cultivated grounds, where they are commonly seen in pairs. Their flight is rapid and undulating, and they seldom ascend above the lower branches of trees. The name *Tailor-bird* is derived from the way in which the nest is formed. Two leaves are taken at the extremity of a twig, and are sowed together by their edges, or a large leaf is sewed together; the necessary holes being made by the bill, and vegetable fibres forming the thread. Within the hollow thus

Tailor Bird and Nest (*Orthotomus longicaudus*).

made, a quantity of a cottony substance is placed to receive the eggs.

TAI'LZIE, the ancient term in the law of Scotland to denote a deed creating an entailed estate. See ENTAIL.

TAIN, a royal, parliamentary, and municipal burgh in the county of Ross and Cromarty, on the south shore of the Dornoch Firth, and 24 miles north-north-east of Inverness. There is no proper harbor. The most interesting building is a small ruined chapel, remarkably rude and simple in architecture, and said to date from the 13th c.; and there is also a collegiate church, founded in 1471, and an endowed academy incorporated by royal charter. Brewing and iron-founding are carried on. Pop. of royal burgh (1881) 2221.

TAINE, HIPPOLYTE ADOLPHE, a French critic, was born at Vouziers in Ardennes, 21st April 1828, and studied at Paris, where in 1853 he obtained the diploma of *docteur ès lettres*, for two essays, *De Personis Platonicis*, and *Essai sur les Fables de Lafontaine*. They were followed by his *Essai sur Tite Live* (1854), crowned by the French Academy; *Les Philosophes Français du dix-neuvième Siècle* (Paris, 1856); *Essais de Critique et d'Histoire* (Paris, 1857); *Histoire de la Littérature Anglaise* (Paris, 1864); *Philosophie de l'Art* (1865; Eng. transl.); *Notes sur l'Angleterre* (1871; Eng. transl.); and others.

In the *Littérature Anglaise* (Engl. transl., Edinburgh, 1872), the author surveys and criticises our whole literature from a point of view which is conceived to be rigorously scientific. According to T., there are three things to be borne in mind when writing the history of a nation's literature: first, the *race* to which the nation belongs; second, its *position* both geographical and in civilization in the different phases of its literary development; and third, the *period* or duration of these. Under this view, the history of literature assumes the character of a psychological problem. Among T.'s recent works is *Les Origines de la France Contemporaine*, of which the first instalment, *L'Ancien Régime*, appeared in 1875 (Eng. transl., 1876). In this the writer gives a graphic account of the social disease that led to the French Revolution. A picture of the revolutionary age itself followed in *La Révolution* (vol. ii. 1881). The New Régime is afterwards to be described. T. was elected a member of the Academy in 1878.

TAI-WAN-FOO, the capital of the island of Formosa (q. v.), on a large plain 3 miles from the south-west coast, with a pop. of 120,000. It is a large straggling town, contains many park-like spaces with fine trees and green lanes, and is surrounded by a high battlemented wall, six miles in extent. Its chief edifices are the residences of the mandarins, and the temples. The harbor of T., at Amping, is only a shallow open roadstead; trade is carried on only in five months of the year, cargo having to be carried in native boats. The chief export is sugar, which is grown all over the plain of Formosa; also rattan canes. About 27 miles to the south is the harbor of Takao, the headquarters of the customs staff; it is better than that of Amping. See a 'Description of Formosa' in the *Geographical Magazine* of 1877.

TAI-YUA'N, a city of China, in the province of Shan-si, on the Fuen-ho, an affluent of the Hoang-ho, 250 miles south-west of Pekin. It is said to be about ten miles in circumference, fortified and populous. Porcelain, iron wares, and carpets are manufactured.

TALAVE'RA DE LA REY'NA, a town of Spain, in New Castile, in the modern province of Toledo, is charmingly situated

on the Tagus, 75 miles south-west of Madrid. It is ancient, straggling, dirty, and inconvenient, is surrounded by interesting old walls, and abounds in antique picturesque fragments. It was formerly a flourishing town; but, of its manufactures, only that of silk is now carried on. Fruits are extensively produced in the vicinity. Here, on the 27th and 28th July 1809, Sir Arthur Wellesley, with 19,000 English and German troops, and about 34,000 Spaniards, who, however, with very trifling exceptions, were not engaged, defeated upwards of 50,000 veteran French troops, under Joseph Bonaparte and Marshals Jourdan and Victor. Pop. (1877) 10,029.

TALBOT, perhaps originally a name equivalent to Bloodhound (q. v.), but afterwards applied to a race of hounds, now extinct, or nearly so, which seem to have been kept for show rather than for use. The T. was of a pure white color, with large head, very broad muzzle, long pendulous ears, and rough hair on the belly. The White St. Hubert Dog was either the T. or a nearly allied breed. The T. is the badge of the ancient House of Shrewsbury (surname Talbot), and the crest of some of the princely Houses of Germany.

TALBOT, WILLIAM HENRY FOX, celebrated in connection with photography, was the son of William D. Talbot of Lacock Abbey, Wilts, and was born in 1800. He was educated at Harrow, and afterwards at Trinity College, Cambridge, where he took his degree with honors, and obtained the junior Chancellor's Medal in 1821. In the first parliament summoned after the passing of the Reform Bill, T. sat for Chippenham; but scientific investigation being more to his taste, he gave up politics, and devoted himself to the problem of fixing shadows, ignorant at the time of what had been effected in this department by Wedgwood and Davy. Step by step he discovered for himself a method of obtaining and fixing sun-pictures, and on the dissemination of a report as to Daguerre's successes in the same field, secured his just rights by publishing a paper (*Phil. Mag.* March 1839), in which the successive steps of his investigation and their result were detailed. See PHOTOGRAPHY. This process, by which a *Negative* (q. v.) was primarily obtained, was subsequently improved by his invention (patent dated February 8, 1841) of the Calotype (q. v.) process. Soon afterwards he obtained fresh patents, for an 'instantaneous process' (which seems to have well deserved the name, as by it a legible picture was obtained of a printed bill fastened to the rim of a wheel revolving 200 times per second), a mode of 'photographic engraving,' and a polyglyptic process. A later invention of his, patented in 1858, was called by him Photoglyphic Engraving; see the art. PHOTOGRAPHIC ENGRAVING. In 1842, T. obtained the medal of the Royal Society for his previous discoveries. Latterly he devoted himself to the study of general physics, and to philological and miscellaneous researches. He died 17th Sept. 1877. Amongst his works are *Hermes, or Classical and Antiquarian Researches; Legendary Tales; Illustrations of the Antiquity of the Book of Genesis;* and a work on *English Etymologies.*

TA'LBOTYPE, a photographic process, called by the inventor Mr. Fox Talbot, the Calotype Process (q. v.). Its essential features consist in the production in the camera of an image by light *on* the *surface* of chemically prepared paper, and this distinguishes it from other *paper* processes, and by consequence from other photographic processes.

TALC, a mineral allied to Mica (q. v.), and, like it, easily separated into very thin flakes, which are transparent and flexible, but not elastic, like those of mica. T. is composed almost entirely of silica and magnesia, in the proportions of 57—63 silica, and 30—35 magnesia, with 2—6 water. Its colors are silvery white, greenish white, and green. It has a pearly or semi-metallic lustre, and is unctuous to the touch, in which it differs from mica. It occurs crystallized, generally in hexagonal tables, or in long prisms: the primary form is a rhomboid. It is also found massive, in beds chiefly in micaceous schists, gneiss, and serpentine.—A kind called *Indurated T.*, or *T. Slate*, has a curved slaty structure, and is not separable into laminæ, like common talc. It approaches in character to steatite, and is used for similar purposes.

TALEGA'LLA, a genus of Gallinaceous birds, of the family *Megapodidæ*, having a strong, thick, and very short bill, the upper mandible curved and pointed; the head and neck almost quite naked; the wings short and round; the tail rather long, rounded on the sides; the legs strong, feathered a little below the joint of the tibia and tarsus; the tarsi covered with scales in front; the toes long and strong; the claws large and sharp. The species are natives of Australia and New Guinea. The best known is the BRUSH TURKEY (*T. Lathami*) of Australia, also known as the WATTLED T. and the NEW HOLLAND VULTURE, the latter name being given to it on account of its naked head and neck, covered in part with fleshy wattles. It is pretty common in New South Wales, inhabiting the most thickly wooded parts. It is a large bird, about the size of a turkey, with blackish-brown plumage. It is shy, and when pursued, endeavors to escape by running through the thickest *brush*, or by leaping to the lowest branches of a tree, from which it ascends higher and higher, branch by branch. It thus avoids the dingoes or native dogs, which, however, often hunt it down on open ground. It is easy game to the sportsman, who finds it roosting under shelter of the branches of trees during the heat of the day, and although several of the flock are shot, the rest keep their place undisturbed.

Brush Turkey (*Talegalla Lathami*).

The T. is generally seen in small flocks, and they make their nests together, the males heaping up, by means of their feet, mounds of several cart-loads of earth and decayed leaves, which are used from year to year, new materials being added every year. The eggs are hatched by the heat of the sun and of the fermenting mound, each egg being separately buried. The parent birds partially uncover them during the day. Nearly a bushel of eggs may sometimes be found in a single heap. The male bird pays great attention to the young after they are hatched, covering them up partially in the mound at night for warmth. The flesh of the T. is excellent, and the eggs are also very delicate and eagerly sought after. It is thought that this bird might easily be added to the list of our domestic poultry.

TALENT (Gr. *talanton*, from a root to balance or weigh), a word used by Homer to signify indifferently a balance, and a definite weight of some monetary currency. But the weight of money to which Homer applies the term talent was very different from that to which it was applied in later times. Tradition assigns to Pheidon, king of Argos, the introduction of the talent as a standard of money and weight.

The *exact* identity of the Æginetan talent with that known as the Babylonian, and generally employed in the East, points to its true origin. It was in all probability introduced into Greece by the Phœnicians, who also introduced a smaller monetary measure and weight, which was by the Greeks known as the Euboic talent. The names Æginetan and Euboic indicate that the talents to which these epithets apply were first used in Ægina and Eubœa; and though, in the East, the larger talent was used for silver, and the smaller for gold, after their introduction into Greece all such distinctive application was soon done away with. The use of the Euboic talent was mostly confined to Athens, Chalcis, and the Chalcidian colonies; while the Æginetan prevailed over the rest of the Greek world. In the 6th c. B.C., Solon introduced at Athens a new talent, which, as the *Attic talent*, succeeded, partly through its superior purity, and partly on account of the greater commercial activity of Athens, in supplanting the other two standards. These several talents were similarly subdivided into 60 minæ, the mina into 100 drachmæ, and the drachma into 6 oboli; and their relative proportions are, Æginetan T. : Euboic T. : Attic T. : : 30 : 25 : 18, both with respect to their values as weights, and as measures of monetary amount.

The following are the values as compared with English standards:

	AS WEIGHT. lbs. avoirdupois.		AS MONEY (SILVER). £.	s.	d.
Æginetan talent	= 95·	=	406	5	0
Euboic "	= 79·16	=	338	10	10
Attic "	= 57·	=	243	15	0

But by the same decree of Solon, a new commercial talent, of increased weight, was introduced, but only as a weight for goods, not for money.

TA'LIPAT PALM, or Great Fan Palm (*Corypha umbraculifera*), the noblest palm of the East Indies, a native of Ceylon, Malabar, &c. It grows to the height of 60, 70, or even 100 feet, and has a straight cylindrical trunk, crowned with a tuft of enormous palmate plaited leaves, which are divided near the outer margin into numerous segments, and are united to the trunk by spiny leaf-stalks. The leaves are usually about 18 feet long, exclusive of the leaf-stalk, and 14 feet broad; a single one being sufficient to protect 15 or 20 men from rain. At the age of 30 or 40 years, the tree flowers, and after ripening fruit, generally dies. It produces a long conical erect spadix, rising to the height of 30 feet from the midst of its crown of leaves, and dividing into simple alternate branches, the lower of which sometimes extend laterally 20 feet, the whole covered with whitish flowers, and forming a very beautiful and magnificient object. The fruit is very abundant, globose, and about an inch and a half in diameter. The leaves are used for covering houses, for making tents, and for many other purposes. On occasions of ceremony, every Singhalese noble is followed by an attendant, who carries above his head a richly ornamented T. P. leaf, which is capable of being folded up like a fan, and is then not thicker than a man's arm, and wonderfully light. The leaves of this palm are used in Malabar for writing upon, characters being traced upon them with an iron style. They are prepared for this purpose by boiling, drying, damping, rubbing, and pressing. The soft central part of the stem, pounded and made into bread, has often been of great use in times of scarcity.

Talipat Palm
(*Corypha umbraculifera*).

TA'LIPÉS, the scientific name for CLUB-FOOT (q. v.). It is derived from the Latin words *talus*, the heel, and *pes*, the foot.

TA'LISMAN (Arabic, but supposed to be derived from the Gr. *telesma*, in the sense of celebration of religious ceremonies), a species of charm, consisting of a figure engraved on metal or stone when two planets are in conjunction, or when a star is at its culminating point, and supposed to exert some protective influence over the wearer of it. The terms Talisman and Amulet (q. v.) are often considered nearly synonymous, but the proper distinctive peculiarity of the former is its astrological character. Talismanic virtues have often been attributed to a peculiarly marked or formed egg, and instances are recorded, by various authors, of eggs hatched with figures of comets or eclipses on them. A species of talisman, which has acquired considerable celebrity, is the Abraxas Stone (q. v.). A species of talisman, at present in use in Asia, is a piece of paper on which the names of the Seven Sleepers and their dog are inscribed. Pasted on the walls of houses, it is believed to be a protection against ghosts and demons.

TA'LLAGE (said by Lord Coke to be from Fr. *tailler*, to share or cut out a part), a name which has been sometimes applied generally to subsidies or taxes of every kind, but which, in its more proper and restricted sense, denotes those taxes to which, under the Anglo-Norman kings, the demesne lands of the crown and all royal towns were subject, which were far more rigorous and irregular than the taxes imposed on the gentry.

TALLAHA'SSEE, the capital of Florida, U. S., situated on a high plain, 180 m. E. of Pensacola, a well-planned, and so far well-built embryo city. It is celebrated for its salubrious, semi-tropical climate, and abundant springs of soft pure water. It is a station on the Jacksonville, Pensacola and Mobile Railway, at the junction of a branch to St. Marks, 23 miles distant on the coast. Pop. (1870) 2023.

TALLEYRAND-PERIGORD, CHARLES MAURICE DE, Prince of Benevento, the most subtle, shrewd, and unprincipled of all modern diplomatists, was born at Paris, February 13, 1754, of an ancient and distinguished family. His father, CHARLES DANIEL, COMTE DE TALLEYRAND-PERIGORD (b. 1734, d. 1788), was an officer in the French army, and fought all through the Seven Years' War.

CHARLES MAURICE being the eldest son, would in all probability have been designed for a military career, had not an accident, which he met with when only a year old, rendered him lame for the rest of his life. He was, in consequence, trained for the church, and studied at St. Sulpice, the Sorbonne, and Rheims, but at no period did he betray the least inclination towards a Christian, or even a moral life. At the age of 20, he came to Paris, and rapidly acquired a reputation for licentiousness. This, however, did not prevent him from obtaining several ecclesiastical benefices, among others, the Abbacy of St. Denis, in the diocese of Rheims (1775). Appointed *agent-général* for the clergy in 1780, a lucrative and important post, which brought him into close connection with the heads of the administrative in France, he now began a serious apprenticeship to public business, without, however, pausing in his career of gallantry. So notorious was his *infâme conduite* (as Mirabeau calls it), that, for some years, Louis XVI. shrank from conferring on him further ecclesiastical preferment, and it was only on account of his administrative abilities, that, in 1788, he obtained the bishopric of Autun..

When the convocation of the *Etats-généraux* took place, in the year following, he was elected by the clergy of his diocese to represent it, and pronounced in favor of an amalgamation with the *Tiers Etat*, which, on the 17th June, had constituted itself the *Assemblée Nationale*. His attitude and speeches recommended him to the notice of the popular party, and along with Mounier, Sieyès, and Lally-Tolendal, he was appointed to draw up a constitution for the nation. In this capacity, he took an active part in framing the famous Declaration of Rights, and he was one of those selected (after the destruction of the Bastile) to investigate the causes and peculiar features of the revolutionary movement. It was T. who proposed (October 10, 1789) the startling measure for the confiscation of church property, arguing that such property did not really belong to the church, but to the nation, and that if the rights of the existing clergy were secured, the nation, or its representatives, were at liberty to apply it to any purpose they saw fit. On February 13, 1790, a decree for the suppression of religious orders was carried, in spite of a vehement opposition, and three days after, T. became President of the Assembly. He was one of the first among his order to take the oath to obey the constitution (December 28, 1790), and eagerly urged the clergy of his diocese to follow his example. About the same time, he demitted his bishopric of Autun, yet, in the following February, we read of his consecrating two new bishops (those of Aisne and Finisterre), and although denounced in pontifical briefs as a schismatic, declaring his sincere attachment to the Holy See!

Our space does not permit us to describe the important share that T. had in the financial deliberations of this first period of the Revolution, but we must specially note the sagacity he displayed in pointing out the perils attending the issue of assignats, his skill in preparing the way for the adoption of the principle of uniformity in weights and measures, and of an arc of a meridian as the basis of the new metrical system; and above all the luminous intelligence shown in the Report which he gave in to the Assembly (September 10 and 11, 1791) upon Public Instruction—a Report conceived in the liberal and comprehensive spirit of the times, and which was undoubtedly the model followed in all the great changes that subsequently took place, when France reorganized her educational system.

In 1792, when the old European despotisms were obviously preparing to coerce the young republic, T. was sent to London—but not in an official character—to negotiate with the English government. He did not make a favorable impression on George III. or on Pitt. Thrice, in that year, he essayed to procure a recognition of the republican government, but in vain. The 'September massacres' (see SEPTEMBRISTS) made even the stanchest admirers of the Revolution shudder. Nothing, therefore, could be done; and T. would doubtless have returned to France, had not a letter of M. de Laporte, *intendant* of the civil list of Louis XVI., been discovered, in which T. was noted as a man 'disposed to serve' the king. He was immediately placed on the list of *émigrés*, i. e., proscribed (December 1792); and thus his connection with the Revolution—fortunately, we believe, for his reputation—was suddenly brought to a close. His career as an exile was (as is generally the case) one of hardship and insignificance. He remained in England till forced to leave by the 'Alien Bill,' when he sailed for the United States (February 1794), where he lived for more than a year.

After the fall of the Terrorists, he procured the revocation of his banishment; and in March 1796, re-entered Paris, having paved the way for a favorable reception by a series of the most adroit and judicious intrigues. We may first note, *en passant*, that in private life he continued to play the *rôle* of a gay Lothario.

T. attached himself to the *cercle constitutionnel* that gathered round Madame de Staël, and so dexterously did he comport himself, that, in 1797, he was named Minister of Foreign Affairs in place of C. Delacroix. The rise of Bonaparte was a phenomenon which so penetrating a politician as T. could not overlook. He cultivated the friendship of the young general with a sagacious assiduity, keeping him constantly *au courant*, when away from Paris, of the situation of parties, and became his confidant in those designs, the execution of which resulted in the overthrow of

the Directory, Brumaire 18 (q. v.), 1799. After this *coup d'état*, the subtle finesse of T. was constantly in requisition. He divined, with a sort of miraculous cleverness, the ideas of Bonaparte, and his whole policy was directed to consolidate the power and authority of his master. In all the diplomatic negotiations that followed the victories of France under the Consulate, he had the principal part; but Bonaparte thoroughly understood his man, and T. was quite conscious, as M. Thiers remarks, that he could never impose on his superior. It was he who proposed the kidnapping of the Duke d'Enghien (q. v.); and it was by his instructions that the crime was consummated, in spite of the vehement opposition of Josephine, whose honest indignation led her to denounce him, as a *maudit boiteux* (cursed cripple).

T. took an active part in preparing the way for the establishment of the Empire (1804); and when, in the following year, England, dreading a French invasion, formed a powerful European coalition against France, it was by the ingenuity of T. that it was partially broken up. To him, as much as Napoleon, was owing the organization (1806) of the famous *Confederation of the Rhine* (q. v.), which so effectually served the ambitious designs of the emperor. In conducting the negotiations that brought about this Confederation, he exhibited a truly Macchiavellian art. Napoleon was not ungrateful. T. received the principality of Benevento, which he held as an imperial fief.

When the views of the emperor in regard to Spain became apparent, T., who for more than a year had rather fallen into disfavor with Napoleon, came forward with a plan of his own, which, however, was not adopted; but his presence at the interview between Alexander and Napoleon at Erfurt (1808), proved that his influence was as yet undiminished. The ill success of the Spanish war (at first) induced T. to pronounce against it, and occasioned violent invectives on the side of his sovereign, to which the accomplished cynic (who retained to the last the manners of the old noblesse) only replied by the sarcasm: '*Quel dommage qu'un si grand homme soit si mal élevé!*' (what a misfortune that so great a man should have been so badly educated!).

T. declared in favor of the Austrian marriage; but already the *entente cordiale* between him and Napoleon was ruptured, and he began to look forward to a future in which his own schemes might be hostile to those of the emperor. In a word, he was meditating treachery against the power by which he had risen. The victories of Wellington in Spain, and the reverses of Napoleon in Russia and Germany, widened the breach between them, and T. now only waited the decisive moment in which to ruin the cause of his master. He became the center of a group of Parisian malcontents, whose influence grew with the advance of the allied armies, and finally, communications were opened up with the latter and with the Bourbons. It was T. who dictated to the senate the terms of the deposition of Napoleon; and on the restoration of the Bourbons, he became Minister of Foreign Affairs in the first government of Louis XVIII. He was also head of the French legation in the celebrated Congress of Vienna; but after the battle of Waterloo, a coolness sprung up between him and the Bourbons, and he was relieved of all his offices. Henceforth, his career is uninteresting to the student of history. He caballed to regain power, but in vain; and during the reigns of Louis XVIII. and Charles X., he was merely a discontented senator, who never lost an opportunity of injuring the court and the government.

After the July Revolution, Louis Philippe employed him as ambassador at the English court, where he contrived to bring about a friendly feeling between the new monarchy and the English government. During the brief remainder of his life, nothing externally notable occurred. He died at Paris, 17th May 1838. T. was neither a wise, nor a great, nor a good man; but he was infinitely cunning, dexterous, and supple. He had a larger share than most men of what Carlyle calls 'vulpine understanding;' and if this world had had nothing but knaves and fools in it, the policy and principles of T. might have enjoyed a perpetual triumph; but there were forces in the world, both intellectual and moral, of which he took no account, but which took account of him, and with all his amazing cleverness, dropped him into obscurity and disgrace. T. was an 18th c. sceptic, over whom the Revolution had exercised little influence, while France, and indeed all Europe, had been roused into earnestness by the outburst; and when the ideas of political liberty began their swift, irresistible march, this *diable boiteux* inevitably lagged behind, and sunk out of sight. T. has left *Mémoires*, which are not to be published till 1890. For estimates of his character and policy, see the *Mémoires Politiques* of Lamartine; the *Histoire de Dix Ans* of Louis Blanc, where T. is rigorously criticised; the *Mémoires* of Guizot; works by Mignet and Bastide; and the *Correspondance inédité du Prince T. et du Roi Louis XVIII.* (2 vols., 1881; Eng. transl. 1881), edited by Pallain.

TALLICOO'NAH OIL. See CARAPA.

TALLIEN, JEAN LAMBERT, a French Revolutionist, was born at Paris in 1769, and first became notable in the beginning of 1792 as the editor of a Jacobin journal, called *L'Ami des Citoyens*, meant to be a friendly rival of Marat's *Ami du Peuple*. From this date, his influence over the lower orders of the city steadily increased. He was conspicuous in the events of the 10th August, and in consequence received the appointment of secretary to the *Commune Insurrectionelle*. He promoted, and afterwards defended the massacres of September; and on account of his unscrupulous zeal, was elected to the Convention by the department of Seine-et-Oise. There he became the apologist, if not the advocate of Marat, denounced the minister Roland, urged with savage emphasis the condemnation of Louis XVI., and was rabidly eager for the ostracism and and annihilation of the Girondists (q. v.). Towards the close of 1793, he was sent to Bordeaux, charged with the mission of destroying every trace of the party he hated. His career in the south-west was a mixture of reckless cruelty and shameful vice. To the odious tyrannies of a proconsul, he added the luxurious profligacy of a satrap. Fortunately for his countrymen, a passion which he conceived for one of his victims, Madame de Fontenay (*née* Cabarrus), led him to pause in his bloody course. He was called to Paris to account for this singular change in his disposition, satisfied his associates (by paroxysms of patriotic vehemence) that it meant nothing particular, and on the 22d March 1794, was chosen president of the Convention. Robespierre, however, had found out the sort of man that T. was. He hated him for his insincerity and immorality, felt instinctively that he could not be trusted, denounced him severely in the Convention, and on the 14th of June got his name erased from the list of members at the Jacobins.

T. recognized his danger, and taking advantage of the reaction against the Terrorists (though himself one of the basest of the set), already beginning to show itself in France, he dexterously rallied the Dantonists, Hebertists, and others against the rigorous government of Robespierre, St. Just, and Couthon, and brought about the events of the 9th Thermidor (27th July 1794), which caused the fall of [the triumvirate. T. now became for a short time one of the most notable and influential men in France; lent his aid to suppress the Revolutionary Tribunal and the Jacobin Club, and drew up the accusations against Carrier, Le Bon, and others of the Terrorists! But France could not long tolerate this affectation of virtue on the part of one so infamous; his past life was perpetually held up to scorn and reproach; and finally, on the 20th of May 1798, he was forced to leave the Council of Five Hundred. Henceforth, his career is pitiably insignificant. He accompanied Bonaparte to Egypt as *savant* (!), quarreled with General Menou; and on his return to France, was captured by an English cruiser, and brought to England, where the Whig Opposition was stupid enough to make a hero of him (1801). Soon after, he returned to France, and was contemptuously dismissed as consul to Alicante by Talleyrand, outlived (in utter obscurity) the Empire of Napoleon, and died at Paris, 16th November 1820, supported in his last days by the heirs of the monarch for whose death he had inhumanly clamored.

TALLOW. See OILS AND FATS.

TALLOW, MINERAL. See MINERAL TALLOW.

TALLOW TREE, the name given in different parts of the world to trees of different kinds which produce a thick oil or vegetable tallow, or a somewhat resinous substance, which, like tallow, is capable of being used for making candles. The T. T. of Malabar (*Vateria Indica*) is a very large tree of the natural order *Dipterocarpaceæ*. It has leathery leaves, of 4—10 feet long, and panicles of white, fragrant flowers, with five petals. The stem is often 16 feet in circumference. By incisions in the stem, East India copal is got; and by boiling its seeds, there is obtained a firm, white, vegetable tallow, which, as it has no unpleasant smell, is particularly suitable for making both candles and soap. —The T. T. of China (*Stillingia sebifera*) belongs to the natural order *Euphorbiaceæ*. The capsules are internally divided into three cells, each containing a nearly hemispherical seed, which is covered with a beautifully white vegetable tallow. This the Chinese collect for the manufacture of candles, in order to which, the capsules and seeds are crushed and boiled, and the fat skimmed off whilst in a melted state. To give it a firmer consistency, wax is added to it, in the proportion of three parts to ten of the vegetable tallow. Linseed oil is also added. The candles made of it are beautifully white. This tree has been introduced into North America, is cultivated about Charlestown and Savannah, and is almost naturalized in the maritime parts of Carolina. It presents a very beautiful and remarkable appearance at the approach of winter, when the leaves become bright red, and the pericarps falling off, leave the white seeds suspended by threads.—The name T. T. is sometimes given in North America to a species of CANDLEBERRY (q. v.).—The T. T., or BUTTER AND TALLOW TREE of Sierra Leone, is *Pentadesma butyracea*, of the natural order *Guttiferæ*, the fruit of which furnishes a solid oil.

TALLY (Fr. *tailler*, to cut), the name given to the notched sticks which, till a recent period, were used in England for keep-

ing accounts in Exchequer, answering the double purpose of receipts and public records. They were well seasoned rods of hazel or willow, inscribed on one side with notches indicating the sum for which the tally was an acknowledgment, and on two opposite sides with the same sum in Roman characters, along with the name of the payer and the date of the transaction. Different kinds of notches, differing in breadth, stood for a penny, a shilling, a pound, £20, £100, and £1000. The tally was cleft through the middle by the deputy-chamberlain with knife and mallet, so that each piece contained one of the written sides, and a half of every notch; and the one half was retained by the payer as his receipt, while the other was preserved in Exchequer. At the union of England and Scotland, a store of hazel rods for tallies was sent to Edinburgh, but never made use of. Act 23 George III. c. 82 abolished the use of tallies in Exchequer, and the old tallies were ordered to be destroyed by 4 and 5 Will. IV. c. 15. The destruction of the Houses of Parliament by fire in 1834 is supposed to have arisen from the overheating of the flues in which the discarded tallies were being burned.

TALLY SYSTEM is the name given to a mode of buying goods much in vogue among the wives of poor men, whereby they get goods, chiefly articles of dress and cheap finery, on credit, or on terms of payment by small weekly sums till the debt is paid. It, in point of law, gives rise to the following hardships or disadvantages whenever, as is usually the case, the wife, in the absence of, and without the knowledge of, the husband, enters into the contract, and purchases goods which are beyond her station. The husband, when sued in such a case on the contract, can set up a good defence. If he had given his wife sufficient clothes, either in specie or the means of buying them, he is not liable to pay any tradesman who, without his sanction, supplies the wife with more, especially if these are articles of finery. It is only in the case of the articles being strictly called necessaries, that he will be bound at all; and as regards women of the lower classes, a court or jury would construe the word 'necessaries' very strictly in favor of the husband. If the articles are extravagant, and beyond the station of the wife, the husband is then not liable to pay for the price, and no court will compel him to do so.

The only ground on which he can be made liable will be, that the husband knew of the purchase, and directly or indirectly sanctioned it; as, for example, by seeing her wear the clothes, and not returning them, or giving immediate notice to the tallyman that he objected to the purchase. Nevertheless, it must be confessed that judges are not uniform in their decisions, and some too easily give effect to the contract, for want of strong evidence on the part of the husband of the earliest disavowal of it he could make. The tallyman generally makes it a stipulation that the bargain shall be kept secret for a certain length of time. Nevertheless, if, when it is discovered, the husband at once repudiates and returns the articles, it is the tallyman's own fault if he is then obliged to take them back after they have been partly used, and he cannot fix the husband with liability.

TALMA, FRANÇOIS JOSEPH, an eminent French tragedian, was the son of a dentist, and was born at Paris, 15th January 1763. He made his *début* as an actor in 1787, at the Comédie Française, where he played the part of Séide in *Mahomet*. He achieved considerable success, but apparently not enough to excite any very high anticipations of his future career, and for upwards of a year he figured only in secondary characters. The first thing that induced the public to notice him attentively was an innovation in the matter of costume when playing the part of Proculus in the tragedy of *Brutus*. Previously, actors had worn the garb of their own country, and even their own time; and Roman senators stalked about the stage dressed as Parisian 'swells' of the 18th century.

The absurdity of this fashion forcibly struck T., who set himself to amend it, and in the part referred to appeared in the green-room clothed in a Roman toga, greatly to the astonishment of the company, one of whom (Louise Contat) exclaimed: 'Good God! look at Talma; how ridiculous he is! *Why, he has quite the air of an ancient statue!*' The compliment was as exquisite and as just as it was unintentional. Henceforth, a rigorous accuracy in costume became a point with T.; but his first grand triumph in acting was won, 4th November 1789, when he played Charles IX. in Chenier's piece of that name. During the Revolution, he was in the zenith of his popularity, and made peculiarly his own such characters as Abdelazis, in *Abdelazis et Zuléma;* Othello; Néron, in *Epicharis et Néron;* Pharan, in *Abufar;* and Egisthe, in *Agamemnon*. Exceedingly arrogant and choleric, he was often at strife, either with the public or with some of his fellow-actors. T. was a favorite with Napoleon and Louis XVIII. Some of his later characters were among his best, as Marigny, in *Les Templiers;* Leicester, in *Marie Stuart;* Sylla; Oreste in the *Clytemnestre* of Soumet; Leonidas; and Charles VI. He died 19th October 1826.

TA'LMUD (from Heb. *lamad*, to learn)—i. e., Study, by way of eminence—is the name of the fundamental code of the Jewish civil and canonical law, comprising the Mishna (q. v.) and the Gemara (q. v.), the former as the text, the latter as the commentary and complement. We have spoken under HALACHA and HAGGADA of the gradual development of this 'Oral,' or, chronologically speaking, Post-mosaic Code. We have also there mentioned the older collections upon which the Mishna was framed, and finally redacted in the form in which we now possess it. The oldest codification of Halachoth, or single ordinances, is due to the school of Hillel (q. v.). Simon ben Gamaliel the Patriarch (166 A.D.) and his school carefully sifted the material thus brought together; and in the following generation, through Jehudah Hanassi (219 A.D.) and his disciples, the work was brought to its close in six portions (Sedarim), 63 treatises (Mesichtoth), and 524 chapters (Perakim), which contain the single Mishnas. A summary of its contents is given under MISHNA. But besides this authoritatively compiled code, there were a number of other law collections, partly anterior to it, and not fully embodied in it, partly arising out of it—as supplements, complements, by-laws, and the like—partly portions of the ancient Midrash (q. v.); partly either private text-books composed by the masters of the academies for their lectures or enlargements of the existing Mishna. All this additional legal material was collected, not rarely together with the dissensions which begot it, under the name of *Boraitoth*, by Chia and his school, in the succeeding generation.

Not to be confounded with them, however, are the collections of *Toseftas* or *Great Mishnas*, which, commenced at the time of Jehudah Hanassi himself, and continued after his death by Chija and Hoshaja, embody much of what has been purposely left out in the concise Mishna; that only embraced the final dicta and decisions. Such 'additions' we possess now to 52 treatises, forming together 383 Perakim, or chapters. All these different sources of the 'Oral Law'—finally redacted before the end of the 3d c., though probably not committed to writing until 550 A.D.—belong to the period of from about 30 B C. to about 250 A.D. This great mass of legal matter, although apparently calculated to provide for every case, if not for all times, was yet found insufficient. The dicta of later masters, the decisions of the courts, the discussions on the meaning and purport of special traditions, the attempts at reconciling apparent contradictions in the received material, the amplifications or modifications of certain injunctions rendered necessary by the shifting wants and conditions of the commonwealth—all these and a number of other circumstances made a further codification peremptory.

We must not omit to state here that this Mishna (Mathnisin), although it contained nothing but what were indigenous laws and institutions, was yet not a little influenced—if the very fact of its redaction was not indeed caused—by the spirit of the times. At Berytus, at Alexandria, at Rome, the legal schools were then in their most vigorous stage of development, and everywhere system and method were being introduced into what till then had been a vast complex of traditional and popular institutions, decrees, and decisions. The Mishna, in all respects, fulfilled the conditions reasonably to be demanded from such a text-book as it was intended to form; it was clear, concise, complete, and systematic, and, moreover, composed in as classical a Hebrew as still could be written in those days of decadence of the 'sacred language.'

The further development of this Supplementary, Oral, or Second Law, in fact, rather an exegesis thereof, together with the discussions raised by apparent contradictions found in the individual enactments of the Mishnic doctors, is called Gemara Discussion, Complement, or, according to another explanation, Doctrine. Whatever the original meaning of the root (*gamar*), it certainly allows of all these significations. This Gamara contains, apart from the Halacha (q. v.), which is generally written in Aramaic, also a vast number of non-legal, chiefly Hebrew, fragments—homiletic matter, tales, gnomes, legends, and the like—called Haggada (q. v.).

There are two Talmuds, the one called the Talmud of the Occidentals, or the 'Jerusalem' (Palestine) Talmud, which was closed at Tiberias, and the other, the 'Babylonian' Talmud. The first of these now extends over 39 treatises of the Mishna only, although it once existed to the whole of the first five *Sedarim* or portions. Its final redaction—falsely attributed to R. Jahanan (died 279)—probably belongs to the end of the 4th c. A.D.; but the individual academies and masters through whom it received its completion cannot now be fixed with any degree of certainty. There is less discussion and more precision of expression in this than in the second or Babylonian Talmud, emphatically styled 'our Talmud,' which was not completed until the end of the 5th c., and which makes use of the former. As the real editor of the Babylonian Talmud, is to be considered Rabbi Ashe, president of the academy of Syra in Babylon (365—427 A.D). Both the Mishna and the Palestine Gemara had, notwithstanding the brief period that had elapsed since their redaction, suffered greatly, partly by corruptions that had crept into their (unwritten) text through

faulty traditions, partly through the new decisions arrived at independently in the different younger schools—of which there flourished many in different parts of the Dispersion—and which were at times contradictory to those arrived at under different circumstances in former academies.

To put an end to these disputes, and the general confusion arising out of them, which threatened to end in sheer chaos, R. Ashe, aided by his disciple and friend Abina, or Rabina (abbr. from Rab Abina), commenced the cyclopean task of collecting anew the enormous mass of Halachistic material which by that time had grown up. The method he pursued was simple enough. His disciples met twice a year at Syra, in spring and in autumn. At the spring gathering, he gave out all the paragraphs of one treatise; and the disciples had the task to find out until the autumn meeting what opinions the different schools had pronounced on the special points thereof. He then investigated the whole critically, and put it into shape according to a certain order. This process took him, with the assistance of ten secretaries, no less than thirty years; and another thirty years were spent by him in the revision of the work, with which he proceeded in the same manner as he had done with the compilation itself. The final close of the work, however, is not due, as generally stated, to R. Jose, his successor at the academy (died 475), but to the school of the Saburaim at the end of the 5th century.

The Babylonian Talmud, as now extant, comprises the Gemara to almost the whole of the 2d, 3d, and 4th *Sedarim* (portions), further to the first treatise of the first, and to the first of the last order. The rest, if it ever existed, seems now lost. The whole work is about four times as large as the Jerusalem one, and its 36 treatises, with the commentaries generally added to them in our editions (Rashi and Tosafoth), fill 2947 folio leaves. The language of the Talmud is, as we said, Aramaic (Western and Eastern), or 'Chaldee,' closely approaching to Syriac. The minor idiomatic differences between the two, are easily accounted for by the different time and place; but the additional matter—quotations and fragments from older Midrash and Gemara collections, Haggada, &c.—is, as before stated, principally written in Hebrew.

The masters of the Mishna (Tanaim) and of the Gemara (Amoraim) were followed by the Saburaim (see above). The code of the Oral Law had come to a close with the second named; and not its development, but rather its proper study, elucidation, and carrying into practice, was the task of the generations of the learned that followed. Apart from this, the Aramaic language itself began to die out as the popular language, and required a further study. The Saburaim no longer dared to contradict, but only opined on the meaning and practicability of certain enactments, and undertook the task of inculcating and popularizing the teachings laid down by their sires: apart from bestowing proper care upon the purity of the text itself, and adding some indispensable glosses. Their activity was at its height in the 8th c., when Karaism (see JEWISH SECTS), which utterly denied the authority of the Talmud, sprang into existence.

Respecting, however, this authority of the Talmud itself, there has never been anything approaching to a canonicity of the code, or of a reception of it as a binding law-book by the whole nation. The great consideration in which it was always held is owing partly to its intrinsic value, and to the fact of its becoming the basis of all further development of Jewish literature (it being undeniably the most trustworthy receptacle of the traditional Jewish law), and partly to a prosecution against the Jews in the Persian Empire at the time of Jesdegerd II., Firuz, and Kobad, who closed the schools and academies for a space of nearly 80 years, during which this book was the sole authoritative guide of public conscience, and remained endowed with its importance even when the schools were restored. The best commentaries of the Mishna are by Maimonides and Bartenora; of the Babylonian Talmud by Rashi (q. v.) and the *Tosafists* of France and Germany. An abstract of the Talmud for practical (legal) purposes by Maimonides (q. v.) is called Mishne Thorah.

The Mishna was first printed at Naples, 1492; the Talmud of Jerusalem at Venice about 1523. The Babylonian Talmud was first published at Venice in 1520. It is generally printed in twelve folios, the text on the single pages being kept uniform with the previous editions, to facilitate the references. No translation of the Gemara has ever been carried further than a few single treatises. The complete Mishna, on the other hand, has been translated repeatedly into Latin, German, Spanish, &c., by Surenhus, Rabe, Jost, and others. We must refrain, in this place, from attempting a general characterization of the Talmud, a work completely *sui generis*. It will assuredly some day, when properly investigated, prove one of the most important records of humanity. Nothing can give even an approximate idea of the immensity of material, historical, geographical, philological, poetical, that lies hidden in its mounds. A contribution to the records of fanaticism may also be found in the 'exoteric' history of the Talmud, which was, albeit utterly unknown save by a few garbled extracts, prohibited, confiscated, burned, and generally prosecuted and inveighed against by emperors, popes, theologians, and fanatics generally, from Justinian down almost to our own day, as perhaps no other book has ever been.

In our own times, however, its value begins to be recognized by great scholars, not merely as the only source of the knowledge of Judaism, but as the chief source—next to the gospels—even for the history of the origin and early days of Christianity; a notion long ago hinted at by eminent divines like Lightfoot and others. See also JEWS, MIDRASH, MISHNA, HALACHA, HAGGADA; and an important essay in the *Literary Remains* of Em. Deutsch, author of the above article.

TA'LPIDÆ. See MOLE.

TALUS, a term employed in Geology, to designate the sloping heap which accumulates at the base of a rock or precipice, from fragments broken off by the weather, or materials in any way carried over it. The term is also applied to the slope of a wall which diminishes in thickness as it rises.

TAMA'RA SPICE, a favorite mixture of condiments used by the Italians. It consists of powdered cinnamon, cloves, and coriander seeds in equal parts, and half the same quantity of aniseed and fennel-seed powdered.

TA'MARIN (*Midas*), a genus of South American monkeys, small and beautiful, with short muzzle, prominent forehead, long nails, which, except on the hinder thumbs, are formed like claws, the tail longer than the body, not prehensile, and covered with hair so as to resemble the tail of a squirrel. The SILKY T., or MARAKINA (*M. rosalia*), is the best known of the genus. It is of a golden yellow color, with fine silky hair, of which it is exceedingly careful, to keep it free from stain. It is often brought to Europe, but is very tender, and seldom lives long. It is a very gentle and playful creature. The hair of the head and neck is elongated, so as to form a wig or mane; but this character appears far more strongly in the LITTLE LION MONKEY (*M. leonina*),

Little Lion Monkey (*Midas leonina*).

which inhabits the eastern slope of the Cordilleras, and of which, although it is a very small animal not many inches long, the appearance is an amusing caricature of that of the lion.

TA'MARIND (*Tamarindus Indica*), a beautiful tree, of the natural order *Leguminosæ*, suborder *Cæsalpineæ*, a native of the East Indies, but now very generally cultivated in warm climates. Only one species is known (*T. Indica*), a spreading tree, 30 or 40 feet high, with alternate pinnate leaves, which have from 12 to 15 pair of small leaflets, and fragrant flowers, with three petals, the pods brown and many-seeded, as thick as a man's finger, and about six inches long. The pods are filled with a pleasant, acidulous, sweet, reddish-black pulp. It is brought to Europe, mixed with seeds and fibres, in the form of a mass resembling jam, from the East and West Indies, and the Levant. Tamarinds are generally preserved by throwing hot syrup on the ripe pulp; but a better method is to put alternate layers of tamarinds and sugar in a stone jar, the color and taste being thus more like those of the fresh pulp. The wood of the T. tree, and especially of its roots, is a cabinet wood of much beauty, but of extreme hardness, so that it is wrought with difficulty.—The pods of some other trees of genera allied to *Tamarindus* are filled with a similar pulp, which is used in the same way, as the T. Plum of India (*Dialium Indicum*), and the Brown and Velvet Tamarinds of Sierra Leone, species of *Codarium*.

On chemical analysis, tamarind pulp is found to contain citric, tartaric, and malic acids; potash, sugar, vegetable jelly, &c. As a salt of copper is a common adulteration, a piece of polished iron (a knife, for example) should be plunged into the pulp, and left in it for an hour, when, if copper be present, it will be deposited on the iron. Tamarind pulp is refrigerant and gently laxative; and in combination with more active remedies, is often employed in the diseases of children. It is used in India as a cooling article of food, and a kind of sherbet is also formed from it; it is also an excellent addition to curries. Tamarind tea is made by infus-

ing tamarinds in boiling water; when cold, it forms an agreeable and cooling drink in inflammatory or febrile disorders. Tamarind whey is prepared by boiling one ounce of tamarinds with a pint of new milk, and straining: this also is an excellent cooling drink in similar cases.

TA'MARISK (*Tamarix*), a genus of plants of the natural order *Tamaricaceæ*. This order contains rather more than forty known species, all natives of the warmer parts of Europe and Asia, and of Africa, generally growing in arid situations. Some of them are herbaceous, others are shrubs or small trees, with rod-like branches, scale-like leaves, and small flowers in close spikes or racemes. The calyx has four or five segments; the corolla four or five petals; the stamens are hypogynous, equal in number to the petals, or twice as many; the pistil has three styles; the fruit is a one-celled capsule, with numerous hairy seeds. The COMMON T. (*T. Gallica*) grows in sandy places in the countries near the Mediterranean, and has been naturalized in some places on the southern coasts of England. It sometimes attains a height of 30 feet. The twigs seem to possess tonic properties, and their medicinal virtues were once in high repute. The ashes of this and some other species of the genus contain much sulphate of soda.

Common Tamarisk (*Tamarix Gallica*).

The ORIENTAL T. (*T. orientalis* is one of the few trees to be seen in the Arabian and African deserts, with the sands of which it seems to struggle more than any other tree or shrub. Its leafless appearance accords with the surrounding desolation. It is called *atlé* or *ethel*, and its wood is used both for fuel and for many economical purposes.—Galls are found on some species in India; and are valued both for medicinal use and for dyeing. *T. mannifera*, perhaps a variety of *T. Gallica*, yields the kind of Manna (q. v.) known as Mount Sinai manna.—The GERMAN T. *Myricaria Germanica*) belongs to another genus of this order. It is a smaller shrub than the Common T. and abounds in many parts of Europe and Asia, although not found in Britain. It was formerly supposed to possess valuable medicinal properties, but is now little regarded.

TA'MBOUR (Fr. *tambour*, drum), a frame upon which muslin or other material is stretched for embroidering. The tambour frame originally was made round. Tambour-work was extensively employed for the decoration of large surfaces of muslin, &c., for curtains and similar purposes; but pattern-weaving has been brought to resemble it so closely, that it is being rapidly superseded.

TAMBOUR, in Fortification, is a small work, usually a timber stockade, about 6 feet high, and loopholed. Its object is to defend a gateway, the road into a village, or to afford flanking fire on a bridge, &c. The tambour on the covered-way is the traverse which closes an entrance from the glacis.

TAMBOURI'NE, a very ancient musical instrument of the drum species, much used by the Biscayan and Italian peasants at their festivities, and sometimes introduced into orchestral music where the subject of the piece is connected with a people who use it, as the Basques, gipsies, or peasants of the Abruzzi. It is composed of a piece of parchment, stretched on the top of a hoop furnished with little bells, and is sounded by the hand, fingers, or elbow. When sharply struck by the hand, the tambourine has not much effect, unless used in numbers. When sounded by gliding the fingers along the parchment, a roll results, in which the bells are chiefly heard; and by rubbing the parchment, without quitting it, with the whole weight of the thumb, the instrument gives out a wild, grotesque sound, which is sometimes of service in masquerade scenes.

TAMBO'V, a government in the south-east of Great Russia, bounded on the E. by the governments of Penza and Saratov. Area, 25,542 sq. m.; pop. (1880) 2,405,713. The southern districts are hilly; the interior is a somewhat elevated plateau, with a gradual slope toward the north. Several lakes are found in the north of the government, and the principal streams are the Tsna, an affluent of the Moksha, and the Moksha, which is itself an affluent of the Oka. The climate of T., owing to its exposure to the biting north winds, against which there is no protection, is more severe than in neighboring governments. The soil in the central and southern districts is a rich vegetable mould, and is very productive. In the north, clay predominates, and requires much manure. The chief agricultural products are rye, wheat, buckwheat, oats, hemp, and flax. The larger forests are found in the north, and pasture-lands extend for the most part along the banks of the rivers. Agriculture and cattle-breeding are the principal employments; and some of the breeds of oxen, sheep, and horses are excellent. Cloth, distilled liquors, tallow, and iron are the chief manufactures. The products of the government are exported largely by the Tsna and the Moksha to the Oka and Volga.

TAMBOV, capital of the government of the same name, on the Tsna, 750 miles south-east of St. Petersburg. It was founded in 1636 under the Czar Michael Theodorovitch, and served as a fortress against Tartar invasion. It is regularly built, and, though the houses are mostly of wood, there are several important institutions, as the college, the military hospital, &c. T. is the seat of considerable manufacturing trade, there being in all 28 factories, in which cloth and sailcloth are extensively made. The chief articles of trade are leather, wool, tallow, and salt beef. Pop. (1880) 26,403.

TAME ANIMALS, in point of law, render their owners subject to certain liabilities. There is no restriction as to what wild animals may be tamed; and the person who tames one, and retains possession, becomes the owner of it. There is, however, in all such cases an obligation on the owner to keep the animal with due care; and if it tends to be a nuisance to a neighborhood, he would, in extreme cases, be liable to an indictment, or in most cases, to an action of damages. If the animal tamed is naturally ferocious, then it is incumbent on the owner to keep it secure, so as not to allow it an opportunity of doing mischief; and in case of accidental escape, it is seldom that a jury will be pursuaded that the owner is not guilty of negligence, and liable for the damage done. There is a certain class of animals which may exist in a wild state, yet by long use, or a second nature, have become domesticated, such as dogs and cats, and are called *mansuetæ naturæ*, in contradistinction to ferocious animals, such as lions.

With regard to animals *mansuetæ naturæ*, the rule is, that the owner is only liable for mischief done by such animals when he has been guilty of some negligence in keeping such animals; and in practice this amounted to saying, that, if the owner was ignorant that the animal had once before done similar mischief, he would not be liable, unless he had omitted to take some care to restrain that evil propensity. Thus, if a dog or cat, from some sudden whim, chose to attack some person, or other animal, not being incited to it by the owner, such owner is not at common law liable for the first offence; but in case of a second offence, he was generally held liable, at least whenever there was evidence of slight negligence superadded. Hence, if a dog worried sheep casually, the owner was held to be not liable, if it was the first offence. This state of the law was, however, found to work harshly, and a statute passed first for Ireland, then for Scotland, and lastly for England, the effect of which is to make the owner of a dog liable for damages caused by its worrying sheep, even though it is the first offence, and though the owner was not guilty of any negligence.

These statutes passed in 1862, 1863, and 1865 respectively, and they establish an exception to the general rule, which still is in force, as to mischief done by dogs, other than worrying sheep—namely, that before the owner can be made liable, it must be proved that he knew of the dog or cat's mischievous propensity to do the act in question, and did not use due care in restraining it. This is the rule where, for example, a dog bites a person, or a bull gores a passenger. In short, negligence is the gist of the action, and more than mere ownership must be proved against the owner. Sometimes owners of lands plant spring-guns, traps, and similar implements, with a view to kill dogs, cats, and other vermin straying in such fields. The practice of placing spring-guns and man-traps, with a view to kill poachers, was found once to prevail, and created a great outcry about fifty years ago; and the legality of the practice was questioned, but the judges in England held, that if the man injured was a trespasser, the owner of the land was not liable; consequently, a statute was passed to make it illegal in future to place such engines, except in, and close to, dwelling-houses.

In Scotland, the judges held that the practice was illegal at common law, and no statute was necessary. But though man-traps put in fields are now illegal, traps which destroy dogs or cats are not so, with this qualification, however, that the traps must not be put near a highway, where the dog or cat might be lured aside when lawfully passing, as this would be taking too great an advantage of the instincts of the animal. As regards the stealing of tame animals, it was a technical defect in the common law of England that the offence of larceny could not be committed upon them; but by statutes, it is provided that in most cases the offence

of stealing or destroying tame animals is punishable either by fine or by imprisonment, in much the same way as larceny is punishable.

TAMERLANE. See TIMUR.

TAMIL′ (more properly spelled *Tamir′*, but erroneously written *Tamul*, and erroneously termed by the earlier Europeans 'the Malabar') is the name of the language earliest cultivated of all the idioms which the Rev. R. Caldwell designates as Dravidian—this term comprising, according to him, besides the Tamil, the Telugu; Canarese; Malayâlam, or Malayârma; Tul′u, or Tul′uva; Toda, or Tuda, or Tudava; Kôta; Gônd; and Khond, or Kund, or Ku. 'The Tamil language,' this learned author says in his *Comparative Grammar of the Dravidian or South-Indian Family of Languages*, 'is spoken throughout the vast plain of the Carnatic, or country below the Ghauts, from Pulicat to Cape Comorin, and from the Ghauts, or central mountain-range of Southern India, to the Bay of Bengal. It is also spoken in the southern part of the Travancore country, on the western side of the Ghauts, from Cape Comorin to the neighborhood of Trivandrum; and in the northern and north-western parts of Ceylon, where Tamil′ians commenced to form settlements prior even to the Christian era, and from whence they have gradually thrust out the Singhalese.

All throughout Ceylon, the coolies in the coffee-plantations are Tamil′ians; the majority of the money-making classes even in Colombo are Tamil′ians; and ere long, the Tamil′ians will have excluded the Singhalese from almost every office of profit and trust in their own island. The majority of the domestic servants of Europeans, and of the camp-followers in every part of the presidency of Madras, being Tamil′ people, Tamil′ is the prevailing language in all military cantonments in Southern India, whatever be the vernacular language of the district; hence, at Cananore, in the Malayâla country; at Bangalore, in the Canarese country; at Bellary, in the Telugu country; and at Secunderabad, where Hindustani may be considered as the vernacular, the language which most frequently meets the ear in the bazaar is the Tamil′. The majority of the *Klings*, or Hindus who are found in Pegu, Penang, Singapore, and other places in the further east are Tamil′ians. . . . . Including Tamil′ians resident in military stations and distant colonies, and the Tamil′ian inhabitants of South Travancore and Northern Ceylon. . . . . the people who speak the Tamil′ language may be estimated at about *ten millions*.' 'Tamil′ includes two dialects, the classical and the colloquial, or the ancient and the modern, called respectively the Shen-Tamil′ and the Kod′un-Tamil′.' The former is the language of poetry and of the ancient inscriptions; it contains fewer words borrowed from the Sanscrit than the colloquial Tamil′, and among these chiefly such as express abstract ideas of philosophy, science, religion, and technical terms of the more elegant arts; and, in general, it so considerably differs from the colloquial Tamil′ that it is almost unintelligible to the unlearned Tamil′ian.

Of all the Indian languages, Tamil′ has the most imperfect alphabet. The latter consists of 12 vowels—viz., *a, â, i, î, u, û, e, ê, o, ô, âi*, and *aû*—and of 18 consonants—viz., *k, ch, t′, t, p, R, ng, ñ, n′, n, m*, a final *n, y, r, l, v, r′, l′*. Compared to the Devanâgarî alphabet of Sanscrit, it is deficient therefore in the vowels *r′i, r′î*, and *lr′i*, though it possesses a short *e* and a short *o*, which the Devanâgarî has not; it has but one sound for *k, kh, g, gh;* for *ch, chh, j, jh;* for *t′, t′h, ′d, ′dh;* for *t, th, d, dh;* and for *p, ph, b, bh*. It is destitute, moreover, of the Sanscrit aspirate *h*, of the Sanscrit sibilants, *s, s′*, and *sh*, and of Anuswa′ra and Visarga. Of combined consonants, which abound in the Devanâgarî alphabet, it admits only the junction of the nasal and the mute, as *n-t, n′-t′*, &c.; double nasals, as *n-n, m-m*, &c.; double surds as *k-k, ch-ch*, &c.; also *t′k, t′p, Rk, Rch, Rp, yy, ll, vv*, and *nR;* of triple consonants, only *r′nd* and *ynd*. If Sanscrit derivatives, therefore, are Tamil′ized, various devices are resorted to in order to separate Sanscrit groups of consonants. Thus, Sanscrit *pra* becomes Tamil′ *pira;* Sanscrit *kr′ishn′a* becomes Tamil′ *kirut′t′ina-n* or *kit′t′ina-n* (*t′t′* instead of *sh*).

The earliest history of the Tamil′ country is still involved in obscurity. From evidence afforded by the language, Dr. Caldwell has drawn a sketch which would tend to show that the un-Aryanized Tamil′ians had 'kings,' who dwelt in 'fortified houses,' and ruled over small 'districts of country;' that they had 'minstrels,' who recited songs at festivals; but that they were without 'hereditary priests,' without 'idols,' and ideas of 'heaven, hell, soul, or sin;' yet that they acknowledged the existence of God, whom they styled *kô*, or king, and erected to his honor a temple which they called *kô-il*, or God's house. Their chief worship, however, seems to have consisted in bloody sacrifices which they offered to 'the devil.' Dr. Caldwell further shows that they were acquainted with the ordinary metals, except tin and zinc, and with the planets known to the ancients, except Mercury and Saturn; that they had medicines, hamlets, towns, ships, and practised the necessary arts of life, such as cotton-weaving and dyeing, though none of the arts of the higher class, as painting, sculpture, &c.; that they knew no astronomy, and were ignorant of philosophy and grammar.

The earliest civilization of the Tamil′ians is traditionally attributed to the influence of successive colonies of Brahmans from Upper India; and the leader of the first colony is said to have been the Rishi (q. v.) or saint *Agastya*, a personage who plays an important part in Brahmanical legends. He is called the first king of the Pândîya kingdom, which was situated near the southern extremity of the peninsula; and by the majority of orthodox Hindus he is believed to be still alive, though invisible to ordinary eyes. His era is supposed to belong to the 6th c. B.C.; though, like all other ancient Hindu dates, this date, too, cannot be fixed with any degree of certainty. Whether the Vedic worship (see VEDA) was ever known in the Tamil′ country, may be matter of doubt; the worship introduced by the Brahmans seems, on the contrary, to have been that based on the incarnations of Vishn′u (q. v.) and S′iva (q. v.), and therefore to belong to an advanced stage of Hinduism. Vaishn′avas, S′aivas, and S′âktas (see INDIA) are the now prevalent sects of the Tamil′ country; for the Jainas (q. v.), who flourished in the Pândîya kingdom, probably from the 8th or 9th c. to the 12th or 13th after Christ, were finally expelled from it; and only a few adherents of this sect may now be met with there.

The oldest Tamil′ works are, however, those written, or claimed to have been written, by the Jainas; and it is a remarkable fact, that at any period of Tamil′ literature few Brahmans have contributed anything to it that may be deemed worthy of preservation. The finest composition which Tamil′ possesses is the *KuRal′* of Tiruval′l′uvar, 'a work consisting of 1330 distichs or poetical aphorisms, on almost every subject connected with morals and political economy.' Dr. Caldwell holds that it is not later than the 9th c. after Christ. A commentary on this work by Parimelar′agar is the most classical production which has been written in Tamil′ by a Brahman. Besides the *KuRal′*, the following works are said to have received the sanction of the Madura College, which, according to tradition, founded by Vams′a S′ekhara for the cultivation of the Tamil′ language and literature, was then probably the most celebrated seat of learning in all Hindustan. Their names are: *Naladiyar, Nanmanikkadikai, Iniyavai Narppatu; Inna Narppatu, Kar Narppatu, Kallavali Narppatu, Tokai, Tirikadukam, Asara Kovai, Pala Moli, Siru Pansa Mulam, Mutu Moli Kanji*, and *Elati*.

For a list of other and later works written in Tamil′, both medieval and modern, embracing the topics of Religion—Protestant theology, Roman Catholic theology, Hinduism, and books published by Mohammedans—Jurisprudence, Philosophy, Science, Arts, Literature, Philology, Geography and History, Periodicals and Newspapers, see the very useful *Classified Catalogue of Tamil′-printed Books, with Introductory Notices*, compiled by John Murdoch (Madras, 1865); and for learned purposes, the invaluable *Comparative Grammar of the Dravidian or South-Indian Family of Languages*, by Rev. R. Caldwell (Lond. 1856).

TA′MMERFORS, a town in the south of Finland, 250 miles (direct line) west-north-west of St. Petersburg. It is situated on a rapid which connects two lakes, and affords motive-power to an extensive cotton-mill employing a large number of hands. There is also a large flax-mill, a fine stocking manufactory, and a paper-mill. Pop. (1880) 10,000.

TA′MMUZ, a word which occurs once in the Bible—viz., Ezek. viii. 14: 'And, behold, there sat women weeping for Tammuz.' The derivation of the word is as problematic as is the meaning itself. The Vulgate (all the other versions give the word unchanged—thereby confessing the universal ignorance on the subject) has Adonis, and this has indeed been accepted as the most credible explanation of this strange name. It probably means the Phœnician god Adonis, whose chief temple and worship was at Byblus, but who at an early period had been introduced into Syria, Cyprus, and Greece, where he was connected with Aphrodite. His festivals were partly the expressions of joy, partly of mourning. In the latter, the women gave themselves up to the most unmitigated grief over the 'lost Adonis,' shaved off their hair, and sacrificed their chastity in his temples. The days of mourning were completed by a solemn burial of an image of the god. This period was followed by a succession of festive and joyful days, in honor of the resurrection of Adonis. The river Adonis (Nahr Ibrahim) (see PHŒNICIA), which once a year 'ran purple to the sea' from the Lebanon, was supposed to be tinged by the blood of the god; and a vessel sent off from Alexandria, and carried by the tide to Byblus, used to inform the mourners by letter that he had been found again.

There is no doubt that the different phases of the year, or rather the disappearance and reappearance of the enlivening rays of the sun, and their influence upon all nature (see OSIRIS), were symbolized in these originally poetical, afterwards licentious and fanatical rites. The time of the year at which these feasts were celebrated, has given rise to much dispute. Most probably, they

took place at the summer solstice; and the designation of a Hebrew month as Thamuz—which falls about our August—seems further to favor this opinion.

TAMMY, a thin worsted stuff, highly glazed. It is much used for ladies' boots, under the name of *Lasting;* it is also called *Durant*. It is also used, undyed, to form sieves for use in cooking, to strain sauces. Such sieves are called Tammies, or Tamis.

TAMP, TAMPING. See MINES and BLASTING.

TAMPAN, a Tick (q. v.) of South Africa, remarkable for its very poisonous bite, found in Angola, and the country southward from it, and described by Livingstone in his *Travels*. It attacks by preference the parts between the fingers or toes. It attains the size of a pea, and when it has satiated itself with blood, is of a dark-blue color, and its skin so tough, that it cannot be burst by squeezing with the fingers. The first effect of the bite is a mingled sensation of pain and itching, which ascends the limb until it reaches the abdomen,and soon causes either violent vomiting and purging, or fever. The tingling sensation lasts for a week.

TAMPI'CO, or Santa Anna de Tamaulipas, a seaport of Mexico, in the state of Tamaulipas, on the Panuco, 5 miles from its mouth in the Gulf of Mexico. Its streets are broad and regular, and among other institutions it contains a custom-house. At the mouth of the river is a dangerous bar, and the harbor is unsafe. Hides, tallow, bones, and salted meat are exported to Great Britain and the United States. The annual imports amount to about £668,000; the exports—greatly reduced within recent years by the state of anarchy and confusion into which the country has been plunged—to £235,000.

TA'MPION, the wooden plug placed in the mouth of a piece of ordnance to preserve it from dust and damp.—In Naval Gunnery, the tampion is the wooden bottom for a charge of grape-shot.

TAM-TAM, an Indian musical instrument, resembling the Tambourine (q. v.), but larger and more powerful, and oval instead of round. It has been occasionally introduced into orchestral bands.

TAMUS. See BYRONY.

TA'MWORTH, a parliamentary and municipal borough, partly in the county of Stafford, partly in that of Warwick, at the confluence of the Tame and Anker, 7 miles south-east of Lichfield. Of the ancient church, the transepts are Norman; the remains of the ancient castle, to which modern additions have been made, are in various styles. Brickmaking, brewing, dyeing, wool-stapling, and manufactures of tapes and small wares are carried on. There is a bronze statue to the late Sir Robert Peel, erected in 1852. Pop. (1881) of municipal borough, 4888; of parliamentary borough, 14,098.

TA'NAGER (*Tanagra*), a genus of birds of the Finch family (*Fringillidæ*), having a conical beak, triangular at the base; the

Tanager (*Tanagra cyanocephala*).

upper mandible notched towards the tip, and its ridge arched. The species are numerous, and the Linnæan genus has been divided into a number of genera, all of which possess the characters just given, and popularly receive the name Tanager. All of them are American, and most of them belong to warm regions; but some visit more northern parts of America as birds of passage. Many of the tanagers are birds of very beautiful plumage, and many have good powers of song. The ORGANIST T. (*T.* or *Euphonia musica*) is particularly famous for its rich full tones.

TANANARIVO. See ANTANANARIVA.

TANCRED, a Sicilian prince, the son of Eudes, a Norman baron, and of Emma, the sister of Robert Guiscard (see GUISCARD), was one of the celebrated heroes of the first crusade, and was born after the middle of the 11th c. A.D. Some chroniclers profess to detail the events of his early life, describing him as the most accomplished youth of his time in athletic and military exercises, and of a wisdom far surpassing that of men of mature years, and as a partisan of his cousin Bohemond (q. v.) in the quarrel with their uncle, Roger ((q. v.) of Sicily. But the first authentic information respecting him is that he raised a large body of men in Apulia and Calabria, and joined Bohemond, then on his way to the first crusade. The two cousins landed in Epirus, and first one and then the other made their submissions to the Greek emperor, Alexis. T.'s exploits on the way to Syria; his quarrel with Baldwin for the possession of Tarsus, and his subsequent chivalrous forbearance to, and rescue of, his rival; his wondrous valor before Antioch, where he killed no fewer than 700 infidels, transmitting the heads of 70 to the pope, and receiving a corresponding number of marks of silver in return; his vigorous repulse of the first sortie by the infidels from Jerusalem, his sad and lonely vigil on the Mount of Olives; and his gallantry at the storming of the sacred city, are all detailed by the numerous chroniclers of this epoch, in their usual style of extravagant laudation, but with a harmony which speaks favorably for their correct appreciaton of his character. He was one of the claimants of the throne of Jerusalem, and was pacified by Godfrey (q. v.), the successful competitor, with the gift of some towns in Palestine, and the principality of Galilee or Tiberias. A brief quarrel with Baldwin, after Godfrey's death, petty combats with the infidels, and occasional wars with the other Christian princes who had settled in Syria and Palestine, occupied the remainder of his life, which was brought to a close at Antioch in 1112.

TANGANYIKA, a lake of Eastern Central Africa, lying between lat. 3° and 9° S. Long. of center, 30° E.; length about 400 m.; breadth, from 15 to 60 m. It was discovered by Speke and Burton in 1858. Cameron surveyed the S. and W. coasts in 1874, and discovered an outlet, the Lukuga, on the W. side. In 1876 Stanley satisfied himself that this channel, which he proved to communicate with the Lualaba or Upper Congo, is generally dried up in certain parts of its course, and only carries the overflow of T. westward at intervals of years. Thomson re-affirmed the connection between T. and the Congo by the Lukuga. Mr. Hore who spent above two years on the shores of the lake, found the height of the surface in March 1879 to be 2700 feet above sea level; in August 1880 the water had fallen 10 feet 4 inches. Mr. Hore believes that the lake had gradually for several years been rising to the former, apparently its highest level, that the obstructions in the Lukuga had then been carried away, and so the water had found its way to the Congo. Except when several rainy seasons follow one another, the evaporation keeps the water about the same level. See the *Proceedings of the Geog. Soc.*, 1882.

TANGENT. See TRIGONOMETRY.

TA'NGHIN (*Tanghinia venenifera*, or *Cerbera Tanghin*), a tree of the natural order *Apocynaceæ*, a native of Madagascar. The fruit is a drupe, of which the kernel is so deadly a poison, that although not larger than an almond, one kernel is sufficient to destroy twenty people. It was used in Madagascar as an ordeal for the discovery of guilt or innocence, and with the general result of the death of those subjected to it. A little of the powdered kernel was placed on the tongue of the suspected person, and he was obliged to swallow it. Only those recovered whose stomachs quickly rejected the dose. The progress of Christianity and civilization in Madagascar has led to a discontinuance of the use of this ordeal. A similr poison-ordeal is used in some parts of Africa. See ORDEAL and ERYTHROPHLÆUM.

TANGIE'R, a seaport of Morocco, on a small bay or inlet of the Straits of Gibraltar, 38 miles south-west of the town of that name. It is a small, ill-built town, situated on two hills; the houses—with the exception of the residences of foreign officials—being, as a rule, miserable edifices, and the streets being narrow and dirty. The town is surrounded by old walls, and protected by several forts. It has an extensive shipping trade—the annual value of the entering and clearing cargoes being, according to recent accounts, above £600,000. T. was taken by the Portuguese in 1471, ceded to the English in 1662, and held by them for 22 years. Pop. about 9500.

TANGLE, the common name of *Laminaria digitata* and *L. saccharina*, two species of sea-weed, natives of the British shores, growing on rocks in deep water. The stem is woody, the frond leathery, flat, and without a midrib. The woody stems are sometimes used for knife-handles, the blade being stuck in when the handle is soft, and held fast by its shrinking as it dries. The young stalks form an article of food, and are nutritious, owing apparently to the large quantity of gelatinous matter which they secrete. They are also used for feeding cattle. *L. potatorum*, a large species, supplies the aborigines of Australia with instruments, vessels, and food.

TANIS, the Tyrian name of the goddess Astarte (q. v.).

TA'NISTRY, an ancient Celtic custom of succession, which is generally described as devolving the right to inherit lands or honors on the oldest and worthiest of the blood. The tanist, or

righdomna, was the heir-apparent of the monarchy, whom it was the practice to appoint during the lifetime of the sovereign; and there is no doubt that the nearest to the original stock was held to have a preferable claim, as contended by Bruce in his claim to the Scottish throne. The practice of electing a successor was also applied to the inheritance of land, and to succession to ecclesiastical offices.

TANJU'R, more commonly written TANJORE, an important town of India, in the presidency of Madras, 180 miles south-south-west of the city of that name, in the midst of an extensive plain, on one of the branches of the delta of the Kaveri. The town comprizes two forts and several suburbs. The former are so connected that they may almost be regarded as one. The smaller of the two is a parallelogram in shape, and 600 yards in extreme length. It is joined on the north to the larger fort, which is circular in shape, and 1100 yards in greatest diameter. The walls of both are lofty and strong, and are surrounded by a ditch cut out of the solid stone. The principal edifices of T. are the Great Pagoda, esteemed the finest specimen of a pyramidal temple in Hindustan (see INDIAN ARCHITECTURE), and the palace of the rajah. Silks, muslins, and cottons are manufactured. Pop. (1871) 52,175.

The province of Tanjúr, of which the town of the same name is capital, has an area of 3735 sq. m., and contained, in 1871, 1,975,042 inhabitants.

TANK-WORMS. The mud in Indian tanks has been found to abound in *Filariæ*, some of which closely resemble the guinea-worm infesting the human body. Although there is no positive evidence, there is extreme probability that these tank-worms are the origin of the guinea-worm. Dr. Carter, who has had much personal observation of the guinea-worm in India, 'argues, and apparently with good reason, *No tank-worm, no guinea-worm.* Persons who bathe in water in which the former is found may expect to have the latter.' Mr. Bastian, who has written an excellent paper on the anatomy of the guinea-worm, states that there is an undoubted anatomical relation between it and the tank-worm. The real difficulty in the theory is that these tank-worms are widely diffused, while the guinea-worm is restricted in its localization.

TANNAHILL, ROBERT, was born on the 3d June 1774, at Paisley, where his life was almost entirely passed in the humble occupation of a weaver. Very early he exhibited a taste for poetry, and out of his constant study of the works of Burns, Fergusson, and Ramsay, the ambition was developed in him of emulating these favorite authors. His poetry soon became known, and procured him a local celebrity, which, on the publication, in 1807, of a collection of his pieces (*Poems and Songs;* new and larger ed., with a memoir of the author, Glasgow, 1838), was ratified by a wider acceptance. But whilst his modest fame was extending itself, his life had an abrupt termination. He was found one morning (May 17, 1810) drowned in a canal near Paisley; and there seems almost no reason to doubt that his death was that of the suicide. A morbid melancholy which seems to have been inherent in his nature had gradually been growing upon him, and clouding his life with hopeless gloom. He died at the age of 36.

As a song writer, T. continues to be remembered; and some few of his best pieces have established themselves as part of the musical repertory of the Scottish people. He has a genuine lyrical gift, much tenderness of sentiment, and a true eye and feeling for the simple effects of nature with which he was familiar. Of the force and passion of Burns, he has nothing; but in grace and sweetness, Burns himself has scarcely perhaps surpassed certain of his happier passages.

TANNHÄUSER, the subject of one of the most attractive German legends of the middle ages, is a knight who, in the course of his travels, comes to Venusberg (q. v.), and enters the cave-palace, to behold the wonders of the Lady Venus and her court. After having lived there for some time in every kind of delight, his conscience smites him. Invoking the Virgin Mary, he obtains leave of absence, and makes a pilgrimage to Rome, to Pope Urban, to seek, through confession and penance, remission of his sins, and escape from damnation. But the pope, who happens to have a wand in his hand, tells him that he can as little obtain God's mercy as that dry wand can become green again. Thereupon T. departs in despair, and returns to the Lady Venus in the mountain. Three days afterwards, however, the wand begins to sprout and bear green leaves; and the pope immediately sends out messengers to every country, but in vain—T. can nowhere be found. Such is the story, as told in the popular ballad once common all over Germany, and even beyond it, and sung in the district of Entlibuch as late as the year 1830—the best version of which is in Uhland's *Alte hoch- und niederdeutschen Volkslieder* (Stuttg. 1845). In the preface of the *Heldenbuch*, it is further added that 'the faithful Eckhart'—a character in German heroic legends—sits before the mountain, and warns the people of its dangers. In this shape, the story may be traced as far back as the 14th c.; but the substance of the legend is much older, and goes back to the days of German paganism. Some traditions connect it with the Hoselberg or Hörselberg, near Eisenach, in which the Lady Holle or Holda (see BERCHTA) held her court, who, on her part again, seems to be identical with Freyja, the Scandinavian Venus.

The peculiar mythological meaning of the saga, which has numerous points of contact with many other German traditions, has, however, never yet been thoroughly inquired into. Grimm sees in it a touching portrayal of the regret that lingered in the popular heart after the departing paganism, and of the sternness of the Christian priesthood in regard to it. Compare Kornmann, *Mons Veneris* (Fkf. 1614); Grässe, *Die Sage vom Ritter Tannhäuser* (Dres. and Leip. 1846). In later times, the saga has been put into poetical form, among others by Tieck, and made use of by R. Wagner in an opera. This idea of subterranean palaces in which the king or queen of dwarfs, pigmies, fairies, and so forth, held their court, seems to have been universal. Everywhere, stories are told of men being enticed to enter, and finding it difficult or altogether impossible ever again to obtain their liberty. See RHYMER, THOMAS. The visit of Ulysses to the isle of Calypso, and that of Circe, appear to be only modifications of the same idea.

About the middle of the 13th c., and contemporary with Pope Urban (Urban IV., 1261—1265), there lived in reality in Germany a Bavarian knight named Tannhäuser, who, as Neidhart relates, after returning from the wars, resided as Minnesinger (q. v.) at the court of the Austrian Duke Frederick II. the Quarrelsome. At the duke's death, and after having wasted his substance in dissipation, he resided partly with Duke Otto II. of Bavaria, and partly led a wandering life. T. has composed fine spirited ballads, which, however, show the decay that had already set in in the Minnesinger's art. T.'s memory was held in high regard by the Meistersingers, who also preserved one of his measures; and it is quite possible that this T. may have been introduced into popular fiction, and have had his name worked into a myth, in which there is some resemblance to his actual fortunes; in which process, however, that old myth became transformed into the more modern saga. The poems of T. are published partly in the second part of the *Minnesinger* (published by Von der Hagen, Leip. 1838), and partly in the sixth vol. of Haupt's *Zeitschrift für deutsches Alterthum* (Leip. 1848).

TA'NNIC ACID, or TANNIN. Under these synonymous terms, chemists include a number of solid non-nitrogenous substances, consisting of carbon, hydrogen, and oxygen, some of which are crystalline, and others amorphous, and possessing no smell, but a well-marked astringent taste. They are soluble in water and alcohol, the solutions being acid, and yielding precipitates with most metallic oxides. A solution of gelatine is also precipitated by a solution of any of the tannic acids, and the gelatigenous tissue in raw hides is by an analogous process converted into leather. See GALLOTANNIC ACID. None of these acids are volatile; and when exposed to the action of heat, they decompose, and yield the so-called pyro-acids. The persalts of iron yield bluish-black or green precipitates with the tannic acids.

The members of this gronp are widely diffused throughout the vegetable kingdom. 'The bark and leaves of most forest trees, such as the oak, the elm, the willow, the horse-chestnut, and the pine—and of many fruit trees, such as the pear and plum, contain tannin in notable quantity. The wood and bark of many shrubs, such as the sumach and whortleberry, and the roots of the tormentilla and bistort, are also powerfully astringent, owing to the presence of one of the forms of tannin. Coffee and tea, as well as Paraguay tea, likewise contain a modification of this principle. All these bodies, except coffee, precipitate the persalts of iron of a bluish-black color; or, if a free acid be present, the solution assumes a dark-green color.'—Miller's *Organic Chemistry*, 2d ed. p. 400.

The variety of tannin, or tannic acid, occurring in catechu and kino, produces a green precipitate with the persalts of iron; while that occurring in matricaria, rhatany, and the common nettle, produces a gray precipitate. The principal members of this group are—1. *Gallotannic acid* or *Tannic acid*, $C_{54}H_{22}O_{34}$ (in the ordinary acceptation of the word), which is mainly obtained from the gall-nut, and has been described in a special article; 2. *Moritannic acid*, $C_{28}H_{16}O_{20}$, obtained from fustic (*Morus tinctoria*); 3. *Quinotannic acid*, $C_{20}H_{18}O_{17}$, obtained from cinchona bark; 4. *Quercitannic acid*, from oak bark; 5. *Mimotannic acid*, $C_{54}H_{24}O_{24}$, from catechu; and 6. *Kinotannic acid*, from kino; to which some chemists add a variety occurring in coffee and Paraguay tea, to which the term *Caffotannic acid* is given.

TANNING. See LEATHER.

TANSY (*Tanacetum*), a genus of plants of the natural order *Compositæ*, sub-order *Corymbiferæ*, allied to *Artemisia* (q.v.), and having hemispherical heads of flowers, with the florets all tubular, the receptacle naked, the pappus a slight membranous border.

The species are pretty numerous, and are natives of the temperate parts of the Old World.

COMMON T. (*T. vulgare*) is a native of Britain and of Continental Europe, growing in fields and by roadsides, river-banks, &c. It has long been generally cultivated in gardens. It is now naturalized, and pretty common in many parts of North America. It

Tansy (*Tanacetum vulgare*).

is a perennial, from two to four feet high, with great abundance of deep-green, bipinnatifid, inciso-serrate leaves; the flowers in terminal corymbs, yellow, and rather small. The leaves and flowers have a strong aromatic smell and a bitter taste. The young leaves are used for flavoring puddings, cakes, omelets, &c. The plant is also tonic and anthelmintic, and *Tansy tea* is an old popular medicine. Some curious old customs still linger in many parts of England connected with the use of *Tansy cakes* and *Tansy puddings* at Easter, which was originally intended to represent the use of bitter herbs at the Paschal feast. In some parishes of the counties of Devon and Dorset, the clerk carries round to every house a few white tansy cakes as an Easter offering after divine service on Good Friday, and receives a gratuity from each householder. In former times, both ecclesiastics and laics played at ball in the churches for tansy cake at Easter-tide. The highest dignitaries took part in this, and began the ball-playing, which went on during the antiphone, and was accompanied with dancing. After the ball-playing was over, all retired for refreshments; and a gammon of bacon was a standard dish, to signify abhorrence of the Jews. A tansy pudding was an essential part of the feast. —See Chambers's *Book of Days*.

TA'NTALUM (symb. Ta, new equiv. 182) is a very rare metal, discovered in 1802 by Ekelberg in the Swedish minerals known as tantalite and yttrotantalite. It is so closely allied to columbium or niobium, that Wollaston regarded the two metals as identical, a view which was generally adopted till Rose disproved it. As it is of no practical importance, it is unnecessary to enter into any details regarding it.

TA'NTALUS, a character noted in Greek mythology for the punishment he suffered in the lower world. He is said to have been the son of Zeus by Pluto, and some accounts describe him as king of Argus or Corinth. Various reasons are assigned for his undergoing the severe punishment which he did, the most common being, that he divulged the divine councils of Zeus, which the latter had communicated to him as secrets. In the lower world, he was afflicted with an insatiable thirst, and had to stand up to the chin in a lake, the waters of which receded whenever he tried to drink of them. Clusters of fruit hung over his head, which eluded his grasp whenever he endeavored to reach them, his mind at the same time being kept in a state of constant terror lest a huge rock, suspended above his head, and ever threatening to fall, should crush him. T., or rather the punishment which he suffered, has supplied the English language with the very significant verb, 'tantalize.' T. was the father of Pelops, Broteas, and Niobe.

TANTALUS, a genus of birds of the family *Ardeidæ*, resembling storks in their feet and bill, except that the ridge of the bill is rounded, and its tip gradually curved downwards, and slightly notched on each side; a portion of the head, and sometimes of the neck, is bare. The AFRICAN T. (*T. ibis*) was long regarded as the Ibis (q. v.) of the ancient Egyptians, but it is rare in Egypt, and belongs chiefly to Senegal. It is much larger than the true ibis. The AMERICAN T., or WOOD IBIS (*T. loculator*), is as large as a stork, but more slender, white, with black quill and tail feathers, the naked skin of the head and neck black. It is found both in North and in South America. In the United States, it chiefly inhabits the swampy districts of the south.

TANTRA (from the Sanscrit *tan*, to believe, to have faith in; hence, literally, an instrument or means of faith) is a name of the sacred works of the worshipers of the female energy of the god S'iva. See S'AKTAS. A Tantra is said to comprise five subjects —the creation and destruction of the world, the worship of the gods, the attainment of all objects, magical rites for the acquirement of six superhuman faculties, and four modes of union with spirit by meditation. A variety of other subjects, however, are introduced into many of them, whilst some are limited to a single topic, as the mode of breathing in certain rites, the language of birds, beasts, &c. They always assume the form of a dialogue between S'iva and his wife, in one of her many forms, but mostly as *Umâ*, or *Pârvatî* (q. v.), in which the goddess questions the god as to the mode of performing various ceremonies, and the *mantras*, or prayers and incantations to be used in them. These he explains at length, and under solemn cautions that they involve a great mystery, on no account whatever to be divulged to the profane.

The efficacy of these *mantras* is deemed to be all-powerful, and according to some Tantras, that of the faith in these revelations of S'iva so great, as to free a believer from the consequences of even the most atrocious sins. The followers of the Tantras profess to consider them as a fifth Veda (q. v.), and attribute to them equal antiquity and superior authority. Though such an antiquity, or even one approaching the age of the four Vedas, is entirely imaginary, the question of their date is nevertheless involved in obscurity. As Tantras are referred to in some of the *Purân'as* (q. v.), they must have preceded these; but as, on the one hand, the age of the Purân'as themselves is merely conjectural, and as there probably existed older Purân'as than those we possess now; and, on the other hand, as there might likewise have been older Tantras, from which the works now so called were compiled, the circumstance that Tantras are quoted by some Purân'as would not throw much light on the date of those now extant. It seems more significant, however, that the oldest known author of a glossary of classical words, Amarasinha (see *Lexicography*, under SANSCRIT LITERATURE), should have omitted from amongst the meanings he assigns to the word *tantra*, that of 'a sacred book;' whereas the later commentators on his work do not fail to supply this omission, which certainly would have been an extraordinary one had Tantras existed at the time of Amarasinha.

If, then, this negative evidence has the value which it seems to have, the Tantras would, at all events, be later than the first centuries of the Christian era. The works of this class are very numerous, and it is to be regretted that Sanscrit philology, which has already investigated, more or less profoundly, nearly all the branches of Sanscrit literature, should hitherto have almost entirely neglected this particular branch of it. The principal Tantras are the *S'yâmârahasya*, *Rudrayâmala*, *Mantramahodadhi*, *S'âradâtilaka*, and *Kâlikâtantra*.—See H. H. Wilson, *A Sketch of the Religious Sects of the Hindus*, Works, vol. i., edited by Dr. Rost (Lond. 1862).

TA'NTUM E'RGO, the hymn uniformly sung in the Roman Catholic Church at benediction with the Holy Sacrament. These are the first words of the penultimate strophe of the hymn *Pange Lingua*. The *Tantum Ergo* is the most popular of all the Eucharistic hymns of the Roman Catholic Church.

TANZIMAT, or TANSIMAT, the plural of the Arab word *tansim*, generally signifies 'regulations,' but in a special sense denotes the organic laws established by the Hatti-Sherif of Gulhane, in accordance with which the administration of the Turkish Empire is carried on. These organic laws, the first attempt at constitutional government in Turkey, were published by Sultan Abdul-Medjid in 1844, and treat of—*1st*, the political organization of the empire, and the powers and jurisdiction of the chief officials and higher courts; *2d*, administration and finance; *3d*, justice; *4th*, military affairs. But the tanzimat was a dead letter, or nearly so, except in connection with the army; so that on 7th September 1854, the sultan found it necessary to publish a new ordinance, in which the complete carrying out of the tanzimat in all respects was commanded; and a commission was appointed to see that this was done.

TAORMI'NA (anc. *Tauromenium*), a town on the east coast of Sicily, province of Messina, situated on a narrow ledge of rock, 900 feet above the sea, about 30 miles S.-W. of Messina. It consists mainly of a single street, more than a mile in length, is surrounded by a Saracenic wall, has numerous convents and churches, many picturesque palaces and mansions built in the middle ages, and numerous relics of antiquity, among which are very fine sepulchres, an aqueduct, tesselated pavements, remains of a 'Naumachia' and of a theater, the last reckoned one of the most splendid ruins in Sicily, and commanding a view of almost unparalleled magnificence. T. has some trade in wine and hemp, and a population (1872) of 3004.

Ancient *Tauromenium* was built after the destruction of Sicilian

Naxos in 403 B.C., but the exact date is uncertain. It rapidly attained prosperity.

TAOUISM, the religious system founded by LAOU-TSZE (q. v.; and see CHINA).

TAPA'JOS, an important river of Brazil, and an affluent of the Amazon, is formed by the confluence of the Arinos and the Juruena, both of which rise in the south of the province of Matto Grosso. After a northward course of upwards of 1100 miles in length, the T. falls into the Amazon, about 20 miles below the town of Santarem. In lat. about 7° 30′ S., it has a fall of 30 feet; but the interruptions to the navigation, which is said to reach to within a short distance of the source of the river, are few. A portage of only 18 miles separates the upper waters of the T. from those of the Paraguay.

TA'PESTRY (Fr. *tapisserie*), a kind of carpet-work for decorating walls and furniture. The art of working tapestry is extremely ancient, but we have little information about it until the time of the Saracens, who revived it, and brought it into notice. They, in all probability, only used tapestry as drapery or curtains for the courts of their houses; its use as a covering for walls seems to have been an invention of the Flemings previous to 1606, at which date it was introduced into France by Henry IV., who engaged Flemish artists to teach it. At that period, so generally was its origin attributed to the Saracens, that it was called *Sarrazinois*. The oldest piece in existence is that described under the name of the BAYEUX TAPESTRY (q. v.).

At first the Saracenic tapestries were only ornamented with flowers and geometric figures; but the Flemings aimed higher, and sought to enrich them with historic subjects of the highest order; and so important did this art become, that the most eminent masters in painting, from Raphael downwards, bestowed their greatest efforts upon cartoons to serve as copies for the tapestry-workers, of which the celebrated Raphael cartoons, formerly at Hampton Court, now in a gallery specially designed for them in the Kensington Museum, are illustrations (see CARTOON). After its first introduction into France by Henry IV. at the beginning of the 17th c., the art of making tapestry does not appear to have made much progress until the middle of that century, when a small establishment founded by the brothers Canaye on the premises formerly occupied by Jean Gobelin, a dyer of wool, was commenced, and was afterwards carried on by a Dutchman named Gluck and his assistants with such success, that it was suggested by Colbert, the minister of Louis XIV., that it should be taken under the king's patronage; in consequence of which the establishment was bought, and constituted a royal manufactory in 1667, under the management of M. Lebrun, who was the first director. A royal carpet-manufactory had been previously established in 1615; this was called La Savonnerie, from the previous use of the buildings for the manufacture of soap.

The Savonnerie and the Gobelins were both carried on with great spirit by successive sovereigns, and were formed into one establishment in 1826, when the works of the Savonnerie were removed to the Gobelins, where this most interesting work is now carried to great perfection, and also at a minor establishment at Beauvais, in the department of Oise, where it is, however, worked in a different style and manner. At the Gobelins, a series of threads are arranged vertically in a frame like the warp of a loom and the workman stands behind the frame, the pattern being placed behind him for reference. To produce the design, he has a number of wooden needles threaded with wool and silk of the colors required, and these are passed through the upright warp-threads, and brought back, so that each thread becomes covered with the necessary color; and such is the extreme nicety with which this is done, and such the delicacy and multiplicity of the shades of color employed, that but little difference can be detected between the tapestry picture and the painting from which it was coped. At Beauvais, the warp is placed horizontally, and the workman stands over it; this renders it necessary to cut off the ends on the upper surface, which is avoided in the other plan of working from behind. The Beauvais is, however, a style intermediate between tapestry and carpet-work, and the roughness of surface so produced has a good effect. Much fine tapestry was employed in former times in decorating the palaces and mansions of Great Britain, in many of which it is still seen in great beauty. The modern works of the Gobelins were distributed as presents by the late imperial government of France. They are not produced in great numbers, and are of great money value. The number of artists employed is about 120.

TA'PEWORM, is a word popularly used in a vague sense to designate any worm of the group *Cestoidea* (see CESTOID WORMS). According to Dr. Cobbold, upwards of 250 distinct forms of cestoid worms have been described, of which probably somewhat less than 200 may be regarded as really good species. These he divides into the three families of (1) *Tæniadæ*, or true tapeworms; (2) *Bothriocephalidæ*, and (3) *Tetrarhynchidæ*. For the natural history of the tapeworms generally, we must refer to the article

CESTOID WORMS. We will here only remind the reader of the following points necessary for the due understanding of this article, and that every T. passes through several distinct phases during its life-history. 'In the ordinary colonial or tapeworm condition, says Dr. Cobbold, 'it has been termed the *strobila* (Van Beneden). The separate joints of which the strobila is composed are denominated *proglottides*, or zooids. The anterior segment forms the *head*, and remains barren, those of the neck and front part of the body being sexually immature during the process of strobile-formation. The mature proglottides at the caudal end are capable of realizing an independent existence, and the eggs which they contain develop the six-hooked embryos, or *proscolices* (Van Beneden), in their interior. These latter become metamorphosed into *scolices* or nurses, representing the well-known cysticercal state, which, in its sterile or aborted condition, forms the common *hydatid*.'—*Entozoa*, p. 105. During the greater part of their existence, the tapeworms are parasitic animals, the mature proglottides and eggs being free only during a comparatively short interval. They are mostly restricted in their distribution to the vertebrate animals, comparatively few of the invertebrates (excepting the cuttle-fish) appearing to harbor them in their adult condition, although the T. larvæ, nurses, or *scolices* probably abound in various invertebrate groups.

In the human body, no less than ten species of T. occur, viz., eight *true tapeworms*, and two species of *Bothriocephalus*; and as four distinct species have been found in the Barbary ape, it is obvious that errors of diet, due to civilization, are not the cause of these parasites. Amongst the animals with which we are most familiar, the species are plentiful in the common dog (and in true carnivora generally), in rats, and mice. The typical ruminants are almost constantly infested both by mature and immature forms; while the larger pachyderms, and solidungulates (the horse, ass, &c.), harbor only a few adult forms; but only larvæ appear to be known in swine. These worms appear to be as abundant in granivorous birds as in Carnivorous hawks, owls, &c. In the water-birds generally, the adult worms are very abundant, their larvæ existing in the food of such birds, in fishes, molluscs, &c. In reptiles, these worms are extremely rare, although other parasitic worms abound; while in fishes they are very abundant both in the adult and larval forms.

The *Tæniadæ*, or *true tapeworms*, may be distinguished from the other families of the order *Cestoidea* (cestoids or tapeworms in the popular sense) 'by the possession of a small distinct head, furnished with four simple oval or round suctorial discs (suckers), and commonly also with a more or less strongly pronounced rostellum (proboscis) placed at the summit in the median line. This prominence, when largely developed, becomes retractile, and when not in use, is lodged within a flask-shaped cavity, lined by a sheath, and supplied with special muscles; it is also very frequently armed with a single or double crown of horny chitinous hooks, there being occasionally as many as five or six separate circular rows of these organs. Attention to the number, relative size, and disposition of the hooks is often sufficient to determine the particular species. In nearly all cases, the reproductive orifices are situated at or near the margins of the joints which are bisexual.'—Cobbold, *op. cit.*, p. 109. The eight true tapeworms occurring in man are—(1) *Tænia solium*, Linnæus; (2) *T. mediocanellata*, Küchenmeister; (3) *T. acanthotrias*, Weinland; (4) *T. flavopuncta*, Weinland; (5) *T. nana*, Von Siebold; (6) *T. elliptica*, Batsch; (7) *T. marginata*, Batsch; (8) *T. echinococcus*, Von Siebold.

Fig. 1.

1. Head, neck, and upper joints of *Tænia solium* magnified: *a*, the circle of hooks; *b* and *c*, two of the sucking discs; *d*, the neck.—2. One of the lower or sexually mature joints of the same, showing the water-vascular canals, and the branched uterine organ distended with ova.

The *common tapeworm*, *Tænia Solium*, derives its Linnæan title

from the idea that it is always a solitary worm. Although this is commonly, it is not by any means always the case: Küchenmeister has several times found two or three together, and cases are recorded in which 30 and even 40 worms have been expelled from one patient. The full-grown T. (strobila) has been known from the earliest times, and is described by Hippocrates, Aristotle, and Pliny; but its organization and mode of development have only been properly understood during the last few years. The segments of which it is composed vary in size, and number from 800 to 1000, the earlier immature ones being extremely narrow, and the sexually mature joints commencing at about the 450th segment. From 10 to 35 feet may be regarded as representing its ordinary length; its breadth at about the widest part being one-third of an inch. The head, which is seldom seen in the tapeworms exhibited in our museums, although the evacuation of the head with the rest of the worm is not very rare, is very small and globular (about the size of a pin's head), with black pigment ingrained in it.

On examining it with a low magnifying power, it displays four circular sucking discs, in front of which is a conical proboscis, armed with a double crown of hooks, from twenty-two to twenty-eight in each circular row. The head is succeeded by a very narrow neck, nearly half an inch in length, which is continued into the anterior or sexually immature part of the body, in which traces of segmentation first appear in the form of fine transverse lines, which are gradually replaced by visible joints. These joints or segments represent the body, and each mature segment contains both male and female organs of generation; and in addition to these structures, the entire series of joints is traversed by a set of vascular canals constituting the so-called aquiferous system, which consists of two main channels, one passing down on either side of the worm, and both being connected by transverse vessels, which occur singly at one end of every joint. It is only in the alimentary canal of man or some other animal that a T. of any kind can attain to sexual maturity; and in all of these the eggs are fecundated before being discharged.

Fig. 2.
The double crown of hooks more highly magnified.

The expulsion of the eggs may take place in any of the following ways: First, the mature segments separate from each other, and passing out of the body, either with the ordinary evacuation of the bowels or independently, become decomposed, and set free the enclosed eggs. The single joints thus discharged undergo violent contraction after being expelled, which led to their being formerly mistaken for a distinct species of worm, to which the title *Vermes cucurbitini* was applied, from their resemblance to a pumpkin seed. There is a figure in Aitken's *Medicine*, 3d ed. vol. i. p. 815, showing the joints of a *Tænia mediocanellata* (which will be presently described) of the natural size, in various stages of contraction; and on examining the recently discharged excrement of a constipated dog, the same phenomenon may be very frequently observed. Secondly, the eggs may be discharged through the genital pore by pressure from any cause. It is only thus that we can account for the occasional (but very rare) co-existence of a *Cysticercus cellulosæ* (the embryo of the worm) and an adult T. in the intestinal canal of the human subject—an association which constitutes one of the most serious dangers which the matured worm can inflict upon its host, and one of the strongest indications for its removal. Thirdly and lastly, the mature joints sometimes appear to undergo disintegration within the intestine, and to liberate the eggs; but the conditions under which this disintegration occurs are unknown.

In reference to the ultimate fate of the embryos *in ovo*, that are liberated in the intestinal canal, Dr. Cobbold has informed the author of this article in a private communication, that, in his opinion, they do not migrate in the living host, except when by regurgitation they occasionally get into the stomach, when, after their shells have been dissolved by the gastric juice, the young organisms commence their wanderings. The mature segments are usually expelled from the human bowel at the rate of six or eight a day. Their vitality is prolonged by moisture, which favors the distribution of the liberated eggs over grass and other vegetables, or in water, which may be used as food or drink by animals. For a full description of the eggs, we must refer to Dr. Cobbold's work. It is sufficient here to remark, that, in their mature condition, they 'present a globular figure, and are easily recognized by their remarkably thick shell, which surrounds the six-hooked embryo. They present an average diameter of $\frac{1}{64}$th of an inch, the shell itself measuring about $\frac{1}{4000}$th of an inch in thickness. After a while, by accident, as it were, a pig coming in the way of these embryos, or of the proglottides, is liable to swallow them along with matters taken in as food.

'The embryos, immediately on their being transferred to the digestive canal of the pig, escape from the egg-shells, and bore their way through the living tissues of the animal, and having lodged themselves in the fatty parts of the flesh, they there rest to await their further transformations or destiny. The animal thus infected becomes measled, its flesh constituting the so-called measly pork. In this situation, the embryos drop their hooks, and become transformed into the *Cysticercus cellulosæ*. A portion of this measled meat being eaten by ourselves, either in a raw or

Fig. 3,
a, a fully developed *Cysticercus cellulosæ* or *Measle*, taken from fresh pork (natural size); *b*, Cysticercus from salted pork; *c*, the same as *a*, magnified about 3 diameters; *d*, the same as *c*, with the head and body withdrawn from the caudal vesicle.

imperfectly cooked condition, transfers the cysticercus to our own alimentary canal, in which locality the cysticercus attaches itself to the wall of the human intestine, and having secured a good anchorage, begins to grow at the lower or caudal extremity, producing numerous joints or buds to form the strobila or tapeworm colony.'—Cobbold, *Entozoa*, p. 221. In its fully mature stage, the *measle* presents the appearance of an elliptical hydatid, varying in size from that of a pea to that of a small kidney-bean, the average diameter being one-third of an inch. On dissecting or breaking up a measle, it will be seen that the great vesicular portion constitutes the bladder-like caudal extremity of the cysticercus, while the head, neck, and body can be drawn out so as to exhibit a vermiform character.

In the article GENERATIONS, ALTERNATION OF, it was stated that the group of phenomena included in that term would be further illustrated in the history of the tapeworm. From what has been already shown, it appears that 'we have a simple alternation of generation in which the immediate product of the proglottis (or sextually matured zooid individual) is a six-hooked brood; by metamorphosis, the latter becomes transformed into the cysticercus, having a head with four suckers, and a double crown of hooks; and by gemmation, the latter gives rise to a whole colony (strobila) of individuals, the greater part of which are destined to become sexually mature—zooid individuals or proglottides. It will be observed, therefore, that the product of a single ovum is, in the first instance, a single non-sexual embryo; in the second phase, it becomes a non-sexual cysticercus (these two phases together constituting the protozooid); in the third change it gives off, by budding, numerous gemmules, most of them destined to be sexually mature individuals (or deuterozooids), in this way resembling their original parents.

'The relation and nature of these developmental changes may be further simplified by placing the various life phases in a tabulated form as follows:

'(*a.*) Egg in all stages.
(*b.*) Six-hooked embryo = proscolex. } Protozooid.
(*c.*) Resting larvæ or *Cysticercus* (*telæ*) *cellulosæ* (scolex). }
(*d.*) Immature tapeworm.
(*e.*) Strobila, or sexually mature *Tænia solium*.
(*f.*) Proglottis (cucurbitinus) = free segment = deuterozooid.'

—Cobbold, *Entozoa*, pp. 221, 222.

How long a T. can naturally exist in an intestinal canal is not known; but there is doubtless a period at which the parasite spontaneously separates from the intestinal mucous membrane of its host—a period probably coinciding with the shedding and non-renewal of the circlet of hooks. When this separation occurs, the whole length of the worm is expelled in the same manner as if the parasite had been first killed by the administration of a vermifuge medicine. From this history of the structure and life-history of this organism, which applies with slight difference in minor points to all other tape-worms, we proceed to describe the injurious effects which the worm in its adult and larval stages produces on man, and the precautions which should be taken to prevent its entrance into the system; while the discussion of the means of expelling it when it has once found a lodgment in the intestinal canal, will be postponed to the article on VERMIFUGES.

The common T. may cause disease, and even death, by its aggressions, either in the adult or in the larval stage of its existence. A mature T. in the intestinal canal may give rise to a series of anomalous symptoms, including 'vertigo, noises in the ears, impairment of sight, itching of the nose and anus, salivation, dyspepsia, and loss of appetite, colic, pains over the epigastrium and in different parts of the abdomen, palpitation, syncope, the sensation of weight in the abdomen, pains and lassitude in the limbs, and emaciation.'—Davaine, *Traité des Entozoaires*, &c., p. 103. Many cases are on record in which hysterical fits, chorea, epilepsy, convulsions of various kinds, and even mania, have been induced by the irritation excited by this parasite, and have ceased at once on its removal. But distressing as these symptomatic phenomena may be, their injurious effects are trifling as compared with the troubles which follow the deposition and growth of the larval form within the body, especially when the cysticerci find a home in the more important vital organs. There are at least a hundred cases on record in which the cysticercus has caused death by its development within the human brain.

In the present state of our knowledge, it is impossible to diagnose these cases; and even if a correct diagnosis were possible, nothing could be done in the way of treatment. Epilepsy, with or without mania or imbecility, is commonly, but not invariably present in these cases. 'Cysticerci,' says Dr. Cobbold, 'may develop themselves in almost any situation in the human body, but they occur most frequently in the subcutaneous, areolar, and inter-muscular connective tissue; next, most commonly in the brain and eye, and lastly, in the substance of the heart and other viscera of the trunk.'—*Entozoa*, p. 226. The *adult form of the worm* enters the system as the cysticercus of measly pork, and to eat raw or underdone measly pork is an almost certain means of introducing this parasite into the body. It is satisfactory to know that the temperature of boiling water is quite sufficient to destroy the vitality of the measles; and that in ordinary salted pork, and in hams, they are destroyed by the action of the salt in the one case, and of the combined salt and smoke in the other. Sausages, into which it is to be feared measly pork too often finds its way, are rendered safe if they are cooked till no pink, raw like, fleshy look can be seen in their center. Butchers are especially liable to T., in consequence of their touching and cutting measly pork, and then accidentally transferring the cysticercus by the hand, or even by the knife, to the mouth; and by indiscriminately using the same knife for various meats, both butchers and cooks may readily disseminate the infection over various articles of food.

The *larval worm* may gain access into the human body by our swallowing the mature eggs of the tapeworm. Those who, as students of this department of natural history, handle fresh tapeworms, are perhaps especially liable to this misfortune; but, says Dr. Cobbold, 'our neighbors, who devour choice salads, also run a certain amount of risk, not only as regards this entozoon, but as respects several others. The vegetables may be manured with night-soil containing myriads of tapeworm eggs, or they may be watered with fluid filth into which these eggs have been cast. In such cases, one or more tapeworm ova may be transferred to our digestive organs, unless the vegetables are carefully cleansed before they appear on the table. In the same way, one perceives how fallen fruits, all sorts of edible plants, as well as pond, canal, or even river water, procured from the neighborhood of human habitations, are liable to harbor the embryos capable of gaining an entrance to our bodies. It thus becomes evident also how one individual suffering from tapeworm may infect a whole neighborhood, rendering the swine measly, these animals in their turn spreading the disease far and wide.' Such a person may also prove dangerous—even fatal to his neighbors directly (without the intervention of a pig), by ejecting mature proglottides, from which thousands of eggs may escape, some of which may readily come in contact with human food or drink, make their way into the stomach, and from thence get into the circulation, and finally to the brain, where they cause convulsions and death.

The most remarkable case on record of what may be termed a *measly* man, is one described, in 1864, by Delore, in the *Gazette Méd. de Paris*, and quoted by Dr. Cobbold. He died at the age of 77, from pulmonary catarrh, old age, and fractured neck of the thigh-bone; and on examining his body after death, no less than 2000 cysticerci were found, of which 111 occurred in the nervous centers.

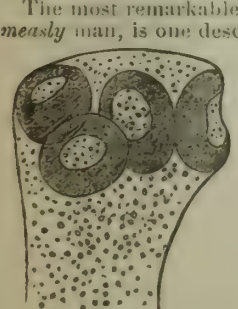


Fig. 4.
Head of *Tænia mediocanellata*, magnified about 35 diameters. (From Cobbold.)

The T. that ranks next in importance to the *Tænia solium* is the *Tænia mediocanellata*, which was first established as a distinct species by Küchenmeister only a few years ago. It exceeds the *T. solium* both as regards length, breadth, and the thickness of the individual segments; the head is also somewhat larger, abruptly truncated at the crown, destitute of a proboscis and a hook-apparatus—hence this species has been described as the *hookless tapeworm*—but furnished with very large sucking-discs, surrounded by much dark pigment, which gives the head a blackish appearance. The specific name of *mediocanellata* has reference to an interesting and almost specific character in connection with the water-vascular system, into which we have not space to enter.

Leuckart has proved by experiment that the measles or cysticerci which produced this worm are to be found in the muscles and internal organs of cattle. He administered proglottides of *T. mediocanellata* to three calves, a sheep, and a pig. In the two last-named animals, they produced no effect, as was shown by their post-mortem examination; while in the calves they produced a kind of leprosy, which has since been characterized as 'acute cestoid tuberculosis,' and which proved fatal if too large a dose of eggs was administered. On examining one of these animals after its restoration to health—48 days after the eggs were swallowed—he found numerous cysticercus-vesicles, larger and more opalescent than those of the pig, lodged within the muscles; and as the heads of the contained cysticerci exhibited the distinctive peculiarities presented by the head of the adult worm, 'we are supplied with the most unequivocal evidence that man becomes infested with this second form of tapeworm by eating imperfectly cooked veal and beef.' Hitherto, the two above-described species have commonly been included under *T. solium*, from want of due examination, especially of the head. Dr. Cobbold believes that their respective frequency will ultimately be found pretty well on a par, though probably the *T. solium* will maintain a slight ascendency, in consequence of the relative cheapness of pork. 'Admitting occasional exceptions,' he observes, 'the hooked worm infests the poor, and the hookless worm the rich. This circumstance accords with the fact, that the lower classes subsist chiefly upon pork, whilst the wealthier prefer mutton, veal, and roast-beef.'—*Entozoa*, p. 243. It gives rise to the same symptoms as the *T. solium*.

The next five tapeworms infesting man may be passed over without notice, as being of very rare occurrence. *Tænia acanthotrias* is only known from a single case, in which, in the larval stage, it was found in the muscles of a woman. The last species we shall describe, the *T. echinococcus*, is, in its larval condition, probably more fatally injurious to the human race than all the other species of entozoa put together. In its mature (strobila) condition, in which it is found only in the dog and wolf, it seldom exceeds the fourth of an inch in length, and develops only four segments, including that of the head. The final segment, when sexually mature, equals in length the three anterior ones, and contains as many as 5000 eggs. The proscolex or embryo forms large proliferous vesicles, in which the scolices or larvæ (known also as acephalocysts, echinococci, echinococcus heads or vesicles, pill-box hydatis, &c.) are developed by gemmation internally. The eggs develop in their interior a six-hooked embryo, and these embryos are introduced into our bodies with food or water into which the eggs have been carried.

'With an especial liking for the liver,' says Dr. Cobbold, 'they bore their way into this organ or are carried along the circulating current to other organs. In these situations, they sooner or later become transformed into simple vesicular, bladder-like bodies, commonly called acephalocysts or hydatids.' Instead, however, of displaying the head, neck, and body of a cysticercus, the vesicle retains a globular figure. Its growth is slow, and many months elapse before echinococci are developed within our bodies, after we have swallowed the proper T. eggs and their contained embryos. There have been great differences of opinion amongst physiologists as to the mode of development of these echinococci; but the following is probably the current view. The inner surface of the vesicle presents after a time slight papillæ or prominences, which, as they enlarge and become oval, are eventually scoleciform, and contain a cavity filled with a limpid fluid. This scolex-like development produces in its interior a brood of scolices or echinococcus heads, or, in other words, becomes gradually transformed into the so-called 'brood-capsules' of helminthologists. It is almost impossible to explain the nature of these brood-capsules, with young echinococci in their interior, without the aid of such diagrams and illustrations as are given by Cobbold in his chapter on *T. echinococcus*.

In the fully developed state, the echinococci vary from $\frac{1}{60}$th to $\frac{1}{100}$th of an inch in diameter. The rostellum supports a double curve of hooks, those in the smaller row varying in size from $\frac{1}{1670}$th to $\frac{1}{1850}$th of an inch, whilst those of the larger series are from $\frac{1}{830}$th to $\frac{1}{1850}$th of an inch. Below the hooks are four suckers, and the general appearance of the body is finely granulated, from its containing calcareous particles. These hooklets are so characteristic and important in diagnosis, that we give a highly magnified representation of them. It often happens that the discovery under the microscope of a few of these little hooks at once decides the nature of an otherwise mysterious tumor. Of 373

cases of the parasite occurring in man, collected by Davaine (who devotes more than one-third of his *Traité des Entozoaires* to this subject), 165 affected the liver, 40 the lungs, 30 the kidneys, 20 the brain, and 17 the bones, while the remainder were spread over other parts; and of 136 cases collected by Cobbold, 51 affected the liver. No less than 35 of these 51 cases recovered. 'Four of them were complete natural cases; two others being also temporarily cured in the same way. All the rest were cured by surgical operations.'

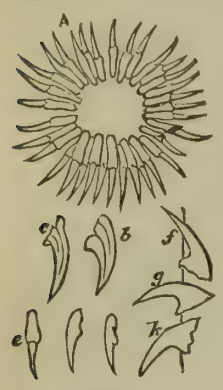


Fig. 5.

A, magnified view of the circle of hooklets seen upon its under surface, thirty-four in number; *b*, *c*, lateral views of the separate hooklets; *e*, hooklets seen on the inferior or concave border; *f*, *g*, *h* illustrates the movements and position of the hooklets, the vertical line running through the fixed point of each of the three hooks.

It is impossible to state with accuracy the degree of prevalence of hydatids in this country, or the extent to which it proves fatal. In Iceland, this disease is endemic to such a degree that about one-sixth of the population are affected with it. It produces a long illness, terminating with a painful death, and no means of cure have yet been discovered. Its prevalence in that island may be rationally accounted for. Firstly, every peasant has, on an average, six dogs, all of which are probably infested by the mature T.; and secondly, there being only six legally authorized medical men, the great majority of the population (over 10,000 persons, scattered over 1500 sq. m.) are in the hands of quacks, whose principal treatment consists in the administration of *fresh dog-excrement!* Our authority for this astounding specimen of homœopathic treatment is Leuckart, whose admirable popular essay, *On the Newest Discoveries regarding Human Intestinal Worms, and their Importance in Relation to Hygiene*, in the *Conversations Jahrbuch*, 1863, is deserving of the most careful study. For an excellent abstract of the remarkable series of experiments by which the relationship between the so-called cystic worms and the cestoid worms was established, we may refer the reader to Aitken's *Science and Practice of Medicine*, vol. i.; while for the subject of T. generally, the highest authorities are the works of Küchenmeister and Siebold, translated by the Sydenham Society; Davaine's *Traité des Entozoaires;* Weinland's *Essay on the Tapeworms of Man;* Cobbold's *Entozoa* (1864), a work equally remarkable for the vast amount of original research which it contains, and for the beauty and correctness of the illustrations; and of Leuckart's *Die Parasiten des Menschen* (Leipzig, 2 vols. (1863—1876), which is the standard work on the subject of the parasites of man.

TAPEWORMS, although rare amongst horses and cattle, are common in dogs and sheep, causing irritability of the bowels, and an unthrifty appearance. For dogs, no remedy answers so well as powdered areca nut, of which 30 grains suffice for a dog weighing about 20 lbs. It is best given after ten or twelve hours' fasting, in a little soup or milk, and should be followed in a few hours by a dose of castor oil. Neither areca nut nor any of the approved remedies used in men, prove effectual in sheep; and one of the best prescriptions for them consists of 40 drops of oil of turpentine, a drachm of powdered green vitriol, and an ounce of common salt, given mixed in a little milk or gruel, or, where their bowels are confined, in linseed oil. A daily allowance of linseed cake and sound dry food should likewise be given with the grass or roots, and pieces of rock-salt left within the animal's reach.

TAPIO'CA. See MANIOC and CASSAVA.

TA'PIR (*Tapirus*), a genus of *Pachydermata*, of the section *Ordinaria;* having a bulky form, with moderately long legs; the fore-feet four-toed, the hind-feet three-toed; the skin thick, the hair short; the tail very small; the neck thick; the ears short; the eyes small; the muzzle elongated; the nose prolonged into a short, flexible proboscis, which, however, does not terminate in an organ of touch and prehension, like that of the elephant; six incisors, two canine teeth, and fourteen molars in each jaw, the molars separated from the canine teeth by a wide interval. The best known species is the AMERICAN T. (*T. Americanus*), which is about the size of a small ass, and is common in almost all parts of South America, its range extending as far south as the Strait of Magellan, although it suddenly ceases to be found at the Isthmus of Darien. Its color is a uniform deep brown, but the young are beautifully marked with yellowish fawn-colored stripes and spots. The skin of the neck forms a thick rounded crest on the nape, with a short mane of stiff hair.

The T. inhabits deep recesses of the forest, and delights in plunging and swimming in water. It feeds chiefly on young shoots of trees, fruits, and other vegetable substances; but is ready to swallow almost anything that comes in its way. Pieces of wood, clay, and pebbles are often found in its stomach. It sometimes commits great ravages in cultivated grounds; a large herd of tapirs sallying forth from the forest by night, trampling and devouring all that they find in the fields. The T. is a very powerful animal, and, protected by its thick hide, forces its way

Malayan Tapir (*Tapirus Malayanus*), and Young.

through the forest where almost no other quadruped can. When assailed by the jaguar, it seeks to get rid of him by rushing through thick underwood, and if it can reach water, is often successful by plunging in and diving. It is inoffensive, never attacking man; but when hard pressed by dogs, makes a violent resistance, and inflicts severe bites. It is very easily tamed, and becomes extremely familiar; but its large size makes it a troublesome pet. Its hide is useful, and its flesh is eaten, although rather dry.—The MALAYAN T. (*T. Malayanus* or *Indicus*) is found in Malacca, Sumatra, &c. It is larger than the American T., and its proboscis is rather longer in proportion. The neck has no mane. The color is glossy black, except the back, rump, and sides of the belly, which are white. The colors do not pass gradually one into another, but the line of separation is marked, giving the animal a very peculiar appearance.

The habits of this species are very similar to those of the American T., and it is equally capable of domestication. The young are striped and spotted as in that species.—A third species is found in the mountainous parts of South America.

The remains of tapirs have been found in Miocene and subsequent strata. In all, about twelve species have been determined. Tapir-like animals are common in Eocene beds. Ten species of *Palæotherium* (q. v.) have been described. *Lophiodon*, of which fifteen species have been observed, differs from *Palæotherium* in the structure of the teeth of the lower jaw—and from other peculiarities in the same organs, *Coryphodon* (containing three species) has been separated from both genera.

The T. is a remarkable exception to the generalization deduced from the comparison of the later Tertiary mammals with those living in the same districts at the present day, viz., that there is a close correspondence between the fauna of the two periods. The Pliocene and Post-pliocene bears, hyenas, tigers, elephants, &c., of Europe and Asia are represented by living species of the same or nearly allied genera. The recent sloths, armadilloes, and prehensile-tailed monkeys of South America were preceded by closely related forms in the later Tertiary period; as were also the marsupials of Australia. Several species of T. have been found in Europe, but they have left no representatives nearer than Eastern Asia and South America.

TAPPING is an operation which is most commonly performed on the abdomen, but occasionally on the chest and head. Tapping of the abdomen gives great relief when the abdomen becomes inconveniently distended with fluid contained in the peritoneal sac, or, in the case of the female, in an ovarian cyst. A small incision is then made about two inches below the navel, through which the cutting surfaces of the trochar—the instrument used in this operation—are passed. By arrangements into which we need not enter, the fluid escapes through this instrument. The wound made by the trochar in the abdomen will, in ordinary cases, heal in a few days.

Tapping of the chest is an operation which is occasionally required for the relief of empyema and other effusions in the cavity of the pleura. Tapping of the head has been occasionally found successful in hydrocephalus. Tapping of the pericardium has been practised in cases of pericardial dropsy, but it is an operation not to be recommended under any circumstances.

TA'PTI, a river of the British presidency of Bombay, India, rises in the Saugur and Nerbuddah territories, in lat. about 21° 46′ N., flows west through Scindhia's dominions and the districts of Candeish and Surat to its mouth in the Gulf of Cambay, 17 miles below the town of Surat. It is 441 miles in length; but can hardly be said to be navigable, for even small vessels of from 40 to 50 tons burden cannot ascend higher than Surat.

TAR is a well-known substance, for which it is difficult to frame a definition, since it varies in composition, color, and consistence, and is derived from all three kingdoms of nature. In various parts of the world, it occurs as a natural mineral product, and is known under the various names of bitumen, asphalt, petroleum, natural tar. See NAPHTHA. As an animal product, a species of tar is obtained from the destructive distillation of bones employed in preparing bone-black. The distillate, which possesses a most offensive odor, separates into a heavier layer of black animal tar—commonly known as *bone-oil*, or *Dippel's Animal Oil*—and a lighter layer of watery solution of sesquicarbonate of ammonia, commonly known as *bone-liquor*, and much employed in the preparation of various salts of ammonia. This animal tar is chiefly used for the lubrication of machinery. The vegetable kingdom is, however, the most important source of tar. On submitting wood to destructive distillation in closed vessels, we obtain a large number of products, which are described in the article WOOD, DISTILLATION OF; some are gaseous and some liquid, and of the latter one portion is soluble and the other insoluble in water. This insoluble portion constitutes wood-tar, and is composed of a mixture of various liquids holding solid matters in solution or in suspension.

Amongst its most important constituents, Professor Miller mentions several forms of hydrocarbon, such as toluol, $C_{14}H_8$; xylol, $C_{16}H_{10}$; cymol, $C_{20}H_{14}$; and eupion, besides a number of oxidized compounds, including creasote, $C_{24}H_{16}O_4$, picamar, and kapnomar, $C_{20}H_{11}O_3$; whilst among the solid portions are resinous matters resembling colophony, and a waxy substance named paraffin, and many other substances, such as napthalin, cedriret, pittacal, pyrene, $C_{30}H_{12}$; chrysene, $C_{12}H_4$; and pyroxanthin. (When the formula is not given, the exact composition of the substance is not determined with certainty.) The *Stockholm tar*, which is so widely used in ship-building, and the *American tar*, which is almost equally celebrated, are chiefly prepared from the resinous wood of the pine, and especially of the root of the tree. The specific gravity of ordinary tar is about 1·040. Peat yields a tar very similar to wood-tar. Coal yields, on distillation in closed vessels, even a larger number of products of distillation than are yielded by wood. In addition to numerous gaseous products, the liquid portions contain water and various forms of hydrocarbon, which collectively form the liquid known as *coal-naptha;* besides which there is a large quantity of a dark viscous matter known as *coal-tar*. The mixture of naptha and tar is described in this work under the title of GAS-TAR. For an account of the beautiful *Coal-tar Colors* or aniline dyes, see the articles DYE-STUFFS and PHENYL.

The distillation of coal-tar is conducted on an extensive scale as a separate branch of trade. From Miller's *Organic Chemistry* we extract the following remarks on the compounds present in this substance: 'Of the substances contained in coal-tar, some are basic, and some acid, but the principal portion consists of neutral or indifferent bodies. The basis include ammonia, aniline, picoline, quinoline, and pyridine. Among the acids, the acetic is present in small amount; but the most important is phenic acid, the carbolic acid of Runge. This chemist also mentions two other acids named *rosolic* and *brunolic* acids. The neutral substances contain several hydrocarbons, including benzol, tuluol, cumol, and cymol, which are among the liquid constituents; while naphthalin, anthracene, chrysene, and pyrene are amongst those which are solid at ordinary temperatures.' When either wood-tar or coal-tar is submitted to distillation, the solid brown or black residue left in the retort constitutes *pitch*.

Wood-tar, under the title of *Pix liquida*, is included in the Pharmacopœia, in which its characters are given as follow: 'Thick, viscid, brownish black, of a well-known peculiar aromatic odor. Water agitated with it acquires a pale-brown color, sharp empyreumatic taste, and acid reaction.' Tar was more used in medicine in former times than at present. Bishop Berkeley's commendatory essay on the use of tar-water, in diseases of the chest and kidneys, is well known to all literary students (see Chambers's *Book of Days*, vol. i. p. 108). Since his time the inhalation of tar-vapor has been highly recommended in cases of phthisis; and tar-capsules are still occasionally prescribed in cases of relaxed mucous membrane. In the present day, tar is, however, seldom used except as a local stimulant in chronic cutaneous diseases.

In modern commerce, there are two kinds of wood-tar known—that made in the north of Europe from the wood of *Pinus sylvestris*, and the North American, which is made from *Pinus rigida*, *P. tæda*, *P. Australis*, &c. The distillation is usually performed in a very rude manner: a funnel-shaped hole is dug in a bank, about 6 or 8 feet in diameter at the upper part, and not more than 18 inches at the lower. At the bottom of the hole is placed an iron pan, having a long spout or pipe, which is made to pass through the bank; the hole is then filled up with billets cut from the roots and branches of the pine-trees, which, after being kindled at the top, are covered over incompletely with turf. The wood is thus charred from above downwards; and the tar, mixed with various other products, flows off at the bottom through the spout into a receiver. A somewhat similar product is obtained in the distillation of coal for gas, and in the distillation of bones in forming animal charcoal. Formerly, the chief value of these materials was as a preservative coating for exposed wood-work, ships, sails, ropes, &c., in consequence of their very highly antiseptic properties. A better knowledge of their chemical history has, however, much increased their value. The imports of wood-tar into Great Britain exceed five millions of gallons annually; while the supply of coal-tar produced in the gas-works, charcoal-works, and bone-works of the United Kingdom cannot be estimated at much under that quantity.

TA'RA, or TARO (*Colocasia macrorhiza*), a plant of the natural order *Araceæ*, of the same genus with the Cocco (q. v.), or Eddoes, and cultivated for its roots, which are a principal article of food in the South Sea Islands. The roots are 12 to 16 inches long, and as much in girth. They are washed to take away their acridity, which is such as to cause excoriation of the mouth and palate. They are cooked in the same way as bread-fruit, the rind being first scraped off. A pleasant flour is made of tara. Many varieties are cultivated. The plant has no stalk; broad, heart-shaped leaves spring from the root; and the flour is produced in a spathe. The leaves are used as spinach.

TARA FERN (*Pteris esculenta*), a species of Brake (q. v.), the root (rhizome) of which was one of the principal articles of food of the New Zealanders, before the settlement of New Zealand by British colonists. This fern comes to perfection only in good soils, and there the plant is 10 feet high. Plants three years old furnish the best roots, which are about an inch in circumference. The root, being dug up, is cut in pieces about 9 inches long, and placed in stacks, carefully protected from rain; it is the better of being a year above ground. For use, it is steeped in water, dried in the sun, and then roasted. A large quantity of a very pleasant flour is obtained from it by beating on a stone.

TARANAKI, a provincial district of New Zealand, occupying the south-west corner of the north island; area, 2,137,000 acres, of which three-fourths are dense forest. The coast is lined with iron-sand. The soil and climate are good for rearing cattle, horses, and sheep. Pop. (1881) 14,858. The capital is New Plymouth, pop. (1881) 3310.

TA'RANTISM may be defined a leaping or dancing mania, originating in, or supposed to originate in, an animal poison. The name is supposed to be derived from the ground-spider, *Tarantula* (q. v.), which conveyed the poison into the human body by its bite. The gesticulations, contortions, and cries somewhat resembled those observed in St. Vitus's Dance, and other epidemic nervous diseases of the middle ages, with which tarantism was contemporaneous; but the affection differed from these in its origin, in the cachexia present, in the elegance of the movements of the victims, in their partiality for red colors, bright and luminous surfaces, their passion for music, and in their restoration depending upon the use of instrumental or vocal music as a remedy.

Although the sufferers were subjected to extraordinary treatment, such as being buried up to the neck in earth, the success of music was so universal and invariable, that a class of tunes is said to have been composed, called *Tarantella* or *Tarentella*, to be employed in the cure of the tarantati. The name may, however, have been given to the dance so called (with pipe and tambourine accompaniment), simply because popular in and near Taranto, and have passed to all musical compositions in the rapid triplet time of the dance. T. was most prevalent in Apulia, where the insects abound. Whatever share in the disorder the bite of the tarantula spider may have had, it is unquestionable that the sufferers were afflicted with some not then recognized nervous malady. The symptoms are plainly those of hypochondriacal and hysterical affections. Modern experiments have proved that the bite of the tarantula is in nowise more dangerous or remarkable in its effects than that of other spiders.—Hecker, *Epidemics of Middle Ages;* Madden, *Phantasmata;* Bergsoe, *Die Italienische Tarantel*.

TARA'NTO (anc. *Tarentum*), a town of Southern Italy, in the province of Lecce, is situated on a rocky islet, formerly an isthmus, between the Mare Piccolo (Little Sea), an extensive harbor on the east or landward side of the town, and the Mare Grande (Great Sea), or Gulf of Taranto, on the west. The natural channel between the two 'seas' has been spanned by a long bridge of seven arches, rendering the Mare Piccolo quite useless as a harbor, and forcing ships to anchor in the outer roads, which are much exposed to south and south-west winds. The principal buildings of T. are a cathedral dedicated to St. Cataldo, a native of Raphoe in Ireland, who was first Bishop of T.; a fine episcopal palace; a castle and fortifications erected by Charles V., and commanding both seas; and two hospitals. The streets are as narrow and dark as those of an oriental city. T. has manufactures of

velvets, linens, and cottons, but little commerce. The Mare Piccolo, however, is still famous (as of yore) for its immense abundance of shell-fish, and a considerable portion of the population (which in 1881 amounted to 33,942) derives its subsistence from the oyster and mussel fisheries.

Ancient Tarentum, however, was a far more famous and splendid city than its modern representative. Founded by a body of Spartan emigrants about 708 B.C., it grew and prospered for centuries in happy obscurity. Its territory was not perhaps very fertile, but its pasturage was of the finest, and its olive groves were unsurpassed. Yet it was not these things that ultimately made it the sovereign city of Magna Græcia; this rank it attained through the supreme excellence of its harbor (the Mare Piccolo), ample and secure beyond all the other harbors of Lower Italy. Gradually it became the chief emporium of the Græco-Italian trade, and long after all the rest of the colonial cities in Magna Græcia had fallen into decay, Tarentum was 'blooming alone' in undiminished prosperity. We may pass over its earlier history, noticing only the fact, that in the 4th c. B.C., it had for its *strategos*, or general (seven times), the philosopher and geometer Archytas, under whom it became the headquarters of the Pythagorean sect, and was honored with a visit from Plato, who was the guest of Archytas during his residence there. But while in the very acmé of its greatness, it provoked a quarrel with Rome (q. v.), 281 B.C., in which, though aided by the gallantry of Pyrrhus (q. v.), king of Epirus, it was utterly crushed, after a struggle of less than ten years; and though its natural advantages hindered it from sinking into such absolute insignificance as other cities of Magna Græcia, it was never after a place of great importance. Under the Empire, it was quite overshadowed by Brundusium on the Adriatic, but rose again during the Gothic wars, and passed into the hands of the Saracens and Greeks, from the latter of whom it was wrested by Robert Guiscard, the Norman, in 1063. Since then, it has shared the fortunes of the kingdom of Naples. Few relics of the classic Tarentum are extant, the chief being bits of an amphitheater, a circus, and traces of some of the temples.

TARA'NTULA (*Lycosa tarantula*), a species of spider, of a genus to which the name Wolf-spider is often given, a native of the south of Europe. It derives its name from the city of Taranto, in Italy, where it is very plentiful. It is one of the largest of European spiders, of a somewhat elongated shape, with rather long legs. It is one of those spiders which seek their prey by hunting. Its bite is much dreaded, and has been supposed to cause

Tarantula Spider (*Lycosa tarantula*).

the disease called *Tarantism* (q. v.).—Several species of spider nearly allied to the T. are found in different parts of the south of Europe. One of them (*Lycosa Narbonnensis*) frequents dry uncultivated grounds in the south of France, and makes a little pit in the ground, near the entrance of which it sits watching for prey. The prey is carried into the pit to be devoured. The female shows great affection for her young.

TARARE, a thriving and important manufacturing town of France, in the dep. of Rhone, stands at the foot of Mount Tarare, one of the highest summits of the Beaujolais range, 21 miles north-west of Lyon. Formerly unimportant, it is now a rich and flourishing town, the inhabitants of which are engaged in the manufacture of muslins, cloth, silk, and merino fabrics, and in embroidering and bleaching. The muslins of T. are famous for their fineness. See TARLATAN. Pop. (1876) 13,563.

TARASCON, a town of France, in the dep. of Bouches-du-Rhone, 13 miles south-west of Avignon by railway. The church of St. Martha dates from the year 1187, and is so called after Martha, the sister of Lazarus, and the patron saint of the town. Woollen and silk fabrics, and brandy and vinegar, are manufactured. Pop. (1876) 7777.

TARA'XACUM, or Dandelion (q. v.) Root, is employed to a considerable extent in medicine. The roots should be gathered in August and September, when the juice is most abundant. There is no very satisfactory analysis of this juice, but it is said to contain mannite, resin, sugar, gum, caoutchouc, and a crystallizable matter termed *taraxicine*, on which its active properties probably depend. This medicine may be prescribed with advantage in the form of extract, decoction, or juice in chronic diseases of the liver, and in certain forms of dyspepsia and skin-disease which are accompanied by derangement of the biliary organs. In very large doses, it has a diuretic and slightly aperient action.

TARAZO'NA, a town of Spain, in the province of Zaragoza, 52 miles west-north-west of the city of that name, on the Queyles, a tributary of the Ebro. It stands on a wind-blown plain, exposed to bleak winds from the Sierra de Moncayo on the south, and from the Pyrenees on the north. It is the see of a bishop; and contains a cathedral with a slender brick spire and rich interior, a bishop's palace, and a Moorish *Alcazar*. Pop. upwards of 8000, mainly engaged in agriculture.

T. is the ancient *Turiaso;* and here a few Roman troops routed a Celtiberian army. It became a municipium under the Romans; and under the Goths, by whom it was fostered, it became famous for its steel.

TARBAGATAI', a frontier town of Chinese Turkestan, 170 miles east of the eastern extremity of Lake Balkash, in lat. 46° 44′ N., long. 82° 28′ E. It stands at the foot of the mountains of the same name, in a plain watered by the Imil, and with extensive meadows and pasture-grounds in the vicinity. The inhabitants consist of 3000 exiled Chinese, 1000 of a Chinese garrison, and a number of Mongolian merchants. The trade with Russia is important.

TARBES, a town in the south of France, capital of the dep. of Hautes-Pyrénées, stands on the left bank of the Adour, 23 miles east-south-east of Pau. It is a station on the *Chemin de fer du Midi*, and the center of communication with all parts of the Pyrenees, the lofty line of which bounds the prospect on the south. The modern cathedral is the principal and indeed the only notable building. There is here a *haras*, or government stud, for the improvement of the breed of horses. T. is the seat of an active general trade. Pop. (1876) 11,080.

T. dates from the time of the Romans, and its bishopric was founded in the year 420.

TARDIGRADA. See SLOTH.

TARE (*Ervum*), a genus of plants of the natural order *Leguminosæ*, sub-order *Papilionaceæ*, distinguished from *Vicia* (see VETCH), to which it is nearly allied, by a capitate stigma, downy all over. It contains only a few species of weak climbing plants, natives of the temperate parts of the Eastern Hemisphere. One of these is the LENTIL (q. v.).—Two (*E. hirsutum* and *E. tetraspermum*), generally known by the name of TARE, are common in cornfields and hedges in Britain. They have very small flowers and pods; the leaves are pinnate and the leaflets small. They afford nourishing food for cattle; but the quantity is so small that they are not worthy of cultivation, and are chiefly known as a nuisance in cornfields. A species of T. (*E. sativum*), with an upright branching habit, is cultivated in some parts of Europe for its herbage, which is used for feeding cattle. The bulk of herbage is small, but its nutritious character is thought to compensate for this. The leaves have from 8 to 14 pair of leaflets. The plant thrives well in poor sandy soils.—It is not supposed that the *Tare* of the New Testament has any affinity to these plants: it is doubtful what it is, but it appears not improbable that it is the DARNEL (q. v.).

TARE AND TRET, certain deductions usually made from the gross weight of goods. *Tare* is the weight of the box, cask, bag, or wrapping in which the goods are contained; and the amount is obtained either by weighing the empty package itself, by taking an average of a few similar packages of equal size, or by mutually agreeing upon a certain proportion of the gross weight. The remainder, after deducting the tare, is the *net weight*. Another deduction at the rate of 4 lbs. for every 104 lbs., or $\frac{1}{26}$th of the net weight, is then made, as an allowance for waste through dust, &c., and is called *tret*. Some other allowances of minute magnitude as draft, cloff, &c., are occasionally made after tret, but they are falling into disuse.

TA'RGET (root uncertain, but the word, in some form, found in all European languages), in its modern sense, is the mark for aiming at in practising with the cannon, rifle, or bow and arrow. In its more ancient meaning, a target or targe was a shield, circular in form, cut out of ox-hide, mounted on light but strong wood, and strengthened by bosses, spikes, &c. Of modern targets, the simplest is that used for Archery (q. v.). With regard to rifle targets, the spread of the Volunteer movement and the numerous rifle-matches have caused ranges to be constructed over the whole country. The necessities are: a butt, artificially constructed or cut in the face of a hill, to prevent wide balls from scattering—a marker's shot-proof cell, near the targets—and a range of such length as can be procured. The sizes of targets used by the British army are as follows: for firing up to 300 yards, the target is 6 feet high by 4 feet broad, with a circular bull's-eye 1 foot in diameter, and a center of 3 feet. Up to 600 yards, the target is 6 feet square; bull's-eye, 2 feet diameter; center, 4 feet (see fig. 3).

Up to 800 yards, the target is 6 feet by 8; bull's-eye, 3 feet in diameter; and center, 5 feet (see fig. 4).

The marker signals the 'hits' from his box, denoting a bull's-eye by a red-and-white flag, a center by a blue flag, and an outer by a white flag. If he show a red flag, it is to cease firing while he inspects the target. In scoring, the outer counts 2; center, 3; and bull's-eye, 4. A red flag should fly on the butt during the whole time of practice, to warn passers-by to keep off the range. The targets used by the National Rifle Association at Wimbledon are not the same as those used by the army. According to the Wimbledon regulations of 1876, the target for the distance of 200 yards had a circle of 40 inches diameter, divided into the circular bull's eye 8 inches in diameter, a center of 16 inches diameter, an 'inner' of 28 inches, the rest of the 40 inches being accounted 'outer.' On the target for 500 and 600 yards, the circle of 70 inches falls into a bull's-eye of 22 inches diameter, center 38 inches, inner 54 inches, and the rest outer.

Fig 1.—Archery Target.

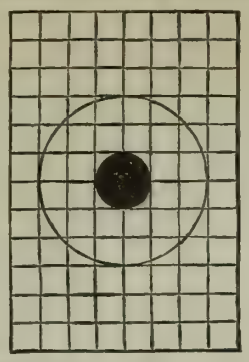


Fig. 2.—Target for distances up to 300 yards.

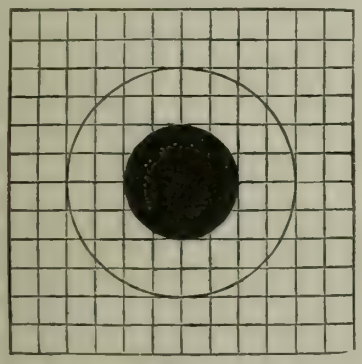


Fig. 3.—Target for distances up to 600 yards.

The rectangular frame for 800, 900, and 1000 yards distance had a circular bull's-eye of 3 feet in diameter, a centre 4 feet 6 inches, a square inner of 6 feet, the remainder of the target counting as outer. Of the ordinary Wimbledon targets for 1880 (as in 1878), that for 200 yards distance is divided into a bull's-eye 8 inches in diameter; 'inner,' 1 foot; 'magpie,' 2 feet; and outer, the remainder of the target, 4 feet square. At 500 and 600 yards, the bull's-eye is 2 feet in diameter; the inner, 3 feet; the magpie, 4 feet; and outer, the rest of the target of 6 feet square. At 800, 900, and 1000 yards, the bull's-eye is 3 feet diameter; inner, 4½ feet; magpie, 6 feet square; and outer, the rest of the target of 12 feet by 6 feet.

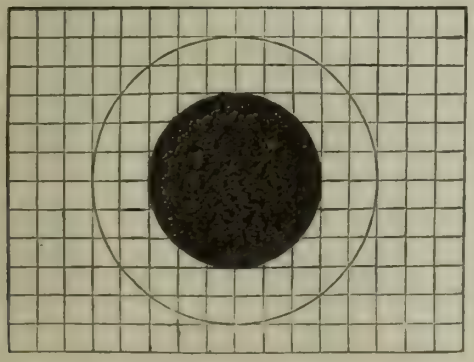


Fig. 4.—Target for distances up to 900 yards.

Previous to the inaugurating of the Wimbledon meeting in 1860, all targets were circular, and made of iron. From that year till 1873 inclusive, they were square iron plates; but in 1874, targets of canvas stretched on an iron frame were introduced. The superiority as marksmen displayed in the Transvaal war by the Boers suggested the introduction into military training of practice at objects moving at various rates of speed and at a greater or less distance. A 'running-man target' has been devised, which consists of a mill-board figure running on wires, worked by the marker in the butt.

TARGOWI'TZ, or TARGOWICZA, in Russia, a small town in the government of Kiev, was the scene (May 1792) of a plot by five Polish nobles who were adverse to the constitution of 3d May 1791 (see POLAND). They were incited to this by Catharine II., and only escaped death by precipitate flight to Russia, where they were munificently rewarded.

TA'RGUM (Chaldee, from *tirgem*, a word of uncertain origin, designating to translate, explain), the general term for the Aramaic Versions of the Old Testament, which became necessary when, after, and perhaps during the Babylonian Exile, Hebrew began to die out as the popular language, and was supplanted by 'Chaldee,' an idiom, or rather a family of idioms, on which we have spoken under SHEMITIC LANGUAGES.

The origin of the Targum itself is shrouded in mystery. The first signs of it—as an already fixed institution—have been found by some in the book of Nehemiah, and according to tradition, Ezra and his coadjutors were its original founders. However this be, there can be no doubt that its beginnings belong to a comparatively early period. The Mishna (q. v.) contains a number of strict injunctions respecting it, and also respecting a certain guild of Meturgemans (whence dragoman) or interpreters, who had sprung up as professional followers of those learned men who, at a previous period, had volunteered their services in the translation and paraphrastic interpretation, both activities, as we said, implied by the term.

At first, and indeed for many centuries, the Targum was not committed to writing, for the same reason that the 'Oral Law' itself was not at first intended ever to become fixed as a code for all times. In the course of time, however, both had to yield to circumstances, and their being written down, was considered preferable to their being utterly forgotten, of which there was no small danger. Yet a small portion only of the immense mass of oral Targums that must have been produced, has survived. All that is now extant are three distinct Targums on the Pentateuch, a Targum on the Prophets, Targums on the Hagiographa, viz., on Psalms, Job, Proverbs, the five 'Megilloth' (Song of Songs, Ruth, Lamentations, Esther, Ecclesiastes), two Targums on Esther, one on Chronicles, one on Daniel, and one on the apocryphal pieces of Esther. The most important of the three Pentateuch Targums is the one named after Onkelos (q. v.) probably a corruption of Akylas, whose Greek version had become so popular that this Chaldee version was honored with being called after it. In its present shape, this translation dates probably from the end of the 3d or beginning of the 4th c. A.D., although snatches of it were collected and written down more than a hundred years earlier. We have spoken of its language and its general character already under ONKELOS, and may here briefly state that it is composed in an Aramaic closely resembling that of Daniel, and that it is as excellent a translation 'for the people,' which it meant to be, as can well be conceived. Occasionally, when the subject imperatively demands it, it introduces some paraphrastic by-work, and it only deviates from the text where the divine dignity would have appeared to suffer in the eyes of the multitude by a literal interpretation. Its value for exegetical purposes is no less great than it would be for linguistic and antiquarian purposes, were it more explored with that view than has been the case as yet.

The two other Targums on the Pentateuch, hitherto known as Targum Jonathan ben Uzziel, and Targum Jerushalmi, are merely recensions of one and the same version—the name of the first recension being merely a perpetuated error of a single scribe—which owes its origin to Palestine or Syria (Onkelos being of Babylonian origin), and cannot well have been redacted before the 7th c. A.D. There is no doubt that originally this 'Jerusalem Targum' embraced the whole of the Old Testament, as did the Babylonian; but nothing has survived beyond these two recensions of the Pentateuch, the first complete, the second in a fragmentary condition: the former probably intended as an emendation of Onkelos, chiefly in the direction of homiletic paraphrase and legendary lore, and the latter as a further emended emendation of single portions. As a version, this Targum is of small importance; but it is invaluable as a storehouse of allegories, parables, sagas, and the like popular poetry of its time. Its language and grammar are exceedingly corrupt; it abounds, moreover, with foreign—Greek, Latin, Persian, and Arabic—terms; and its general use lies more in the direction of Jewish literature itself, as well as of archæology and antiquities of the early Chris-

tian centuries, than in that of a direct interpretation of the Bible text itself. The Targum on the Prophets is generally and erroneously ascribed to Jonathan ben Uzziel, an eminent master of the law at the time of Hillel the Elder; the fact being that, except one spurious Talmudical passage, in which mention is made of his having translated the Prophets, this Targum is everywhere else, from the Talmud down to the authorities of the 10th c. A.D., ascribed to one R. Joseph, president of a Babylonian academy in the 4th century. And it would indeed seem as if this statement were completely in accordance with the real facts—if not the writing, but the collection and final redaction of this Targum is ascribed to him. Respecting the nature of this version, it may be said that, while being tolerably literal in the first—historical—books, it gradually becomes a mere framework of Midrash (q. v.) or Haggada, which it introduces at every turn and at great lengths. It further contains historical bits, disguised, or rather typified, and some lyrical pieces of rare poetical value. In language and general manner, it resembles Onkelos, with which it is of one growth, place, and date, and of which it forms only a kind of continuation.

To the same Joseph 'the Blind' to whom the redaction of the foregoing Targum is probably due, is further ascribed a Targum on the Hagiographa. But between him and the Hagiographical Targums lie, at the least, 600 years; their date being approximately given as about 1000 A.D. Certain distinctions between the different books must further be made. The Targums on Psalms, Job, and Proverbs were probably contemporaneous compositions due to Syria. The two former are made more paraphrastic than the last, which resembles closely the Syriac version. The paraphrase on the five 'Megilloth'—a very late production indeed—is principally a collection of more or less poetical fancies, traditions, and legends, to which the single verse in hand merely seems to furnish the key-note. There is, we need not add, but very little to be found in them of what originally must have formed the Targum on these books; nor is there the slightest hint to be fouud as to who was the real author or editor of their present form. That it was one man's work, is probable enough, from a certain unity of design and style noticeable in all of them. Their dialect lies somewhat between the East and West Aramaic. The Targum on the Book of Chronicles—almost unknown until the 17th c.—also belongs to a late period, and was probably composed in Palestine. There are some useful philological, historical, and chiefly geographical hints to be gleaned from it, but nothing more; least of all can it be used exegetically. A Persian version of a Targum on Daniel (unedited) is all that has been discovered on that book as yet. It was probably composed in the 12th c., the influence of the early Crusades being plainly visible in it. On the paraphase of the apocryphal pieces of Esther, we shall not dwell here, any more than on the scanty fragments of a 'Palestinian Targum' that are found either interspersed in the general (Babylonian) Targum, or as independent pieces. It seems probable that more of this Palestinian version will come to light some day, as authorities of a few centuries back still quote from it rather largely. At present, however, their quotations are nearly all that remains.

Very little—we might say, next to nothing—has been done as yet to utilize this most important branch of Aramaic literature; in fact, not even an attempt at anything like a critical edition has been made, although it would be difficult to find a more corrupt text than that offered by the MSS. and single printed portions. Some parts have been done into Latin, English, German, &c. The ed. pr. of Onkelos is dated Bologna, 1482; that of the Targum on the Prophets, Leiria, 1494.

TARI'FA, a seaport town of Spain, 20 miles south-west of Gibraltar. It is the most southern town of Europe, is surrounded by tower-embattled walls, and communicates by a causeway with a small island, on which stand a fortress and light-house. The town is the most thoroughly Moorish in Andalusia; it is quadrangular in shape, and its streets are narrow and dark. Tunny and anchovy fisheries are actively carried on. Pop. (1877) 12,234.

T., the Carthaginian *Josa*, and the Roman *Julia Traducta*, received its present name from the Moors, who are said to have called it after Tarif (= Tarik? Ibn Malik, who landed there to reconnoitre previous to the conquest of the country. See MUZA; RODERIC. It was successfully defended in 1811 by 2500 troops (mostly British) against a French force of 10,000 men, under Victor and Laval.

TA'RIFF (from *Tarifa* (q. v.), where, during the rule of the Moors in Spain, duties were collected), a table or catalogue, generally drawn up in alphabetical order, of the duties, drawbacks, bounties, &c., charged or allowed on different kinds of merchandise, as settled by authority, or agreed to between different states. The principles of the tariffs of different countries depend on their respective commercial policy, and on the fluctuating interests and wants of the community. According to the presently existing British tariff, only about 20 kinds of merchandise are subject to an import duty, and none to an export duty.

TARIM RIVER. See TURKESTAN, EASTERN.

TA'RLATAN, a thin gauze-like fabric of cotton, used for ladies' ball dresses, &c. It is usually dyed or printed in colors. Tarare, in France, is the chief center of this manufacture, whence it is largely exported. Switzerland alone competes with France in the production of tarlatan, but those of the latter country far surpass the former in fineness.

TARN, a dep. in the south of France, bounded on the N. by the deps. of Aveyron and Tarn-et-Garonne, receives its name from the river Tarn. Area 2216 sq. m.; pop. (1881) 359,223. The surface is in general elevated, and in the south and south-east are the Montagnes Noires and the Monts de l'Espinous, branches of the Cévennes. The rock of Montalet, the principal summit, is 4430 feet high. Wooded mountains, vine-clad hills, beautiful valleys, and fertile or grass-producing tracts, are the principal features of the landscape. The chief river is the Tarn, an affluent of the Garonne (q. v.), and which has a westward course of 200 miles. A fifth part of the surface is covered with forests, chiefly of oak and beech. The dep. is for the most part agricultural, and the most improved methods are in use. Eleven million gallons of wine are made in average years. T. is divided into four arrondissements: Albi, Castres, Gaillac, and Lavaur. Albi is the capital.

TARN-ET-GARONNE, a small dep. in the south of France, bounded on the S.-E. by the dep. of Tarn. Area, 1435 sq. m.; pop. (1881) 217,056. The principal river is the Garonne, which flows north-west, and its affluents, the Tarn and Aveyron. The surface is marked by plateaux, about 1000 feet in average altitude; the highest hills do not rise above 1600 feet. The climate is beautiful, healthy, and temperate. Cereals are raised in great quantities. Of wine, 11,000,000 gallons are produced. The dep. is divided into the three arrondissements of Montauban, Castelsarrasin, and Moissac. Montauban is the capital.

TARNO'POL, a town of Austria, in Galicia, charmingly situated on the left bank of the Sered, 80 miles east-south-east of Lemberg. Agriculture employs the great mass of the inhabitants, and the horse-market held here periodically is the most important in Galicia. Horse-races also take place. Pop. (1880) 25,819.

TA'RNOW, a town of Austrian Galicia, near the right bank of the Dunajec, a navigable tributary of the Vistula, and 49 miles east of Cracow by the Vienna and Lemberg Railway. It is the seat of a Catholic bishop, contains a theological college, and a beautiful cathedral, in which are numerous monuments of marble, surmounted by statues, enriched with *bassi rilievi*, and rising to from 60 to 70 feet in height. Several industries are actively carried on, and there is a good general trade. Pop. (including suburbs) (1880) 24,627.

TARPAU'LIN, a large sheet of the coarsest kind of linen or hempen cloth, saturated with tar to render it waterproof. It is used for covering loaded wagons, the hatchways of ships, and similar things, as a temporary protection from wet.

TARPEI'AN ROCK (Lat. *Rupes Tarpeia*, or *Mons Tarpeius*), the name originally applied to the whole of the Capitoline Hill (see CAPITOL), but latterly confined to a portion of the southern part of the hill, the following being the legend commonly related in connection with it. In the time of Romulus, Tarpeia (a vestal virgin), the daughter of Sp. Tarpeius, governor of the Roman citadel on the Capitoline, covetous of the golden ornaments on the Sabine soldiery, and tempted by their offer to give her what they wore on their left arms, opened a gate of the fortress to the Sabine king, Titus Tatius, who had come to revenge the rape of the Sabine women. 'Keeping their promise to the ear,' the Sabines crushed Tarpeia to death beneath their shields, and she was buried in the part of the hill which bears her name. Subsequently, it was not unusual for persons condemned on the charge of aspiring to restore the monarchy, or of treason to the state generally, to be hurled from the T. R.—e. g., the famous Manlius, the savior of the Capitol during the invasion of the Gauls.

TARQUI'NIUS, the family name of two kings of Rome, with whose history, or rather with the legends regarding whom, the fortunes of the city are closely interwoven. The story goes that Demaratus, a Corinthian noble, emigrated from Greece, and settled at Tarquinii, in Etruria, where he married an Etruscan wife, by whom he had two sons, Aruns and Lucumo. Aruns died during his father's lifetime, but Lucumo married into one of the noblest Etruscan families. His wife, named Tanaquil, was a bold, ambitious, and wise woman. By her advice, Lucumo resolved to go to Rome. He set out, accompanied by a large train of followers, and as he approached the Janiculum, an eagle swooped down, and snatching off his cap, carried it up to a great height, then descending, placed it on his head again. Tanaquil, who was deeply skilled in the science of augury, prophesied from this omen the

highest honors for her husband, who was hospitably received at Rome, and soon after admitted to the rights of citizenship, whereupon he took the name of L. Tarquinius, or, according to Livy, L. Tarquinius Priscus. The Roman monarch, Ancus Marcius, appointed him guardian of his children; and on the death of the former, the senate and the citizens unanimously elected him to the vacant throne. His reign was a glorious one. Against the Latins, Sabines, and (according to Dionysius) the Etruscans, he waged successful war, forcing the whole of the twelve sovereign cities of Etruria to recognize his supremacy, and do him homage. But the works that he executed at home are even more renowned than his exploits abroad. To L. Tarquinius Priscus (*Priscus* is commonly translated the 'Elder;' but Niebuhr objects to this translation as involving an anachronism, and notices the fact that *Priscus* is a common cognomen among the Romans) are ascribed the construction of the magnificent *Cloacæ*, or sewers (see, however, CLOACA MAXIMA), which remain uninjured to this day; the laying out of the Circus Maximus and the Forum; the institution of the great or Roman games; and (some say) the building of the Capitoline temple (see CAPITOL.). The legend also represents him as effecting certain political and sacerdotal changes. See ROME.

T. was assassinated after a reign of 38 years, at the instigation of the sons of Ancus Marcius, who considered themselves as best entitled to the throne, and dreaded lest he should use his influence to get his favorite and son in-law, Servius Tullius, chosen as his successor. But their crime did not avail them, for, through the dexterity of Tanaquil, Servius was elected to the vacant throne, and signalized himself not only by his military exploits, but also by great organic changes in the Roman constitution (see article ROME for an account of the 'Servian Reform'). T. left two sons, L. Tarquinius Superbus and Aruns, both of whom married daughters of Servius Tullius; and two daughters, one of whom married Servius Tullius himself and the other M. Brutus, by whom she became mother of L. Brutus, first consul of the Roman Republic.

L. TARQUINIUS SUPERBUS, son of the preceding, having murdered his father-in-law, Servius Tullius, at the instigation of his wife, is represented in the legend as audaciously usurping the vacant throne; but as the whole drift of his legislative policy was to abolish the reforms of Servius, there can be little doubt that the real significance of this part of his career lies in the fact, that it indicates a successful reaction, on the side of the patricians, against the more liberal and progressive policy of the preceding age. That the younger T., at least, is a historical character seems to be pretty generally allowed. The incidents of his career are so numerous and coherent, and the impress of his name and character is so deeply stamped on the national memory, that he cannot be regarded as a wholly imaginary personage. Analyse the story how we may, there will always remain a residuum of insoluble fact, not essentially at variance with the character of the tragic tradition. As far as we can gather from the ancient annals, the usurpation of T. was probably achieved by the help of an enterprising section of the nobles, who clung tenaciously to their privileges, and could not endure the constitutional recognition of the *plebs*.

It does not appear that the whole of the senators connived at or even approved of T.'s procedure. We are expressly told that he drove numbers of those whom he mistrusted into exile; in other words, he persecuted and banished the adherents of the Servian policy of conciliation. Like a Turkish tyrant, he surrounded himself with a body-guard—another indication of the original insecurity of his position, and strengthened himself by foreign alliance, marrying his daughter to Octavius Mamilius, Prince of Tusculum. By means of subtle and unscrupulous intrigues, he obtained or consolidated the Roman hegemony in Latium; offered sacrifice in the name of all the Latins at the Alban Mount; fused the contingents of the latter with the Roman legion; put to death as traitors such of their chiefs as opposed him (e. g., Turnus Herdonius); and, at the head of the combined forces, penetrated into the Volscian marshes, and subdued the natives. On his return, he completed the building of the Capitol, which the Elder T. had begun, and deposited in the vaults the Sibylline books he had curiously acquired. See SIBYL. He next conquered the town of Gabii (where many of the banished nobles had found shelter), through an elaborate stratagem, in which his son Sextus played the principal part. But his lavish expenditure both in war and peace necessitated the imposition of heavy taxes, and murmurs of discontent were heard among the people. The patience both of plebs and patricians was beginning to give way. Coincident with this state of things, a fearful omen was beheld: from the altar in the royal palace crept forth a serpent, and devoured the entrails of the victim.

T. sent two of his sons, Titus and Aruns, to Delphi to consult the oracle. They were accompanied by their cousin, L. Junius Brutus (q. v.), who had long feigned himself a fool in order to save his life, for T. had killed his father and brother in order to possess himself of their great wealth. On their return, they found that the king had opened war upon the Rutuli, and was besieging Ardea, whereupon they joined the Roman camp. Here occurred, between Sextus and Callatinus, the famous dispute about the virtues of their respective wives, which led to the rape of Lucretia. The details of this legend are so familiar that it is unnecessary to recount them. Suffice it to say that it roused such a storm of indignation, that the people of Collatia (where the shameful deed was done) rose in arms, and renounced their allegience to Tarquinius. Brutus carried the news to Rome, and the senate, fired with a righteous anger, deposed the tyrant; finally, the army before Ardea also revolted. T. and his sons were obliged to flee, and an aristocratic republic was constituted at Rome. Three different attempts were made to restore T. by force: first, by his own Etruscan kinsmen of Tarquinii; second, by Lars Porsena (q. v.) of Clusium; and third, by his son-in-law, Octavius Mamilius, 'prince of the Latian name,' all of which, according to the legend, failed; and at length T., utterly baffled and beaten, retired to Cumæ, where he died, a wretched and childless old man, for all his sons had met death before him.

TA'RRAGON. See ARTEMISIA.

TARRAGO'NA, a seaport of Spain, chief city of the modern province of the same name, stands on the Mediterranean shore, at the mouth of the Francoli, 60 miles west of Barcelona. It consists of two portions—the upper (the ancient) and the lower (the modern) towns. The former stands on a hill 720 feet high, and is girdled with ramparts. The lower town, completely separated from the higher by a line of works, is regular and open, and is defended by two forts. The beautiful cathedral, in Gothic and Norman, and which dates from the middle of the 12th c., is the principal edifice. There is an interesting antiquarian museum, rearranged in 1868. Brandy-distilling and the manufactory of wines and olive oil are the chief industries. The harbor is pretty good. Pop. (1877) 23,046.

T., called by the Romans *Tarraco*, was founded by the Phœnicians (who called it *Tarchon*, citadel), and afterwards became the capital of the Roman province of Tarraconensis. Among the Roman antiquities are the remains of an amphitheater, which has been used as a quarry; a magnificent aqueduct, 96 feet high, and 700 feet long—still in use—and near the town the Tower of the Scipios, much decayed. T. was taken and cruelly sacked, in June 1813, by the French under Suchet.

TA'RRYTOWN, a village of New York, U. S., on the east bank of the Hudson River, 27 miles north of New York city. It is beautifully situated on a lake-like expansion of the river, called the Tappanzee, surrounded with fine scenery, and filled with elegant residences. It has 6 churches and 4 academies, and is noted as the scene of the capture of Major André. Pop. 3500.

TA'RSHISH, probably the same as *Tartessus*, a city and emporium of the Phœnicians in Spain, somewhere near the mouth of the Guadalquivir. It is frequently mentioned in Scripture, notably so in connection with the prophet Jonah, who took ship for T. when he sought to 'flee from the presence of the Lord.'

TA'RSIA-WORK, a beautiful kind of marquetry made in Italy. It is produced by inlaying pieces of colored wood so as to represent figures and landscapes. That of Sorrento is very celebrated; and lately, many fine pieces of this work have been made in Perugia. It is usually applied to the decoration of cabinet-work.

TA'RSUS, anciently the chief city of Cilicia, and one of the most important in all Asia Minor, situated on both sides of the navigable river Cydnus, in the midst of a beautiful and productive plain, and about 18 miles from the sea. It was a great emporium for the traffic carried on between Syria, Egypt, and the central region of Asia Minor. In the time of the Romans, two great roads led from T., one north across the Taurus by the 'Cilician Gates,' and the other east to Antioch by the 'Amanian' and 'Syrian Gates.' T., judging from its name, was probably of Assyrian origin; but the first historical mention of it occurs in the *Anabasis* of Xenophon, where it figures as a wealthy and populous city, ruled by a prince tributary to Persia. In the time of Alexander the Great, it was governed by a Persian satrap; it next passed under the dominion of the Seleucidæ, and finally became the capital of the Roman province of Cilicia. At T., Antony received Cleopatra, when she sailed up the Cydnus, with magnificent luxury, disguised as Aphrodite. Under the early Roman emperors, T. was as renowned for its culture as for its commerce, Strabo placing it, in respect to its zeal for learning, above even Athens and Alexandria. It was the birthplace of the Apostle Paul, who received the greater part of his education here; and here the Emperor Julian was buried. Gradually during the confusions that accompanied the decline of the Roman and Byzantine power, it fell into comparative decay; but even yet, it is—under the name of *Tarso* or *Tersus*—the most considerable place in the south-east of Asia Minor, has a pop. of 30,000 (in winter); and exports corn, cotton, wool, copper, gall-nuts, wax, goats' hair, skins, hides, &c.

TA'RTAN, or PLAID, a pattern woven in cloth, in which bands of different colors are woven or printed side by side, both the warp and weft way of the material, thus giving the well-known checkered pattern. This is probably the oldest pattern ever woven; at all events, the so-called shepherd's plaid of Scotland is known to have a very remote antiquity amongst the eastern nations of the world. The plaid pattern admits of a very great variety of modifications, by the introduction of different colors, and by varying the amount of each color employed. These colored plaids were in great favor in the Highlands of Scotland, where each clan wore a particular kind as its distinctive dress.

TA'RTAR, a mixture of bitartrate of potash and tartrate of lime (see TARTARIC ACID), is a deposit formed from wine, and known in its crude form as Argol (q. v.). About 900 tons annually of this substance are imported into Great Britain, from the chief wine-producing countries of Europe and the Cape of Good Hope.

The word *Tartar*, which gives the name to tartaric acid, is derived from the Greek *Tartaros*, hell. 'It is called *Tartar*,' says Paracelsus, 'because it produces oil, water, tincture, and salt, which burn the patient as Tartarus does.'

TARTAR, CREAM OF. See TARTARIC ACID.

TARTAR, FOLIATED EARTH OF, an old name for acetate of potash, in consequence of the foliated satiny masses in which that salt occurs.

TARTAR OF THE TEETH is a deposit of salts of lime and organic matter from the saliva, and usually occurs most abundantly on the inferior incisors. If it is suffered to accumulate, it causes inflammation and absorption of the gum, and gradual loosening of the teeth. The accumulating of this substance may usually be prevented if due attention is paid to the cleaning of the teeth. 'The teeth,' says Dr. Druitt, 'should be cleaned at least twice a day with a soft tooth-powder (precipitated chalk is best) and a little soap. The hairs of the tooth-brush should be soft, and not too closely set, so that they may penetrate the better into the interstices of the teeth.' When the tartar has accumulated to any extent, it must be removed by the *scaling instruments* of the dentist.

TARTAR, SOLUBLE, a term applied by some chemists to neutral tartrate of potash, and by others to borotartaric acid. See TARTARIC ACID.

TARTA'RIC ACID. Ordinary tartaric acid, $C_8H_4O_{10},2HO$, is usually seen in the form of colorless, transparent, oblique, rhombic prisms, which are not affected by the action of the air, have an agreeable acid taste, and are soluble in water and alcohol. The crystals when gently warmed become strongly electric, the opposite sides of the crystals exhibiting the opposite forms of electricity. On heating tartaric acid to about 340°, it fuses; and at a slightly higher temperature it becomes successively changed, without losing weight, into two metameric acids, *metatartaric* and *isotartaric* acids, the former of which is bibasic and the latter monobasic. At about 374°, two atoms of the acid lose one equivalent of water, and *tartralic acid*, $C_{16}H_6O_{20},3HO$, is formed. If the same temperature be maintained a little longer, half the basic water is expelled, and *tartrelic acid*, $C_{16}H_6O_{20},2HO$, is formed; and finally, all the basic water is driven off, and *anhydrous tartaric acid*, or *tartaric anhydride*, $C_8H_4O_{10}$ (or $C_{16}H_8O_{20}$), remains in the form of a white porous mass insoluble in water, alcohol, or ether. If, however, it be allowed to remain long moist, it gradually becomes converted into crystallized tartaric acid. Finally, on distilling tartaric acid in a retort at a temperature of 400° and upwards, it is decomposed into certain gases and empyreumatic oily matters, water, and acetic, pyruvic (or pyroracemic), and pyrotartaric acids.

Oxidizing agents, such as peroxide of lead or nitric acid, readily act upon tartaric acid, and convert it into formic and carbonic acids; and when fused with caustic potash, it splits up into acetic and oxalic acids. It is one of the strongest of the organic acids.

This acid occurs abundantly in the vegetable kingdom both in the free and combined state. It is found as a free acid in tamarinds, grapes, the pine-apple, &c.; and in combination with potash and lime in tamarinds, grapes, mulberries, and the unripe berries of mountain-ash, and in small quantity in the juice of many other vegetables. It is, however, from Argol (q. v.), a product of the fermentation of grape-juice, that the tartaric acid of commerce is obtained. The details of the process may be briefly described as follows: Argol, or crude bitartrate of potash, is dissolved in boiling water, and chalk is added as long as effervescence occurs. An insoluble tartrate of lime is precipitated, and tartrate of potash remains in solution. This tartrate of potash is converted, by the addition of chloride of calcium, into insoluble tartrate of lime and soluble chloride of potassium. The tartrate of lime obtained by these two operations, if treated with sulphuric acid, readily yields free tartaric acid in solution, with sulphate of lime as a precipitate. The filtered liquid, when cooled and evaporated, yields tartaric acid in crystals.

Tartaric acid is used in large quantity by calico-printers and dyers for the removal of certain mordants, and is much employed in medicine in the preparation of effervescing draughts and for other purposes.

Tartaric acid being bibasic, can form both acid and normal (or neutral) salts, according to the two general formulæ, $MO,HO,\overline{T}$, and $2MO,\overline{T}$, when M signifies any metal, and $\overline{T}$ is used as a symbol for anhydrous tartaric acid, $C_8H_4O_{10}$. The normal salts may contain (1) two similar or (2) different protoxides, or (3) a protoxide and a sesquioxide, or (4) a protoxide and a teroxide; as, for example—(1) Tartrate of potash, $2KO,\overline{T}$; (2) Tartrate of potash and soda, or Rochelle salt, $KO,NaO,\overline{T}$; (3) Tartrate of potash and iron, $KO,Fe_2O_3,\overline{T}$; (4) Tartrate of potash and antimony, or tartar emetic, $KO,SbO_3,\overline{T} + Aq$.

The tartrates are for the most part formed by partially or entirely saturating the free acid with an oxide or carbonate, or in the case of neutral tartrates containing two oxides, by saturating a solution of the bitartrate of one oxide with the other oxide. The most important tartrates are the following:

Tartrate of potash, $2KO,\overline{T}$, a soluble salt, which crystallizes with difficulty, and is formed in preparing tartaric acid from *bitartrate of potash*, $KO,HO,\overline{T}$. This salt is prepared from agol by extraction with boiling water, which dissolves about one-sixth of its weight. As it is much more insoluble in cold water, of which it requires 240 parts, it crystallizes readily as the hot solution cools. The snowy white rhombic prisms which are thus deposited constitute *cream of tartar*. When heated to redness in a covered crucible, a charred mass, consisting of carbonate of potash and charcoal in a fine powder, remains, and is used in the laboratory for reducing operations under the title of *black flux;* and if cream of tartar is deflagrated with twice its weight of nitre, *white flux*, also a reducing agent, consisting solely of carbonate of potash, is obtained. *Tartrate of potash and soda* has been already described in the article ROCHELLE SALT. *Tartrate of potash and iron*, or *Ferrum tartaratum*, $KO,Fe_2O_3,\overline{T} + Aq$, and *Tartrate of ammonia and iron*, or *Ammonio-tartrate of iron*, $H_4NO,Fe_2O_3,\overline{T} + 4Aq$, although the latter is not included in the Pharmacopœia, are excellent medicinal preparations of iron. For the method of preparing them, the reader is referred to Neligan's *Medicines*, 6th ed. p. 658, &c. They occur in the form of brilliant, semi-transparent, reddish-brown scales, and are soluble in about their own weight of water at 60°. *Tartrate of potash and boron*, known also as *soluble tartar* (although the term has also been applied to tartrate of potash), or *soluble cream of tartar*, $KO,BO_3,\overline{T}$, has been employed medicinally, but is not now used.

Tartrate of antimony and potash, known also as *tartarized antimony* and *tartar emetic*, $KO,SbO_3,\overline{T}_{10} + 2Aq$, is one of the most valuable articles in the whole *Materia Medica*. This salt, obtained by a process which is given in the Pharmacopœia, occurs in the form of square prisms, which are soluble in about 15 parts of cold water and in 2 parts of boiling water. This salt is somewhat efflorescent, and when dried at 212°, loses all its water of crystallization; its solution slightly reddens litmus, throws down an orange-colored sulphide of antimony, if a current of sulphuretted hydrogen is passed through it, and has a very peculiar nauseous, metallic taste.

There is no very delicate test for tartaric acid. Its presence in a moderately strong solution may be detected by the addition of acetate of potash, when a sparingly soluble bitartrate is soon separated, especially if the mixture be well stirred. All the tartrates on charring emit a peculiar odor resembling that of burned sugar.

A remarkable metameric modification of tartaric acid is known as *racemic* or *paratartaric acid*, $2HO,C_8H_4O_{10} + 2Aq$. It is a frequent associate of tartaric acid, but is especially abundant in the grapes of the Vosges district. While in most respects it exhibits a close resemblance to tartaric acid (the two acids having the same composition, yielding, when exposed to heat, the same products, and their salts corresponding in the closest manner), it may be distinguished and separated from it by the following points of difference. It crystallizes more readily from solution; it contains two equivalents of water of crystallization; it is less soluble in alcohol; and the racemate of lime is soluble in hydrochloric acid, and is precipitated unchanged on adding ammonia. Its most important difference, however, is, that its solution does not rotate the plane of polarization, while a solution of ordinary tartaric acid exerts a well-marked right-handed rotation.

The brilliant researches of M. Pasteur on the optical and chemical properties of tartaric and racemic acids, have opened up a new and most important field of investigation in relation to the molecular composition of organic bodies. We shall give the briefest possible abstract of his remarable discoveries, and must refer

for fuller information to his numerous Memoirs in the *Comptes Rendus, Annales de Chimie,* and other French scientific journals. He has proved that racemic acid is a mixture of ordinary tartaric acid (to which, from its optical property, he applies the term *dextro-racemic acid*) and of an acid which produces left-handed rotation, to which he gives the name *lævo-racemic acid.* (These acids are also known as *dextro-tartaric* and *lævo-tartaric acids.*) He found that, by saturating racemic acid with soda and ammonia, and allowing this solution to crystallize slowly, two varieties of crystals are obtained, which may be distinguished by their form, in the same way as the image and the reflection of the image in a mirror differ; or as right-handed and left-handed. If the two kinds of crystals are separated, and then dissolved, each solution is found to act powerfully on polarized light, but in opposite directions. On separating these acids from their bases, and mixing equal parts of concentrated solutions of each, racemic acid is again formed, which exerts no action on a polarized ray. M. Pasteur has subsequently made the discovery, that racemic acid may be artificially produced by the action of heat upon certain compounds of tartaric acid (such as tartrate of cinchonine or tartaric ether), which are capable of resisting a high temperature. The formation of racemic acid in this way is accompanied by the production of another modification of tartaric acid, which he calls *inactive tartaric acid,* which, like racemic acid, has no action on polarized light, but, unlike it, cannot be resolved into dextro and lævo racemic acids.

Tartaric acid and the tartrates, in their relation to medicine, are of considerable importance. Pure *tartaric acid,* in small doses diluted largely with water, forms a good refrigerant drink in febrile and inflammatory affections, and is much employed for this purpose in hospitals, &c., as being cheaper than citric acid. It has been stated that persons addicted to habitual drunkenness have been reclaimed by the following treatment. A few crystals of the acid are dissolved in two small tumblers of water, and taken in the morning fasting, an hour intervening between the tumblers. The painful feeling of sinking and craving of the stomach, of which such persons usually complain, is said to be removed by these acid draughts. Under the name of *acidulated drops,* lozenges composed of this acid, sugar, and oil of lemons, are largely employed in mild sore throats and colds. The principal medical use, however, of tartaric acid, is in the preparation of effervescent draughts, when added to alkaline carbonates; and in the composition of Seidlitz Powders (q. v.). *Tartrate of potash* is a mild but efficient purgative in doses of from two to six drachms, which is perhaps hardly so much used as it deserves. In passing through the system, it becomes converted into carbonate, and thus renders the urine alkaline. *Acid tartrate,* or *bitartrate of potash,* commonly known as *cream of tartar,* in full doses, acts as a sharp purgative, but is generally prescribed with some of the milder vegetable cathartics. When administered in small repeated doses (from a scruple to a drachm), in a large quantity of water, it largely increases the secretion of urine, and is consequently of great service in dropsy. It may be agreeably given in either of the following forms: (1) *Imperial,* which is prepared by dissolving a drachm of cream of tartar in a pint of boiling water, and flavoring with lemon-peel and sugar. In incipient dropsy, a couple of tumblers of this mixture, with half a glass of good hollands in each, are strongly recommended by Dr. Neligan as an after-dinner drink. The proportion of cream of tartar to the pint of water may be gradually increased to two drachms.

(2) *Cream of tartar whey* is prepared by boiling 100 grains of the salt in a pint of new milk, and removing the curds by straining. Either of these drinks may be safely taken to any extent agreeable to the patient. *Tartrate of iron and potash,* the *Ferrum tartaratum,* or *Tartarated iron,* of the Pharmacopœia, is a mild chalybeate tonic, which, in consequence of its somewhat sweet taste, is well adapted for children. It occurs in transparent scales of a deep garnet color, is soluble in water, and sparingly soluble in spirit. The dose varies from five grains to a scruple, three times a day, either given with honey or treacle, or dissolved in some aromatic water. The *wine of iron* (*Vinum Ferri* of the *Pharm. Brit.*) consists of sherry with tartrated iron in solution. Each drachm ought to contain one grain of the salt. The *tartrate of iron and ammonia,* or *ammonio-tartrate of iron,* closely resembles in its action the tartrate of iron and potash. Although not in the *Pharm. Brit.,* it is 'an excellent preparation of iron, void of all astringency. Its not disagreeable taste, its solubility in water, its compatibility with the alkaline carbonates, and the permanency of its composition, give it an advantage over most of the other preparations of iron. It is peculiarly suited as a tonic for those derangements of the uterine organs in which ferruginous salts are indicated.'—Neligan's *Medicines,* 6th ed. p. 645. The dose is from five to eight grains, and it may be prescribed in the form of powders, pills, or solution; or made into a bolus with honey. *Tartar emetic,* in doses of from one-twelfth to one-sixth of a grain, frequently repeated, acts as a diaphoretic or sudorific; nausea sometimes accompanies the diaphoresis, but it has the advantage of increasing the tendency to perspiration. The addition of the compound tincture of lavender tends to prevent the supervention of vomiting. Tartar emetic in these small doses is of great service in febrile disorders, in the hæmoptysis of phthisis, in obstinate cutaneous diseases, &c. *Antimonial wine* consists of sherry holding tartar emetic in solution in the proportion of two grains to the ounce. The dose, to produce a diaphoretic action, is 20 or 30 minims every hour. If we require an expectorant action—as in acute pneumonia or bronchitis—the salt should be given in still smaller doses, as from one-sixteenth to one-twelfth of a grain.

Tartar emetic, in doses of two or three grains, dissolved in water, acts as a powerful emetic, and at the same time produces much nausea and depression, and not unfrequently purging. The vomiting seldom occurs till about twenty minutes after the draught has been taken. If tartar emetic is thus given at the commencement of febrile or inflammatory affections, it will often cut short the impending disease. With this view, it is employed in continued fever, croup, whooping-cough, &c. It used to be given to relax the muscular system, in cases of strangulated hernia and dislocation; but chloroform is far better for these objects. In cases of poisoning, it is inferior to sulphate of zinc. It is expedient to take the emetic dose in parts, as too powerful an effect is thus prevented. Two grains, which are generally sufficient, must be dissolved in eight ounces of water, of which a quarter should be taken every ten minutes till vomiting ensues. The patient should walk gently about his room between the doses. If a large dose (of one, two, or even three grains) be repeated every second hour, the nausea, vomiting, and purging (which often follows a full dose) cease after two or three such doses, and the main action seems to be exerted in depressing the circulation and lowering the pulse. Hence, tartar emetic given in this way is a direct sedative or contra-stimulant, and is of great service in pneumonia and pleurisy. 'As a contra-stimulant,' says Neligan, 'tartar emetic is given in doses of from half a grain to two grains every hour or second hour, dissolved in one or at most two ounces of orange-flower water.' The first dose or two should not exceed half a grain, and the patient should not be permitted to drink, so as, if possible, to avoid the production of vomiting. When once a tolerance of the medicine is produced in the system, the quantity taken may be rapidly increased.'—*Op. cit.,* p. 418.

Lastly, tartar emetic, when applied to the skin, produces a crop of pustules, which ulcerate, and discharge purulent matter. In consequence of this property, tartar emetic, either in the form of ointment or of saturated solution, is often employed as a counter-irritant in various affections of the viscera of the chest and abdomen, in diseases of the joints, &c. The *ointment* is applied by rubbing about half a drachm on the skin night and morning. In two or three days, pustules begin to appear, when the further application of the ointment should be temporarily suspended. The saturated solution is a cleaner preparation than the ointment, and acts more speedily. It is applied by means of pledgets of lint soaked in it. Tartar emetic, in excessive doses, or in small repeated doses, acts as an irritant poison. Dr. Taylor has reported 37 cases of poisoning by this agent, of which 16 were fatal. The smallest fatal dose was in a child *three-quarters of a grain,* and in an adult *two grains,* but in the last case there were circumstances which favored the fatal action of the poison. The symptoms occurring in chronic poisoning by this salt are 'great nausea, vomiting of mucus and liquids, great depression, watery purging, followed often by constipation of the bowels, small contracted and frequent pulse, loss of voice and muscular strength, coldness of the skin, with clammy perspiration, and death from complete exhaustion.' A considerable number of cases are on record in this country in which murder has been perpetrated by the slow action of tartar emetic. The most important of them are referred to by Dr. Taylor in his *Medical Jurisprudence,* pp. 146 and 250, to which must be added the Pritchard case in Glasgow (1865). The *Pharmaceutical Journal* for October 1865 contains directions, by Messrs T. and H. Smith of Edinburgh, for preparing an antidote to be prescribed after a large dose of tartar emetic has been taken. The ingredients are a solution of perchloride of iron and calcined magnesia.

TA'RTARS, or, more properly, TATARS, was originally a name of the Mongolic races, but came to be extended to all the tribes brought under Mongolic sway by Genghis Khan and his successors, including Tungusic and Turkic races. The term is therefore not to be considered as ethnological, though all, or almost all, the peoples included under it, in its widest sense, belong to the Turanian family, but is rather to be understood in the same sense as the term 'Franks' used by Mohammedans. In the classification of languages, Tataric has become the distinctive name of that class of Turanian languages of which the Turkish is the most prominent member, while the Mongolic form a separate class. See TURANIAN LANGUAGES.

TA'RTARUS (Gr. *Tartaros;* the name is probably onomatopœic, the reduplication being designed to express something *terrible* or

disagreeable, like *Barbaros*, *Karkaron*, and many other words), according to Homer, is a deep and sunless abyss, as far below Hades as earth is below heaven, and closed in by iron gates. Into T., Zeus hurled those who rebelled against his authority, as, e. g., Kronos and the Titans. Afterwards the name was employed sometimes as synonymous with Hades or the under-world generally, but more frequently to denote the place where the wicked were punished after death—Lowest Hell, in fact. A noticeable feature about these punishments is their congruity with the nature of the offences perpetrated. See HEAVEN and HELL.

TA'RTARY (properly TATARY) is the name under which, in the middle ages, was comprised the whole central belt of Central Asia and Eastern Europe, from the Sea of Japan to the Dnieper, including Mantchuria, Mongolia, Chinese Turkestan, Independent Turkestan, the Kalmuck and Kirghis steppes, and the old khanates of Kasan, Astrakhan, and the Crimea, and even the Cossack countries; and hence arose a distinction of T. into European and Asiatic. But latterly the name T. had a much more limited signification, including only that tract bounded on the N. by Siberia, and on the S. by China and Tibet, along with Independent Turkestan; and at the present day, many writers apply it as a synonym for Turkestan (q. v.).

TARTRA'LIC ACID. See TARTARIC ACID.

TARTRE'LIC ACID. See TARTARIC ACID.

TARTUFE, the name of the chief character in Molière's most celebrated comedy, which has become a synonym in all languages for a hypocritical pretender to religion. The original of the character was most probably a certain Abbé de Roquette, a parasite of the Prince de Conti. The name is said to have suggested itself to Molière on the occasion of a visit to the papal nuncio, where he saw the pious and solemn countenances of the nuncio's courtiers suddenly lighted up with ecstatic animation by the appearence of a seller of truffles—in Italian, *tartuffoli*. This play excited a greater commotion than perhaps any other production of the kind ever did. It was written in 1664; but before it was brought on the public stage, partial representations of it in private companies had made its character known, and raised the alarm of the priests, who believed themselves to be specially satirized therein. Uniting with the many enemies whom Molière had already made for himself by lashing physicians, fops, and fools of all kinds, they used every means in their power to prevent the public representation of the play. The Archbishop of Paris threatened with excommunication all actors who should take any part in the performance, and even those who should only read it; and one dignitary went so far as to declare that Molière—whom he called a devil in human form—was deserving of the stake. It was not till 1669 that Molière succeeded in getting the play publicly acted in presence of Louis XIV.; and then it had an uninterrupted run for three months, to the great vexation of all hypocrites.

TASHKA'ND, till recently a town of Independent Turkestan, but now in the possession of Russia, is situated in the khanate of Khokan, 92 miles north-north-west of Khokan, the capital, on the north bank of the Saralka, a small feeder of the Djirhik River, an impetuous torrent, which empties itself into the Sir-Daria. It is the chief commercial town in the district, is the center of the transit-trade between Bokhara, Khokan, and Chinese Tartary, and has extensive trading relations with Orenburg and Petropavlovsk. Like most of the cities of Central Asia, it stands in a fertile plain. It covers a large tract of ground, being said to extend 10 miles in one direction and 5 in another, and is protected by a high wall of sun-dried bricks. Within the walls are numerous gardens and vineyards, interspersed among the houses; the houses themselves are built of mud, and thatched with reeds. The streets are narrow and dirty. The chief buildings are the castle (which is fortified), various mosques, colleges, old temples, and a bazaar. The chief manufactures are gunpowder, silk and cotton goods, and iron. According to a census taken in 1871, the population amounted to 78,125. T. is also important in a military point of view, and, mainly for this reason, had been long coveted by Russia. The Russians, who captured it in 1854, and retained it for a short time, finally took possession of it in 1865, having in the meantime made great advances in Central Asia. The petition of the inhabitants, that they might be received as Russian subjects, was granted in 1866; and since then it has been governed by a kind of municipal board, the president being a Russian officer, and the members chosen by the townspeople.

TASMA'NIA, formerly VAN DIEMEN'S LAND, a considerable island in the South Pacific Ocean, between the parallels of 40° 40′—43° 40′ S. lat., and between 144° 30′—148° 30′ E. long., lying to the south of, and separated from Australia by Bass's Strait. Its greatest length, from Cape Grim, on the north-west, to Cape Pillar, on the south-east, is 240 miles; and its greatest breadth from east to west, 200 miles; its area, including the adjacent islands, about 26,300 sq. miles. The capital is Hobart Town (q. v.), now called simply Hobart, with a pop. of 21,200. The second town is Launceston (q. v.), with a pop. of 12,750. In the year 1854, the population consisted of—males, 30,613; females, 28,261; total, 64,874. At the census of 1871, the total pop. was 99,328; at that of 1881, 115,705, (61,162 males, and 53,543 females). The majority are native born; some 30,000 were born in the United Kingdom; about 1000 are Germans; and 1000 men are Chinese. Of the inhabitants, about 5000 are mechanics and artisans, about 5000 domestic servants, 6000 farmers, 11,000 farm-laborers, 4000 other laborers, 200 miners, 90 doctors, 80 lawyers.

Physical Features.—The island, which is mountainous and well watered by rivers, has much beautiful scenery, and is much liker home than the other Australian colonies. Its south-eastern coast is deeply indented by the estuaries of the Derwent and Huon, Storm Bay, the inlet of Pitt Water, and Frederick Henry Bay. The last is protected on the south-east by Tasman's Peninsula, reserved as a penal settlement for the colony. The chief indentations on the west coast are Macquarie Harbor (formerly a penal settlement, but now uninhabited), and Port Davey. On the east coast are Oyster Bay, between Freycinet's Peninsula and the mainland; and Spring Bay, sheltered on the east by Maria Island. On the north coast, besides the estuary of the Tamar, there are numerous smaller harbors and rivers, accessible to vessels of from 30 to 300 tons. The chief of these are Circular Head, Port Sorell, and the rivers Mersey, Forth, Leven, Don, and Inglis. The scenery is of a bold mountainous character, varied by deep narrow valleys, extensive undulating tracts of country, and open plains of limited extent. Among the principal mountains are Ben Lomond (5010 feet), Cradle Mount (5069 feet), Ironstone Mount (4736 feet), Mount Barrow (4644 feet), Mount Wellington (4166 feet), with many others exceeding 4000 feet in height. Embosomed among the central mountains, at an average height of about three thousand feet, are numerous lakes, with a united area of about 170 sq. m., which feed the greater part of the rivers draining the south-east slope of the island. With the exception of the reclaimed lands, the basaltic plains, and limited tracts which are unfavorable to the growth of timber trees, the whole island is more or less densely wooded. The vast forests of the western portions of the north and south coasts are extensively utilized for timber, and in the former, the work of reclaiming the rich heavily-timbered lands is rapidly progressing. But the major part of the western half of the island is entirely uninhabited, its soil, climate, and inaccessible position offering little inducement to the settler.

Geology and Mineralogy.—The bed-rocks of the western districts, from Bass's Strait to South-west Cape, consist of vast bands of slates, schists, and quartz rock, belonging to the Azoic or Metamorphic series. Next to these come Lower Palæozoic slates, with conglomerates and dark compact limestones, the latter highly charged with Silurian fossils. Unconformably upon the upturned edges of these rocks lie Upper Palæozoic sandstones, mudstones, limestones, and conglomerates, also traversed by dykes and masses of greenstone and basalt, and with these, reaching an altitude of 4000 feet above the sea-level. In the south-east districts, from the South Esk River on the north to the Huon on the south-west, the lower rocks are entirely absent, or concealed beneath the Upper Palæozoic beds. In the north-east district, the lower rocks again make their appearance, associated with granite and greenstone, and occasionally traversed by dykes and veins of the true auriferous quartz. Here, again, they are overlaid by Upper Palæozoic rocks, extensively denuded, and exposing seams of coal from 2 feet to 14 feet thick, at various elevations. Tertiary rocks are sparingly distributed. At the mouth of the river Inglis, on the north coast, are beds of a whitish freestone, attaining in places a thickness of 120 feet, and containing recent shells, with extinct species of *Trigonia*, *Terebratula*, *Cypræa*, *Voluta*, &c. Tertiary lignites are found in the sandy clays of the valleys of the Derwent and Tamar, with impressions of leaves of unknown trees and plants. Over the greater part of the basin of the South Esk, comprising an area of more than 1000 sq. m., extensive deposits of clays, sands, and quartz drift are met with. No distinct traces of glacial action have been observed; but the thick beds of gravel, and the boulders, which must have traveled many miles from their parent rock, afford evidence of some powerful transporting agency, and were probably deposited in their present sites by the action of icebergs slowly drifting northwards at some period prior to the last general elevation of the land.

The igneous rocks are everywhere present in great variety. The islands of the Furneaux group in Bass's Strait, are chiefly of granite, and form the connecting links which join the north-east angle of T. to the Great Dividing Range of Eastern Australia. Gold has been found in many places, and the workings have for years given fair returns to a limited number of miners. In 1880, the value of the gold (alluvial and drift) produced was £201,297. Silver and antimony have been met with in the gold-drifts, and very rich deposits of tin began in 1872 to be worked at Mount Bischoff, the richest tin mine in the world, which yielded 1050 tons of ore from January to June 1880. Copper occurs in thin veins, associated with galena, on the north coast, and galena is found

BASS STRAIT
BANKS STRAIT
WELLINGTON
DEVON
DORSET
RUSSELL
SURREY HILLS
WESTMORELAND
CORNWALL
MONTAGU
LINCOLN
SOMERSET
GLAMORGAN
CUMBERLAND
FRANKLIN
MONTGOMERY
MONMOUTH
PEMBROKE
BUCKINGHAM
ARTHUR
KENT
TASMANIA
British Miles. 69.15=One Degree
Geographical Miles, 60=One Degree
Longitude East from Greenwich
145
146
147
148
42
43
Hobart to Auckland, New Zealand, 1800 Geogl. Miles
Melbourne to Launceston 120 Geogl. Miles

elsewhere in the primitive limestones. Red and brown hæmatites, containing a large percentage of iron, occur at various points on the north coast, in large masses and lodes. In 1880, 3987 tons of ironstone were raised; and iron-works on an extended scale are now in operation. Coal is worked in several parts of the island, chiefly for local consumption. A large lode of bismuth was discovered in 1875. The older limestones yield fine varieties of marble, and excellent building-stone is obtained from the greenstones, basalts, and Palæozoic sandstones.

Botany.—The flora of T. has been fully described in the botany of the antarctic voyages by Hooker and others. The majority of the species are common to Australia and Tasmania. Of those which are peculiar to the latter, many are limited to particular localities. The most widely diffused genera are the Eucalypti and Acaciæ, the former yielding the ordinary timber of the colony. The Blue Gum (*Eucalyptus globulus*) reaches a height of 350 feet, with a corresponding girth. The Black-wood (*Acacia melanoxylon*) and the Huon Pine (*Ducrydium Franklinii*) also yield valuable timber, which, together with the hardwoods from the Eucalypti, is largely exported to the neighboring colonies.

A species of Beech (*Fagus Cunninghamii*), locally known as the myrtle, and growing in great abundance in some parts of the island, also produces a highly valuable timber, which has not yet received the attention which it merits. There are many beautiful shrubs and plants, but the flowers are usually small and inconspicuous. All the common fruit-trees and culinary vegetables of England have been introduced, and grow with great luxuriance and vigor. Oranges and lemons are cultivated in some situations, but do not usually ripen their fruit. The introduction and cultivation of exotic trees and plants is energetically carried on in the Botanical Gardens under the direction of the Royal Society.

Zoology.—Of the 30 species of mammals, one-half belong to the sub-class *Aplacentaria*, comprising the *Marsupiata* (kangaroo, wallaby, opossum, wombat, &c.), and two species of the singular order *Monotremata* (Ornithorhynchus and Echidna). Among the marsupial animals peculiar to T., the chief are the Thylacine (*Thylacinus cynocephalus*) and the Tasmanian Devil (*Dasyurus ursinus*), both of which are sometimes very destructive to sheep in the outlying districts. The skin of the kangaroo is much prized for leather, and there is always a market for opossum fur. Whales and seals, formerly very abundant on the coasts, are now rare; but whaling is still extensively carried on in the adjacent seas. The birds of T. have been admirably described by Gould. The majority are identical with Australian species. The emu is extinct, and black swans are seldom seen in the settled districts. There is abundance of native game, which is now protected by act of parliament during the breeding season. A species of puffin (*Puffinus brevicaudus*), locally known as the mutton-bird, frequents some of the islands in Bass's Strait, in countless numbers, and many thousands are annually slaughtered for the sake of their oil, and for food by the half-caste islanders. Fish are plentiful in the seas and rivers, the best being known by the local name of trumpeter, and reaching a weight of 40 lbs. There are 13 species of snakes, most of which are venomous, but accidents from their bite are of very rare occurrence. Many species of insects and crustaceans have been described by Erichson, Gray, Gunther, and others. A comprehensive and accurate account of the *fauna* of T. is still, however, a desideratum.

Fallow deer, and several of the English game-birds, have long been naturalized, and salmon have been introduced after several unsuccessful attempts.

Climate, Soil, Produce, &c.—The climate of T. is fine and salubrious. From observations taken at Hobart Town, and extending over a period of twenty years, the extreme of heat appears to be 105°, and of cold 29° 8′. The mean temperature of the hottest month (January) is 63° 57′, and of the coldest (July) 45° 82′, and of the whole year, 54° 92′. In some parts of the island, the temperature, even in winter, rarely sinks to 45°. Snow seldom falls in the settled districts, and does not lie on the ground except on the high table-lands of the interior. The average annual rain-fall at Hobart Town is 21·52 inches, and the average for the rest of the island about 35 inches, except in the western country and the high lands, where a fall of 75 inches has been registered in the year.

The agricultural lands may be divided into three classes—alluvial deposits, tertiary clays, and loamy soils, derived from the decomposition of different kinds of basalt. In their virgin state, some are marvelously productive. On new land, 100 bushels of oats, 70 bushels of wheat, and 15 tons of potatoes per acre, are not uncommon crops. The fertility of the soil has encouraged a system of slovenly farming. In many instances the land has been cropped with wheat and oats for upwards of thirty years without any application of manure, or any rest save an occasional summer fallow. The export trade in the staple articles of produce has much fallen off of late years, partly because the neighboring colonies have begun to depend more upon their own resources, but partly also through the deterioration of the soil from improvident management, and the necessarily increased cost of production. There are skilled and careful farmers in every district, but they are exceptions to the rule. The open pastoral lands are admirably adapted for sheep. The wool from some of the larger establishments is much valued, and brings the highest price in the London market. The cattle and agricultural horses of some of the northern districts are unsurpassed in the colonies. Pastoral and agricultural associations have been formed to promote improvements in the system of farming, and to encourage the breeding and importation of pure stock.

The extent of alienated land is over 4,000,000 acres of which about 380,000 are cultivated. The chief crops are wheat, oats, barley, potatoes, peas, and hay; also hops. Fruit of all kinds is largely grown and exported; and fruit-preserving is an important industry. In 1880–81, 50,000 acres were in wheat, and the yield was 750,00 bushels. There were then upwards of 25,000 horses, 127,000 cattle, 1,780,000 sheep in the colony. The exports, of which wool is the chief, had in 1880 a value of £1,511,-931; the imports, of £1,369,224. There are breweries, tanneries, soap-works, flour-mills, agricultural implement works, coach-works, and one tweed manufactory. The Tasmanian ale is excellent, and is exported to Victoria, and New South Wales. The protective tariffs of Victoria, and the consequent loss of market, is the chief hindrance to the prosperity of T. The whale-fisheries used to be of value to T., but have fallen off. In 1880, the colony possessed 207 sailing-vessels of 18,820 tons and 15 steamers of 4590 tons; and 654 vessels, of 205,217 tons, entered; while 655, of 208,806 tons, cleared the ports of the colony.

Administration.—Since the passing of the 'Constitutional Act' in 1854, the governing authority has been vested in a parliament, consisting of the governor as the Queen's representative, and two elective Houses, the Legislative Council of 16, and the Assembly of 32 members. The qualification of voters is, for the former, a freehold of the annual value of £30, or a leasehold of £200; and for the latter a freehold of the value of £50, or the payment of £7 house rental. Graduates of British universities, and all holding a commission in the army or navy, or in holy orders, are entitled, *ex officio*, to vote at the election of members of both Houses.

The land laws of T. are liberal. Any immigrant who has paid the passage of his family, may demand 30 acres for himself, 20 for his wife, and ten for each of his children. Unmarried immigrants receive land orders for the value of £18. The upset price of agricultural land is £1 per acre, the average price paid in 1880 being about £1, 6*s.* for country land. Town land is worth about £6 per acre. Pastoral land may be had for 5*s.*

The revenue of T. in 1880 was £444,845, the expenditure being £427,712. The public debt was £1,943,700, of which £1,289,000 had been incurred for public works, including railways. The railways are the main line from Hobart to Launceston (133 miles), and the Launceston and Western (45 miles). Other two short railways have been projected.

Religion and Education.—There is now no parliamentary grant for the support of religion, though till lately £15,000 was divided among the various religious denominations according to their respective numbers at the census. By a return in 1870, there were: Church of England, 53,047; Roman Catholics, 22,091; Presbyterians, 9064; Wesleyans, 7187; Independents, 3931; Baptists, 931; Jews, 232. The higher branches of education are under a council, the lower under a board; and public instruction is carefully and liberally fostered. In 1854, the number of schools was 50, and the average attendance of pupils, 2624. In the beginning of 1880 there were upwards of 170 schools supported by government, 320 teachers, 12,286 children on the rolls, with an average daily attendance of 6002. Of the entire population about 60 per cent. can both read and write; about 25 to 30 per cent. are unable to read.

For the promotion of higher education, provision is also made by the legislature. Two scholarships, each of the value of £200 a year, and tenable for four years at either of the English universities, are annually open to competition under the direction of the Council of Education, and exhibitions to the higher schools, with other local honors, are periodically awarded by the same body.

Aborigines.—The number of the aborigines at the first colonization of T. has been variously estimated, but probably at no time exceeded 3000. There were several tribes occupying distinct parts of the island, and differing from each other in dialect and customs; but of a generally uniform type more nearly allied to the Negritos of New Guinea than to the aborigines of Australia. The average height of the men was from 4½ to 5½ feet; of the women, considerably less. Color, a bluish black; the facial angle 75° to 80°; eyes, dark brown, with jet-black pupils; hair, sometimes lank, but generally crisp or woolly; forehead, high and narrow; limbs, lean and muscular; feet, flat and turned inwards. Polygamy appears to have been tolerated: the women performed all menial duties, and were specially charged with that of carrying fire from place to place, when the temporary encampment was broken up. Their usual shelter was a 'break-wind,' constructed of

boughs, but traces of rude huts have been observed. In summer, they went entirely naked, at other times wearing coverings made from the skins of the kangaroo and opossum, which formed their chief food. The coast tribes, at certain times of the year, lived almost exclusively on shell-fish, and the remains of their feasts have often been mistaken for recent marine deposits. Among other articles of food were the roots of the esculent fern, the heart of the tree-fern, and grass-tree (*Xanthorrhœa*), the seeds of the boobialla (*Acacia sophora*), and a singular fungus (*Mylitta Australis*) commonly known as 'native bread,' which grows under ground near the roots of decayed trees. No traces of cannibalism were observed. Their only weapons were the spear and waddy, a wooden club about 2 feet 4 inches in length. The early relations between the settlers and aborigines were friendly; but as the latter were gradually dispossessed of their favorite hunting-grounds, they became inveterately hostile. Shot down without mercy by the settlers, they revenged themselves by bloody reprisals, and for many years the unequal struggle continued, until their numbers were reduced to a few hundreds.

In 1830, an attempt was made to drive the whole body into Tasman's Peninsula, by means of a cordon extending across the whole island, and gradually closing in towards the south-east; but it failed ridiculously, as might have been foreseen. In the following year, Robinson, a builder of Hobart Town, undertook to conciliate the surviving remnants of the various tribes, with a view to their removal to Flinders Island, and this he successfully accomplished, after four or five years of patient, self-denying labor. In spite of all the care bestowed upon these unfortunate people, their numbers rapidly decreased, and only 45 remained when the settlement was removed, in 1847, to a more convenient station at Oyster Cove, near Hobart Town. There were in 1865 only six remaining. No children had been born among them for many years, and the race is now wholly extinct, the last of the number having died a few years ago.

History.—The island was first discovered by Tasman on the 1st December 1642, and named by him Van Diemen's Land, in honor of his patron, the then governor of the Dutch possessions in the East Indies. During the next century, no visit is recorded; but between 1772 and 1802, partial surveys and explorations were made by English and French navigators. In 1803, Lieutenant Bowen was dispatched from Sydney with a few soldiers and convicts to form a settlement in the south of T., which was finally fixed on the spot where Hobart Town now stands. In 1804, a settlement was formed near the mouth of the Tamar, which was removed in 1806 to the spot now occupied by the town of Launceston. From 1817, commenced a rapid increase in the number of free settlers, who received grants of land in proportion to the capital which they brought into the colony, and were subsequently further aided in the clearing and cultivation of their estates by the assignment of convicts as their servants. In 1825, T. was declared independent of New South Wales.

The colony was for a good many years agitated by the question of the disposal and management of the convicts, who were now becoming a prominent and formidable element in the community. At last, in 1853, transportation to T. and New South Wales was finally abandoned by the home government. The abolition of transportation, and the consequent cessation of a vast imperial expenditure, naturally produced a considerable depression in all branches of trade, especially in the southern districts. It is not surprising that the great body of the colonists, instead of setting themselves manfully to turn the true and natural resources of the country to the best account, have rather looked for some great discovery of rich gold-fields, or some gigantic works undertaken under the auspices of government, as the only means by which the prosperity of the colony was to be assured. But such a state of things must ultimately work its own cure. Viewed in a true light, the progress, social, material, and political, has presented a more hopeful aspect since the extinction of the convict system than at any earlier period. For years after the discovery of gold in Australia, the *expirees* of T. flocked in crowds to the neighboring colonies, attracted by the prospect of richer gains, and glad to escape from police surveillance in a country where their antecedents were too well known. Those who remained had, for the most part, by this time become orderly, well-conducted members of the community, not to be distinguished from the immigrant population by whom they were surrounded. Necessity will in due time develop the enterprise and energy which have too long lain dormant. Some of the older settlements may prove inadequate to the maintenance of their former population, but the rich lands of the north coast offer to industrious settlers a field which is practically inexhaustible.

TASMA'NNIA, a genus of shrubs of the natural order *Magnoliaceæ*. *T. aromatica* is an evergreen bush of Van Diemen's Land, growing in the richest soils on the margins of rivers and in shady ravines, and sometimes forming thickets of large extent. Every part of the plant is highly aromatic and pungent. The fruit is occasionally used as pepper. This shrub requires protection from frost in England.

TASSISUDO'N, the capital of Bhoton (q. v.), stands on the right bank of the Godadda, an affluent of the Brahmaputra, in lat. 27° 30′ N. Many of the inhabitants, the number of whom has not been ascertained, are employed in manufacturing paper, and in making brass images and ornaments for their places of worship.

TASSO, Bernardo, an Italian poet of considerable distinction, but most famous as the father of the illustrious Torquato, was born at Bergamo, 11th November 1493. Both by his father's and mother's side, he was connected with the ancient family of the Tassi, known in the 13th c. for having organized and superintended the postal service in Italy, Spain, and Germany. His uncle, Luigi Alessandro, Bishop of Recanati, took charge of his education, and under his care he turned out a fine classical scholar, his love of poetry at the same time becoming every year more ardent. The assassination of the cardinal, in 1520, deprived him at once of protection and support, and for several years he wandered about Italy in a rather necessitous condition. Like his son, he was exceedingly fond of the patronage of noble lords and the smiles of noble ladies. After 1525, we find him high in favor with persons of influence. Guido Rangone, general of the pontifical forces, intrusted him with several missions, among others to the Prince of Salerno, who appointed him his secretary; and T. accompanied the prince on the expedition against Tunis in 1534. In 1539, he married, at Salerno, a young lady of Sorrento, Porzia de' Rossi, who added genuine merit to the advantages of birth, beauty, and fortune, and by whom he became the father of Torquato. The fall of the Prince of Salerno (who had incurred the enmity of Charles V.) brought with it the ruin of T.'s worldly prosperity, and he was obliged to seek for a new patron. He was not long in finding friends. Guidubaldo, Duke of Urbino, and Gugielmo, Duke of Mantua, strove for the honor of attaching the poet to their court. The latter succeeded, and named him governor of the city of Ostiglia, where he died 4th September 1569.

T.'s principal writings, chronologically arranged, are: *Rime* (Ven. 1531); *I tre Libri degli Amori* (Ven. 1537); *Ode e Salmi* (Ven. 1560); *L'Amadigi, Poema* (Ven. 1560); and *Il Floridante, Poema* (Mant. 1587). Of these, the principal is *L'Amadigi* (Amadis), which some Italian critics have not hesitated to place above the poem of Ariosto; but without adopting this extravagant estimate, we may justly admire it for the sweetness and elegance of its language, and for the beauty of its descriptions and comparisons.—For a good idea of the politics and literature of the time, see Seghezzi's edition of his *Lettere* (3 vols., Padua, 1733—1751), to which there is prefixed a biographical notice.

TASSO, Torquato, one of the greatest poets of Italy, was the son of the preceding, and was born at Sorrento in Naples, 11th March 1544. His earliest education was received from the Jesuits. During his childhood, T.'s father was an exile, but the affectionate solicitude of his mother well supplied the want of paternal care. In 1554, he went to Rome to join his father, and left his mother (whom he was destined never again to see) in a convent at Naples. At Rome, and subsequently at Bergamo, Urbino, Pesaro, and Venice, he continued to prosecute his studies. He assisted his father in copying, correcting, and even in completing his poem *L'Amadigi*, though as yet only 16 years of age. No wonder old Bernardo was delighted at the promise shown by his son, and prophesied in his letters that Torquato would yet become a great man. Later, however, sad experience of the miseries of a poet's life, induced him to send T. to Padua, to study jurisprudence under the celebrated Panciroli. But whom the gods have made poetical can never sink into a lawyer. The youth remained at Padua a year, and wrote *Rinaldo* (Venice, 1562), a poem in 12 cantos, the hero of which is the son of Aymon, and cousin of Roland. It belongs, therefore, to the class of heroic romances. After the first burst of anger was over, Bernardo forgave his son for following his example rather than his precept, and became prouder of T.'s genius than ever.

T. now betook himself to the university of Bologna, to study philosophy, and is said to have distinguished himself by an extraordinary facility in the discussion of the most elevated and abstract themes—a circumstance that perhaps says more for his power of rhetoric than his power of speculation. On leaving Bologna, he spent some time with friends at Castelvetre, Modena, and Corregio, but returned to Padua at the request of his friend Scipio de Gonzaga, afterwards cardinal, who had established a literary academy there, of which T. became a member. It was during this second residence at Padua that he conceived the first idea of his great work, the *Gerusalemme Liberata*, a heroic record of the conquest of Jerusalem by the Crusaders under the command of Godfrey de Bouillon. Lamartine beautifully describes the mingled motives of the poet: 'Urged by piety no less than by the muse, Tasso dreamed of a crusade of poetic genius, aspiring to equal by the glory and the sanctity of his songs, the crusades of the lance he

was about to celebrate.' The same critic goes on to observe, in allusion to the less noble passion for the applause of courts that marked the poet: 'The names of all the noble and sovereign families of the West would be revived in this epic catalogue of their exploits, and would attract to the author the recognition and favor of the great. . . . . Finally, the poet was himself a knight, noble blood flowed in his veins, to celebrate warlike deeds seemed, as it were, to be associating his name with those of the heroes who had performed them on the field of battle: thus religion, chivalry, poetry, the glory of heaven and earth, the hope of eternal fame, all combined to urge him to the undertaking.' Bernardo heard of his son's design with exulting joy, and blessed Heaven for making Torquato a greater genius than himself. Meanwhile (1565), T. had been introduced by Cardinal Luigi d'Este (to whom he had dedicated the *Rinaldo*) to his brother, Alfonso II., sovereign Duke of Ferrara. Here for a time he was supremely happy. Young, handsome, courteous, and with that proper tinge of melancholy in his disposition that possesses an irresistible charm for women, he soon became a universal favorite with the beauties of the court. While their bright eyes rained influence, T. painted his *Armida* and *Herminia* almost without effort.

It is only just to add, that the attempt to seek the origin of his subsequent miseries and madness in a presumptuous passion for Leonora, sister of the Duke of Este, which was first encouraged, then repulsed, and finally punished with imprisonment, is utterly at variance with the notorious facts of the case. Space does not permit us to examine the question here, but it appears necessary to correct errors of traditions so specious as to have imposed upon illustrious men. T. courted, platonically and otherwise, various ladies of the court—a pretty chamber-maid even was not beneath his notice; but there is not a vestige of evidence to show that he lifted his eyes to the sister of his sovereign, or that such a suspicion was ever harbored by the lady herself or her brother. In truth, his madness was connected in its origin more closely with his poetry than with his loves. Having finished his great epic about 1575, he sent a copy of it to a society of scholars, critics, and churchmen at Rome, to get their opinion of it. It would have been far better had he published the poem at once, without placing it at the mercy of critics who were delighted to have the opportunity of finding fault before the public was in a position to praise. The critics would then have been forced to swell the chorus of general admiration. T. was tortured by their waspish comments, and, with pitiable agonies, proceeded to make his work more agreeable to his incapable judges. Gradually a morbid melancholy overpowered his reason; the spites and jealousies that are never absent from a gay and pleasure-loving court, contributed to increase his mental disorder. He believed that invisible persecutors had denounced him to the Inquisition as a heretic.

It was in vain that Alfonso and his sisters tried to calm the perturbations of his spirit, and even got the Inquisition to write him a reassuring epistle. His paroxysms increased in violence. Finally, one evening in June 1577, he drew his dagger in the apartments of the Duchess of Urbino, to stab a domestic whom he took to be one of his secret enemies; and Alfonso had him confined in his palace and at Belrignardo for his health's sake, rather than to punish him. Next month he made his escape, and fled across the Abruzzi to his birthplace, Sorrento, where he took refuge with his sister. The air of his native place quickly restored him to health; but no sooner had he recovered, than he began to yearn for the old excitements, begged Alfonso to take him back, and when that prince drily informed him that he might return if he pleased, T. greedily availed himself of the cold permission, and was soon as wretched as before. A new flight ensued, this time towards the north of Italy. The unhappy poet wandered at last half-naked into the city of Turin, where he was humanely received by the Marquis d'Este, brother of Alfonso. After some time, he again ventured to return to Ferrara (1579), but only to madden, almost as soon as he breathed its noxious air. Alfonso shut him up in the asylum of Santa Anna in Ferrara, in which he remained upwards of seven years, suffering terribly from confinement, when the duke, at the request of the Prince of Mantua, Pope Sixtus V., and others, released him (5th July 1586). During the remainder of his life, T. lived chiefly at Naples and Rome. Almost the last incident of his career was his intended public coronation on the Capitol. The excitement was too much for his ruined frame. A slow fever seized him; he was removed to the convent of Santo Onotrio, and there, before the laurel could be conferred on him, he died 25th April 1595, after a brief illness. It should be noted that in 1570 T. visited France, where he spent a year, gaining the friendship of Charles IX.

Besides his *Gerusalemme Liberata*, transl. by Fairfax (1600), Hooke, Hoole, Hunt (1818); Smith (1851); Griffiths (1863), &c.; T. wrote a great number of works in verse and prose. In 1573, he produced his *Aminta*—a pastoral drama, one of the first and most successful of its kind, whose striking beauty led to innumerable imitations. *Rime, insiemi con altri Componimenti* (1581); *Dialoghi e Discorsi* (1587); *Lettere Familiari* (1588); *Rime* (1592—1593); and *Gerusalemme Conquistata* (1593). A complete edition of his works appeared at Pisa in 1832, in 33 vols. See Hasell's T. (1882).

TASTE, ORGAN AND SENSE OF. The principal seat of the sense of taste is the mucous membrane of the tongue, in which dissection reveals a *cutis* or *chorion*, a *papillary structure*, and an *epithelium*. Of the *cutis*, it is sufficient to remark that it is tough, but thinner and less dense than in most parts of the cutaneous surface, and that it receives the insertions of the intrinsic muscles of the tongue, which will be described when we treat of that organ generally. The *papillary structure* differs from that of the skin in not being concealed under the epithelium, but in projecting from the surface like the villi of the digestive canal, and it thus gives to the tongue its well-known roughness. The *Epithelium* (q. v.) is of the scaly variety, as on the skin, but is much thinner on the tongue than on the skin. It is most dense about the middle of the upper surface of the tongue, and it is here that, in disordered digestion, there is the chief accumulation of *fur*, which in reality is simply a depraved and over-abundant formation of epithelium. The *papillæ* on the surface of the tongue are either *simple* or *compound*. The former, which closely resemble those on the skin, are scattered over the whole surface of the tongue in parts where the others do not exist, and they likewise participate in the formation of the compound papillæ, which, from their forms, are respectively termed (1) the *circumvallate* or *caliciform*, (2) the *fungiform*, and (3) the *conical* or *filiform*.

The *circumvallate* papillæ are not more than eight or ten in number, and are situated in the form of a V at the base of the tongue. Their function seems to be to secrete mucus, as well as to take part in the act of tasting. They consist of 'a central flattened projection of the mucous membrane of a circular figure, and from $\frac{1}{30}$th to $\frac{1}{12}$th of an inch wide, surrounded by a tumid ring of about the same elevation.'—Todd and Bowman, *Physiological Anatomy and Physiology of Man*, 2d ed. vol. i. p. 437. They are shown in the figure of the surface of the tongue given in the article on that

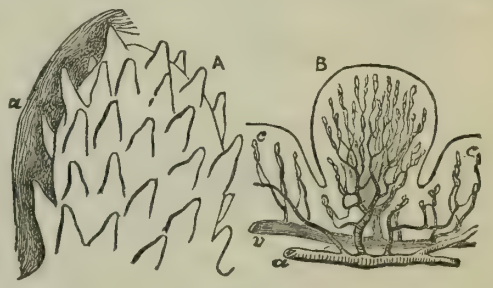


Fig. 1.

A, *Fungiform papilla*, showing the simple papillæ on its surface; and at *a*, the epithelium investing them (magnified 35 diameters) B, a similar papilla, with the capillary loop of its simple papillæ injected; *a*, artery; *v*, vein. Around the base there is often a groove, which is here shown; as also are the capillary loops, *c*, *c*, of two of the neighboring simple papillæ (magnified 18 diameters.)

organ. The *fungiform* papillæ are scattered over the surface in front of the circumvallate papillæ, and about the sides and apex. They are usually narrower at the base than at the apex, where they are about $\frac{1}{30}$th of an inch in diameter. They are covered with simple or secondary papillæ, and their investing epithelium is so thin that the blood circulating in them gives them a red color, which is not seen in the conical papillæ amongst which

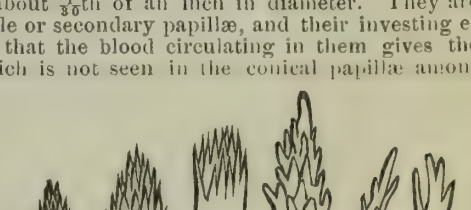


Fig. 2.—Various Forms of Conical Compound Papillæ

a, *b*, *c*, provided with the stiffest and longest epithelium, and the simple papillæ much acuminated; *d*, approximates to the fungiform, and *e*, and *f* to the simple papillæ. (Magnified 20 diameters).

they are distributed. They contain nerves terminating in loops. The shape of the *conical* or *filiform* papillæ is indicated by their names; and even if they take little part in the sense of taste directly, it is convenient to describe them here. Their average length is about $\frac{1}{10}$th of an inch. The structure of these papillæ will be better understood from the accompanying diagrams than from any verbal description. They terminate in long pointed processes, which are bathed by the mucus of the mouth, and are

capable of moving in any direction, although they are generally inclined backwards.

Some of the stiffer of these epithelial processes enclose minute hairs, of which several forms are depicted by Messrs. Todd and Bowman, from whose *Physiological Anatomy* all the figures in this article are borrowed. These authors surmise, on structural grounds, that the filiform papillæ 'can scarcely share in the reception of impressions which depend on the contact of the sapid

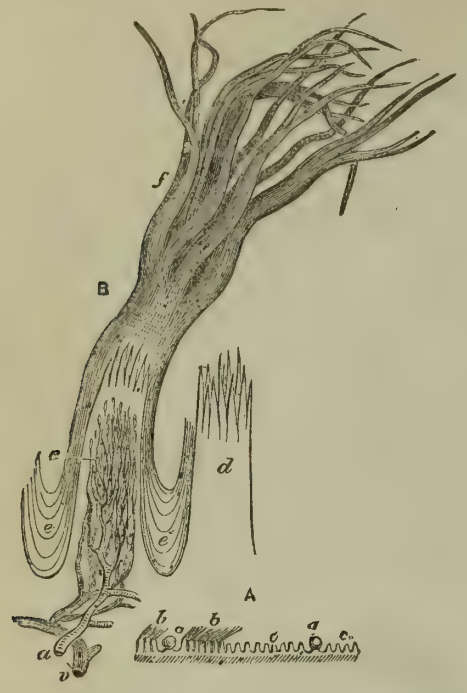


Fig. 3.

A, vertical section near the middle of the dorsal surface of the tongue, showing the basement membrane on which lie *a*, *a*, fungiform papillæ; *b*, *b*, filiform papillæ, with hair-like processes; *c*, *c*, similar papillæ devoid of these processes. B, a filiform compound papilla, magnified 300 diameters: *a*, artery; *v*, vein; *c*, capillary loop; *d*, a secondary papilla deprived of *e*, epithelium; *f*, hair-like processes at the apex.

material with the papillary tissue. The comparative thickness of their protective covering, the stiffness and brushlike arrangement of their filamentary productions, their greater development in that portion of the dorsum of the tongue which is chiefly employed in the movements of mastication, all evince the subservience of these papillæ to the latter function rather than to that of taste; and it is evident that their isolation and partial mobility on one another must render the delicate touch with which they are endowed more available in directing the muscular actions of the organ. The almost manual dexterity of the tongue in dealing with minute particles of food is probably provided for, as far as sensibility conduces to it, in the structure and arrangement of these papillæ.'—*Phys. Anat. and Phys. of Man*, vol. i. p. 441. Notwithstanding the difference in their outward form and mode of arrangement, the simple papillæ, which have been detected by Todd and Bowman as scattered over the whole dorsum of the tongue (although concealed under the common sheet of epithelium), and those clothing the circumvallate and fungiform papillæ, do not seem to present any structural difference; and their epithelium, which is very thin, readily permits the transudation of sapid substances dissolved in the mucus of the mouth. With regard to the use of the singular configuration of the circumvallate and fungiform papillæ, 'it may be conjectured that the fissures and recesses about their bases are designed to arrest on their passage small portions of the fluids in which the sapid materials are dissolved, and thus to detain them in contact with the most sensitive parts of the gustatory membrane.' —*Op. cit.*, p. 441.

There has been much discussion regarding the precise seat of the sense of taste and the true nerves of taste. Although the surface of the tongue is the special seat of gustative sensibility in man, the sense of taste is by no means restricted to that organ, being diffused, in a less degree, over the soft palate, the arches of the palate, and the fauces. Moreover, the gustative sensibility varies on different parts of the surface of the tongue. It is generally allowed that acute taste 'resides at the base of the tongue, over a region of which the circumvallate papillæ may be taken as the center, and also on the sides near the base. These parts are supplied solely by the glossal twigs of the glosso-pharyngeal nerves. Some writers, amongst whom are Valentin and Wagner, believe the middle and anterior parts of the dorsum of the tongue to be usually incapable of appreciating flavor; while numerous others hold the contrary opinion, with which our own careful and repeated experiments, on other persons as well as ourselves, quite accord. Sour, sweet, and bitter substances applied to the sides, and especially to the tip of the protruded tongue, we find to be at once distinguished; though, when placed on the middle of the dorsal region, they make little or no impression till pressed against the roof of the mouth. This region of the tongue is supplied almost solely by the lingual branch of the fifth nerve. We conclude generally, with regard to the tongue, that the whole dorsal surface possesses taste, but especially the circumferential parts, viz., the base, sides, and apex.'—*Op. cit.*, pp. 442, 443. The investigations of Messrs. Todd and Bowman further show that the soft palate and its arches are endowed with taste in some persons, but not universally, while they got no evidence in any case of gustative sensibility on the pharynx, gums, or elsewhere. The soft palate and its arches are supplied by palatine branches from Meckel's ganglion, and sparingly by the glosso-pharyngeal nerves. From (1) the evidence afforded by the anatomical distribution of the nerves to parts enjoying the sense of taste, (2) the evidence of experiments, in which the various nerves of the tongue were divided, and (3) the evidence afforded by disease, it may be safely inferred that the glosso-pharyngeal and the lingual branches of the fifth pair of nerves respectively participate in the sense of taste; and there is also reason to attribute a share to the palatine branches of the fifth.

Impressions of taste may be produced by a mechanical or chemical excitement of the gustatory nerves. A quick light tap of the finger on the tip of the tongue causes a taste, sometimes acid, sometimes saline, which lasts for several seconds; and galvanism acts similarly. If the surface of the tongue, near the root, be touched with a clean dry glass rod, or a drop of distilled water be placed upon it, a slightly bitterish sensation is produced; and if the pressure be continued, a feeling of nausea ensues. If a small current of cold air be directed against the tongue, it excites a cool saline taste like that of saltpetre. From the experiments of E. H. Weber, it appears that one of the conditions requisite for the due exercise of the sense of taste is a temperature not departing far on either side from the natural standard. Thus, if the tongue be immersed for a minute in water at a temperature of 125°, or in iced water, the taste of sugar, &c., is no longer perceived. In order that sapid bodies should cause taste, it is necessary that they should be dissolved, and made to permeate the tissue of the papillæ, so as to come in contact with their nerves. This is proved by the two following facts: 1st, that every substance, whether solid, fluid, or gaseous, which possesses a distinct taste, is more or less soluble in the fluids of the mouth, while substances which are perfectly insoluble are only recognized by the sense of touch; and 2d, that if the most sapid substance be applied in a dry state to a dried part of the surface of the tongue, no sensation of taste is excited. Bitters and acids appear to be the most sapid bodies, since they may be diluted to a greater extent than any other known substances without ceasing to excite sensations of taste. Thus, according to Valentin, 1 part of extract of aloes, or of sulphuric acid, in 900,000 of water, and even 1 part of sulphate of quinia in 1,000,000 parts of water, may, with ease, be distinguished from perfectly pure water.

'The contact of a sapid substance,' says Dr. Carpenter, 'much more readily excites a gustative sensation when it is made to press upon the papillæ, or is moved over them. Thus there are some substances whose taste is not perceived when they are simply applied to the central part of the dorsum of the tongue, but of whose presence we are at once cognizant by pressing the tongue against the roof of the mouth. The full flavor of a sapid substance, again, is more readily perceived when it is rubbed on any part of the tongue, than when it is simply brought in contact with it, or pressed against it. Even when liquids are received into the mouth, their taste is most completely discriminated by causing them to move over the gustative surface: thus, the 'wine-taster' takes a small quantity of the liquor in his mouth, carries it rapidly over every part of its lining membrane, and then ejects it.'—*Principles of Human Physiology*, 6th ed. p. 621. Most sapid substances affect the nerves of smell to a greater or less degree, as they pass down the throat; and it is this compound of taste and smell that constitutes *flavor*. It is a common habit to hold a child's nose when he is taking a nauseous draught, with the view, as is supposed, of deadening the taste. The efficacy of the process depends upon the exclusion of smell, and the reduction of the flavor of the medicine to its mere taste. The agreeable sensation produced by sipping good wine is due to what is termed its *bouquet*, or, in other words, to its flavor, or combined taste and smell. Some substances leave a taste in the mouth very different from that which they first produced. This *after-taste* is usually bitter; but in the case of one of the most bitter substances known, namely, tannin, it is sweet. This connection seems, in a degree, to correspond to the complementary colors in vision.

There can be no doubt that the sense of taste has for its primary object to direct us in the choice of food, to make the act of eating agreeable, and to excite the flow of mucus and saliva which aid the digestive process; and amongst the lower animals, the instinctive perceptions connected with this taste are much more remarkable than in man. As a general rule, it is found that those substances whose taste is agreeable are useful articles of food, and *vice versâ;* although there are some well-known exceptional cases. Sir Henry Holland, in his *Medical Notes and Reflections*, observes that in the majority of instances of actual illness, the desires of the patient as to food and drink may be safely complied with, even when some seeming extravagance of diet is suggested; and that in the early stage of recovery from gastric fevers, he has seen many curious instances of such contrariety to all rule acquiesced in with manifest good to the patient. 'Dietetics,' he adds, 'must become a much more exact branch of knowledge, before we can be justified in opposing its maxims to the natural and repeated suggestions of the stomach, in the state either of health or disease.'

TATE, Nahum, a poet and dramatist, son of the Rev. Dr. Faithful Tate, was born in Dublin in 1652, and educated at Trinity College, Dublin. In 1690, he succeeded Shadwell as poet-laureate, and held that dignity till his death in 1715. His habits were somewhat improvident, and in the latter part of his life he resided within the precincts of the Mint at Southwark, then a privileged sanctuary for debtors—hence perhaps that 'down-cast look' and inability to 'say much for himself,' for which, it is said, he was remarkable. His writings include nine or ten dramatic pieces, *Panacea, or a Poem on Tea*, various birthday odes, and an elegy on the death of Queen Mary. He lived to write the first birthday ode for George I. But T. is best known by the metrical version of the Psalms, which he executed in conjunction with Dr. Nicholas Brady, chaplain to King William and Queen Mary, which was attached to the Prayer-book, and came into general use in the Church of England, supplanting the older version made in the reign of Edward VI. by Sternhold and Hopkins.

TATIAN, one of the early apologists of Christianity against the pagan philosophers, and the founder of a sect which, whether under his own name, or under various other appellations derived from its peculiar tenets or practices, attracted considerable notice in the primitive ages. T. was born in Syria or Assyria about the year 130. Having cultivated rhetoric and philosophy in various places, he came to Rome about 162, where he became the disciple and friend of Justin the Martyr, and was by him converted to Christianity. He is known to have written many works, of which, however, only the Apology is preserved. The date of its composition is uncertain, but it was probably before the death of Justin in 166 A.D. T.'s famous *Diatessaron*, the earliest attempt at a complete Harmony of the Gospels, was one of the lost works. No trace appears in the Apology of the heterodox opinions of T., and it is alleged by Tertullian that it was not till after the death of Justin that he fell into the errors to which he has given a name. He then removed to the east, and is said to have established himself in Mesopotamia. Without entering into the details of T.'s peculiar opinions, it will be enough to say that, especially in their moral aspect, they form the foundation of one of the great divisions of Gnosticism (q. v.). Starting from the common principle of dualism, and of the origin of matter from the evil principle, and its consequent evil nature, T., unlike the Egyptian Gnostics, held the necessity of overcoming the corrupt nature of man, and purifying it by abstinence and ascetic rigor. Accordingly, he reprobated marriage, and condemned all sensual indulgence. One of his 'opinions,' affirming the damnation of Adam, was peculiarly odious to the orthodox party. He condemned the use of wine so strongly as to forbid it even in the celebration of the Eucharist, in which his followers permitted only water to be used, whence they received the name of *Hydroparastatai* (from *hydor*, water, and *paristemi*, I present), and in Latin *Aquarii*. From their generally rigorous ascetism, they were called *Encratites* (from *engkratein* to keep continent). In their dogmatic views as to Docetism, the Demiurge, and Emanations, they differed little from other Gnostics of the Syrian school. See Gnostics, Manichæans, Mysticism.

TATIUS, Achilles, one of the later Alexandrine authors, of whose life absolutely nothing is known. He was formerly thought to have flourished during the 2d or 3d c. A.D.; but as he undoubtedly imitated the style of Heliodorus of Emesa, he cannot be placed earlier than the beginning of the 6th c. (see Novels). Suidas, who calls him Achilles Statius, says that he was originally a pagan, but that he was afterwards converted to Christianity, and rose to be a bishop. If this be true, the romance which has preserved the author's name, *Ta Kata Leukippen kai Kleitophonta* (The Loves of Leucippe and Cleitophon), must have been composed before his conversion, for it is in parts too licentious and too heathenish to be the work of a Christian convert.

TA'TTA (more correctly, **Thatta**), a town of Sinde, on the right bank of the Indus, and at the head of the delta of that river, 64 miles east of Kurrachi. In former times, T. was a most flourishing town, and manufactured fabrics of silk and cotton. The mosque of Shah-Jehan, built of brick, is now falling into decay. The vast cemetery of T. has an area of 6 sq. m., contains, it is calculated, at least a million tombs, and has room for not less than four millions. Pop. of T. about 10,000.

TATTERSALL'S, a celebrated mart for the sale of horses in London, so called from Richard Tattersall, who died in 1795, and who was groom to the second Duke of Kingston. It was established near Hyde Park Corner in 1766, and, on the expiry of a 99 years' lease, in new premises at Brompton, April 1865. The racing subscription-room here is one of the principal rendezvous for patrons of the turf.

TATTOO, in Military life, is the beat of drum and bugle-call sounded at sunset to draw in all stragglers and others on detached duty.

TATTOO'ING, a custom extensively prevalent among savage nations, of marking the skin with figures of various kinds, by means of slight incisions or punctures and a coloring matter. The term is of Polynesian origin, and is said to be derived from a verb *ta*, which signifies to strike. Tattooing is almost universal in the South Sea Islands, except where Christianity and civilization have put an end to it. New Zealanders' heads, exhibiting tattooing, are amongst the curiosities to be seen in museums; and at one time it was very common for the masters of vessels visiting New Zealand to purchase them and bring them home, although there is too much reason to believe that the price paid for them stimulated the feuds of the natives. The tattooing of the New Zealanders and other South Sea Islanders often covers the whole face, and sometimes also the chest, arms, and other parts of the body with elaborate patterns. It is performed in youth, and marks the transition from boyhood to manhood, like the assumption of the *toga virilis* among the ancient Romans. The operation is accompanied with superstitious ceremonies, and is attended with considerable pain, which, of course, is to be endured with manly indifference. An instrument of bone, toothed on the edge, is employed, which is applied to the skin, and stuck with a piece of wood, having first been dipped in a thick mixture made by rubbing down charcoal with a little water. The marks which result are permanent, and appear black on a brown skin; although they are dark blue on the skin of a European. Tattooing is, or has been, practised in almost all parts of the world. It seems to be one of the practises prohibited to the Jews, in Lev. xix. 28, 'Ye shall not make any cuttings in your flesh for the dead, *nor print any marks upon you*,' from which may be inferred its prevalence among the surrounding tribes in the days of Moses, and its connection with their superstitions. The Bedouin Arabs, the Tunguses, and other eastern tribes, and many tribes of American Indians, practise it at the present day. Among the Bedouins, it is a favorite mode of female adornment. It prevailed among the ancient Thracians, and was distinctive of high rank. The ancient Britons also practised it, and traces of it appear to have lingered in England till after the Norman Conquest. Perhaps the practise of sailors to print anchors and other marks on their arms, may be regarded as a relic of it still subsisting.

New Zealand Chief's face tattooed.
(From a Photograph.)

TAU, Cross, in Heraldry, a cross of a form somewhat resembling the Greek letter *Tau*. St. Anthony is generally represented with a cross of this description, embroidered on the left side of his garment

TAUCHNITZ, Karl Christoph Traug, a famous German printer and bookseller, was born at Grosspardau, near Leipzig, in 1761. Bred a printer, he began, in 1796, a small printing business of his own in Leipzig, with which he shortly after conjoined publishing and typefounding, and which, in process of time, became one of the greatest establishments of the kind in Germany. In 1809, he began the issue of a series of editions of the classic authors, the elegance and cheapness of which gave them a European circulation. By offering a prize of a ducat for every error pointed out, he was able to bring out, in 1828, an edition of Homer of extraordinary correctness. He was the first to introduce (1816) stereotyping into Germany; and he also applied it to music, which had not been attempted before. In the latter years of his busy life, he stereotyped the Hebrew Bible, and the Koran in the original Arabic. On his death, in 1836, the business was continued by his son, Karl Christian Phil. Tauchnitz.—A nephew of the elder T., Christian Bernh. Tauchnitz, also set up a publishing establishment in Leipzig, combined with

printing. Among the most noted of his undertakings is the well-known issue of 'British Authors' (begun 1842), of which upwards of 2000 vols. have appeared. Ennobled in 1860, T. was made one of the few Saxon life-peers in 1877.

TAULER, JOHN, a remarkable mystic and preacher, was born at Strasburg in 1290, and died there 16th June 1361. About the year 1308, renouncing a considerable fortune, he entered into the mendicant order of Dominicans, and afterwards studied theology in Paris, showing at that early period a predilection for speculative and mystic writings, as the scholastic philosophy and the prevailing theology of the schools did not satisfy him. Notwithstanding this tendency, his predominating practical turn of mind led him, on his return to Strasburg, to preaching and pastoral duty; and this he continued to practice with zeal and undaunted courage, even when, in consequence of the excommunication which the pope had hurled against the Emperor Ludwig, the country had fallen into a state of dreadful distraction, and almost all the clergy, in obedience to the interdict issued by the Bishop of Strasburg, had suspended worship. Although T. was now 50 years old, and had enjoyed celebrity for several years as a preacher, so powerfully was he influenced by a Waldensian of the name of Nicholas von Basel, who paid him a visit in 1340, that he gave himself up for two years to ascetic exercises and devout contemplation. Afterwards, however, he betook himself more decidedly to vigorous exertions on behalf of the despised and oppressed people, and preached with wonderful power, inveighing against the avarice, ostentation, and hard-heartedness of the laity as well as of the clergy; and, although not departing from the doctrines of the church, yet fearlessly exposing its abuses, and even not sparing the pope. Thus it happened, that although he had indefatigably administered the consolations of religion in the midst of the horrors and desolation of the Black Death (q. v.), the bishop interdicted him from preaching, and he was obliged to quit his native town. He repaired to Cologne; but nothing further is known, either of his residence there or of his return to Strasburg, where, after a life full of toil, denial of self, and beneficence to others, he died, an old man of 70 years, and was buried in his cloister.

If not the greatest German preacher of the middle ages as a whole, T. certainly was the greatest of his times. As his mysticism was in no ways passive, but aimed at rising above the sad condition of his times and the failings of the church by inward piety and a love self-denying but at the same time active; so his style, both in his preaching and in his devotional works, was lively, impressive, picturesque, and had altogether a practical direction. Among his devotional works, the *Nachfolge des armen Lebens Christi* holds the first place. Whether the sacred hymns which bear his name really belong to him, is doubtful. Of his writings and sermons, in which he always used the German language, many have been preserved in MS.; and since 1498, numerous editions have been published, but untrustworthy, and often translated into the dialect of the place where they happened to be printed. A careful translation into new High-German has been published by Schlosser (*Predigten*, 3 vols. Frank. 1826; *Nachfolgung des armen Lebens Christi* (Frank. 1833); Schmidt, *Johannes Tauler von Strasburg* (Hamb. 1841); and Susannah Winkworth, *Life and Times of Tauler*, with 25 of his sermons translated from the German (Lond. and New York, 1857).

TAU'NTON (*Tone-ton*), so named from being built on the banks of the river Tone, is situated in the extensive and beautiful valley of Taunton Dean, or vale of Taunton, in the county of Somerset, 44 miles south-west of Bristol by railway. It communicates by railway with the Bristol and English channels. The streets are wide, well-paved, and lighted; the shops are modern and capacious, but the woollen and silk factories which were once extensive here have almost wholly departed. Assizes are held here twice yearly.

T. is the headquarters of the Somerset Archæological and Natural History Society, in connection with which there is an extensive museum, placed in the ruins of the Norman castle—rich especially in fossils from the Devonian strata, and the bones of mammalia of the cave period from Mendip and the Somersetshire gravels—and a well-conducted reading-room. There is a collegiate school founded by Bishop Fox, 1522, two dissenting colleges, several other good schools, and many charitable and other institutions. T., which is a parliamentary borough, returns two members to the House of Commons. Pop. (1881) 16,611. Ina, king of the West Saxons, built a castle in T. about 700 A.D. This was soon after destroyed, but another fortress was built on the site soon after the Conquest, at which period the town had a mint. In 1127, Giffard, bishop of Winchester, built and endowed a priory for the canons of St. Augustine; and in 1322, we find a house of Carmelite friars. The church of St. Mary is a magnificent specimen of Perpendicular architecture, and is famous for its graceful and delicately ornamented tower. That of St. James was the conventual church of T. Priory. The Shire Hall and the Literary Institution are handsome modern buildings. To T. Castle, Perkin Warbeck fled when he failed in storming Exeter. During the civil wars between Charles and the parliament, the town was twice besieged by Goring, and twice successfully defended by Colonel Blake. In T., Monmouth received the heartiest welcome, and Judge Jeffreys exercised his unbounded cruelty.

TAUNTON, a flourishing city of Bristol county, Massachusetts, U. S., on Taunton River, 35 miles south of Boston, and 30 miles E.N.E. of Providence. The falls of Taunton River and its branches furnish water-power to numerous factories, among which are 6 cotton-mills, 7 for machinery, 2 for locomotives, 6 foundries, 2 tacks and brads, copper and zinc, 2 Britannia ware; iron, metallic gas-pipes, enamelled cloth, screws, files, arms, crucibles, firebrick, &c. In copper manufacture, a capital of about £180,000 is invested; in making iron, which is the chief manufacture, about £400,000. Pop. (1880) 21,213. Several railways pass through T., and it has also a considerable coasting-trade, and important fisheries of shad, herrings, and alewives. There are 19 churches, 60 schools, a state hospital for the insane with 400 patients, academy, court-house, 1 daily and three weekly newspapers, 3 banks, &c. T. was settled from Taunton in England in 1638. Its first minister was William Hooke, afterwards a chaplain of Cromwell.

TAU'NUS MOUNTAINS. See NASSAU.

TAU'RIDA, a government of South Russia, bounded on the E., S., and S.-W. by the Sea of Azov and the Black Sea. Area, 24,140 sq. m.; pop. 878,925, mostly Nogai Tartars. The peninsula of the Crimea (q. v.) forms the southern portion of the government, and is connected with the northern portion by the Isthmus of Perekop (q. v.). The region north of the isthmus is flat; the Crimea contains mountain-ranges which rise upwards of 5000 feet. The only great river is the Dnieper, which forms the north-west boundary; and the other principal streams are the Salgir and Alma in the Crimea. Among the salt lakes of the Crimea, which are very productive in salt, the Lake of Sakky is celebrated for the efficacy of its waters in certain cases of disease. The climate is temperate and warm on the southern shores of the Crimea. The soil is fertile, but cultivation is carried on on a very limited scale. In the north, the pasturage is very rich, and cattle-breeding is the main employment of the inhabitants. In the south, the mountains are clad with forests, the tobacco-plant is successfully cultivated, and fruit-growing and wine-culture are the principal occupations. The Crimean wines, the *bouquet* of which resembles that of Burgundy and the Rhenish wines, are of a very good quality. The native riches of the government, its excellent ports and harbors, promise great commercial progress. Simferopol (q. v.), in the Crimea, is the capital of the government, and Sebastopol (q. v.) and Theodosia are ports of rapidly increasing importance.

TAU'RINE, $C_4H_7NO_3S_2$, is a very remarkable substance occurring in the bile and in other animal products and tissues. In a state of purity, it forms six-sided glistening prisms, which are perfectly transparent, neutral, devoid of odor, readily soluble in hot water, but difficult of solution in cold water, and insoluble in alcohol and ether. It does not enter into combination either with acids or bases. When heated, it undergoes decomposition, and evolves sulphurous acid, in consequence of the sulphur (upwards of 25 per cent.) which it contains. Taurine occurs naturally in the bile of many animals, including man. As a product of the decomposition of the bile, it may be found in the contents of the intestine and in the excrements; and in cases of jaundice it has been found in the blood, transudations, and urine. Its artificial formation has been noticed in the article SYNTHESIS. Its name is derived from the Latin *taurus*, a bull, because taurine was first discovered in the bile of the ox.

TAU'RUS, MOUNT. See ANATOLIA.

TAUTO'G, or BLACKFISH (*Tautoga nigra* or *Americana*), a fish of the family *Labridæ* (q. v.), of the section forming the family *Cyclo-labridæ* of Müller. It is found in the North American seas, and is in great request for the table. It brings a very high price in the New York market. It attains a size of 12 or 14 lbs. Its color is black on the back and sides; the belly is whitish; both jaws have a double row of strong conical teeth; the face is covered with a scaleless integument. The T. is caught by hook and line on rocky bottoms. It is sometimes kept in stews to fatten.

TAUTO'LOGY (Gr. *tauto*, the same, and *logia*, speech) is a term used to denote the useless repetition of the same ideas in different words. It is considered one of the worst vices, whether of oral or written style, and certainly none more effectually robs language of its force and impressiveness.

TA'VERN, a place of entertainment for man and beast, is not a legal term. See INN, PUBLIC HOUSES.

TAVERNIER, JEAN BAPTISTE, BARON D'AUBONNE, a celebrated French traveler, was the son of a Flemish engraver who had settled in Paris, and was born there in 1605. The conversa-

tion of the savants who frequented his father's shop inspired him with an ardent curiosity to visit other countries, and prompted him to leave the parental roof before his 15th year. After visiting England, the Low Countries, Germany, Hungary, and Italy, he eagerly caught at the offer made to him by Father Joseph (the confidant of Richelieu), to accompany two French noblemen to the East. This journey lasted from December 1630 to the summer of 1633, the line of route passing through Regensburg, Dresden, Vienna, Constantinople (where he left his masters), Erzeroum, Tabriz, Ispahan, Bagdad, Aleppo, and Scanderoon, and thence by sea to Rome. T. then obtained an important post in the household of the Duke of Orleans, but received occasional leaves of absence to prosecute his journeys in the East.

The *second journey* (1638—1643) was from Marseille to Scanderoon, thence across Syria to Ispahan, South-western Persia, and Hindustan; the *third* (1643—1649), through Ispahan, much of Hindustan, Batavia, and others of the East Indies; and in the *fourth* (1651—1655), *fifth* (1656—?), and *sixth* (1663—1669), various portions of Persia and Hindustan were visited, the outward route being generally by way of Syria and the Arabian Desert, and the return one by Asia Minor. T. invariably traveled as a dealer in precious stones and other valuable articles of small bulk, and the great profits he realized strongly impressed upon him the advantages of regular commerce between Europe and the East. On his return to France in 1669, he was graciously received at court by Louis XIV., who presented him with 'letters of nobility' in reward for his services to French commerce in India. But his prodigal expenditure and careless generosity speedily reduced his fortune, and the revocation of the Edict of Nantes compelled him to take refuge in Switzerland, whence he removed to Berlin, and became director of an East India Company which was projected by the Elector of Brandenburg. With the view of discovering a road to the Indies through Russia, he set out from Berlin in 1688, but died at Moscow in July 1689. An account of his travels was written for him by various parties (for T. had no literary qualifications), and though full of matter valuable to the historian and geographer, it is so ill-arranged as to be in many cases almost unavailable.

T. was one of the most remarkable of travelers; wholly devoid of classic sentiment, he traversed the plains of Troy, and passed the ruins of Persepolis without even a flutter of interest, and partly owing to this remarkable condition of mind, his statements are distinguished by an accurate truthfulness little common among travelers. But the chief value of his book lies in the fulness and accuracy with which the nature and state of oriental commerce, the chief markets and commercial routes, and the various systems of coinage and their relations are detailed. Some of his statements concerning the conduct of the Dutch in the East Indies called forth a most virulent and abusive reply from Jurieu, the Protestant theologian, in his *L'Esprit de M. Arnauld* (1684), and a more moderate one from Van Quellenburgh; but all T.'s assertions which were of any moment were found to be perfectly correct. His Travels were originally published in 3 vols. (two in 1676—1677, and the third in 1679); they have since been several times republished, last in 1810, in 7 vols.; and have been translated into English (1678, 1684, 2 vols.), Dutch (1682), and German (1684).

TAVI'RA, a seaport town of Portugal, province of Algarve, 20 m. N.-E. of Faros, pleasantly situated at the mouth of the Sequa. T. has decayed considerably since 1654, when, it is said, 40,000 people in the town and environs fell victims to the plague. Pop. (1878) 11,636.

TA'VISTOCK, a parliamentary borough and market-town of Devonshire, picturesquely situated on the western border of Dartmoor, about 35 miles south-west of Exeter, in the fertile valley, and on the right bank, of the Tavy (whence its name), which is here crossed by two bridges within the town. T. is a thriving town, with some small manufactures of serges and woollen cloths, iron-foundries and mining-works, copper, lead, tin, and iron being found in considerable quantity in the neighborhood; but the population is chiefly agricultural. It is a place of considerable antiquity, and was formerly of great importance, owing mainly to its abbey, the largest and most magnificent in Devonshire, which was founded in the year 961, for the Benedictine order, by Ordgar, Earl of Devonshire, father of the infamous Elfrida, and endowed with many privileges, the abbot being a peer of parliament. At the dissolution, when the revenue amounted to upwards of £900, it was bestowed upon John, Lord Russell, in possession of whose descendant, the Duke of Bedford, the property still remains. A printing-press, the second set up in England, was established in the abbey at a very early period. The refectory and abbey gateway still exist in good preservation. The parish church is a handsome edifice, with a tower at the west end, resting on arches, under which there is a thoroughfare. The borough sends one member to the House of Commons. At the breaking out of the Civil War, Pym was member for Tavistock. T. is one of the four stannary towns of the county, and is governed by a port-reeve, elected annually; a county court is held in the town. It is connected with Barnstaple, Launceston, and Plymouth by railway, and with the river Tamar by a short canal. Sir Francis Drake was born in the immediate neighborhood in 1545, and the poet W. Browne in the town in 1590. Pop. (1871) of parliamentary borough, 7725; (1881) 6909.

TAVOY', the chief town of a district in Tenasserim, British Burmah, is situated on the left bank of the Tavoy River, about 30 m. from its mouth, at the distance of about 220 miles south of Moulmein. The site of T., which is low, is enclosed on three sides by rice-fields, and on the fourth by the river. The houses are scarcely visible from the river—umbrageous trees, palms, plantains, jacks, cassias, and hundreds of flowering shrubs, nearly concealing them from view. A wooden-covered pier, supported on piles, forms a convenient landing-place. There is a hospital, a large jail, and a roomy *zayat* or caravansary. The houses are raised from the ground on piles, and are made of bamboo, fastened with rattan, and thatched with the leaf of the water-palm. T. is remarkable for its grand annual buffalo-fight. The sport continues for two days, and during that time eight pair of buffaloes are brought into the field, each animal representing a different district or township. The rice-fields around T. are prolific sources of malaria. Intermittent fevers and dysentery are the most common diseases; but the climate is on the whole healthy. Pop. of T. (1872) 14,467. The bulk of these are true Burmans, the balance being made up with Shans and Thoungthoos, Karens, Chinese, Malays, and natives of India. T. exports rice, sugar, wood-oil, timber, and fruits. The anchorage for large ships is at Goodridge Plains, about 30 miles below the town.—The district of T. has an area of 7200 square miles, and a pop. (1872) of 71,827.

TAX, TAXATION. The proportion in which the various taxes contribute to the revenue of the United Kingdom may be ascertained from the article REVENUE. Distinct from imperial taxation is *local* taxation, locally raised and administered, under the superintendence of the Local Government Board, which was established and first published returns of local taxation in 1870–71. In that year the total amount of local taxation, including rates, tolls and dues, and duties, but excluding money raised by loans, was £21,580,000; in 1879–80 it was £31,043,100. In 1879–80 there was obtained besides £22,879,651, from 'other sources' than taxation, mainly from loans, with a few government grants. The entire local revenue was therefore £53,940,751, to cover a local expenditure of £50,253,007.

The term taxation, as expressing the exaction of money from the individual for the service of the state, is familiar to all mankind a step above barbarism; and yet few subjects are surrounded by a greater number of practical difficulties and theoretical niceties. These may be grouped under two sets of considerations—those which affect the justice of a tax, and those which affect its productiveness, and these two often tell on each other. Taxation, indeed, has so frequently been the means of perpetrating political injustice, that the term has fallen into bad popular repute. Whenever the produce of a tax is used otherwise than in the service of those who pay it, the tax is unjust. In its more oppressive form, it has been levied on conquered states, for the benefit of the conquerors, and in this shape it has sometimes been called tribute. The direction which all constitutional struggles to cleanse taxation from injustice have taken has been that of self-taxation, the community as a whole deciding on what it requires to take from the individual members for the public service. The accomplishment of this has been the chief object of all the struggles which have made a free constitution for the British Empire. There were old feudal dues which the monarchs had the power of exacting; but when these were insufficient for their ambitious projects, they had to ask parliament for a supply, and parliament generally took the opportunity of granting it to demand redress of grievances. It came thus to be a fundamental constitutional doctrine, that no tax can be levied save by the consent of the representatives of the people who have to pay it. The constitutional doctrine thus created by Britain was remembered by the American colonies when Mr. Grenville sought to raise there a stamp-duty and a customs-duty on tea, and the colonies revolted under the celebrated cry that 'Taxation without representation is tyranny!'

It was discovered, in the course of the long struggle of the House of Commons to keep its hold on the purse, that the least afflictive of taxes may be the most dangerous. A fixed land-tax comes, for instance, to be no impost at all, in the afflictive sense of the term. If a thousand a year has been drawn off a certain acreage of land from time immemorial, the proprietors never possessed that part of the rents, and are no more sufferers from not having them than from not possessing their neighbors' estates. A government with a large revenue of this kind, however, will certainly be inimical to freedom. The time when the liberties of England were in the greatest danger was the twelve years of

Charles I.'s reign in which he was able to get on without going to parliament for money. The extravagance of sovereigns who wasted the domains of the crown has generally prevented them from having too formidable an influence by the possession of independent incomes. In Britain, this difficulty has been effectually guarded against, and any of the expenses of the crown which can now be paid without going annually to parliament for a vote of supply are of a very trifling character.

How to make taxation productive, is a vast and complicated practical science. Turgot, one of the wisest of financiers, called it the art of plucking the goose without making it cry. The most ingenious devices to this end, however, have often, in practice, met with counteracting difficulties. It was supposed that indirect taxation—that is, a duty levied on articles before they reach the consumer, must, in a civilized and orderly country, be almost inexhaustible. The merit of the system lay in the consideration, that the burden of the tax did not fall on the person who paid it. Income-tax, house-tax, dog-tax, and the like are levied directly on the person on whom the burden ultimately falls, and if he do not pay, the amount will be taken by force.

Tea-duty, wine-duty, and the like, however, are not levied on the consumer, though he was to pay them; they are levied on the importer, who has no, or a very slight, interest against the tax, since he must charge it on the consumer. But this form of taxation is met by checks. If it is excessive, people will not buy the taxed article; and it has often been found that reducing the duty increases the revenue. An indirect tax on luxuries, and especially on those which may be used to vicious excess, has strong recommendations. In some cases, it is no great calamity should the tax throw the article nearly out of use. But then comes another check in the smuggler, whose profession may probably do more to corrupt and disorganize society than the free use of the article in which he deals. A tax on the necessaries of life, on bread or salt, cannot be evaded, as in the case of luxuries, by the abandonment of use, and therefore it is very productive, but it is also very oppressive. The tax on salt in France was one of the chief causes of the French Revolution. The happiest condition for the revenues of a country is when luxuries are so abundantly used by all classes that a small addition to their price is a slight burden, yet yields a large revenue. In this country, the revenue thus derived from tea, tobacco, and stimulants may be set down in round numbers at 30 millions. The chief taxes which now form the revenue of Britain are—1. Those by old custom called 'assessed,' and levied upon certain items in the possessions and enjoyments of the citizen, as his male-servants, dogs, carriages, and armorial bearings. 2. The property and income tax, which, after long disuse, was renewed in 1842, and is raised from time to time according to the exigences of the government. 3. The customs. 4. The excise. 5. The stamps and post-office; and 6. The land-tax See CUSTOMS DUTIES, EXCISE, POST-OFFICE, STAMPS, LAND-TAX, FINANCE.

TAXA'TION OF COSTS is the checking or reviewing of the charges made by attorneys or solicitors for legal business; and there is an officer of the court provided for the purpose, called in England a master or a taxing-master, or a registrar, according to the nature of the court; in Scotland, he is called an auditor. Solicitors differ from all other professions in this, that they are treated as officers of the court, and they are not at liberty to charge what prices they please for the various services they perform. Hence, every step in a suit has a certain value put upon it by the court, and the business of the taxing-officers is to see that this standard is not transgressed. There are many exceptional matters, however, which arise in every suit, which often cause difficulty in apportioning a proper amount of remuneration, the taxing-officer having a considerable discretion. In consequence of a taxing-officer being provided by the court, it is a right which every client of a solicitor has, if not satisfied with the bill of costs delivered to him, to have it referred to the taxing-officer to be taxed. But in general, this must be done without delay. If the taxing-officer certify that more than one-sixth too much has been charged, then not only is the client not bound to pay the excess, but the expense of the taxation must be borne also by the solicitor; whereas if less than one-sixth is taxed off, the client has to bear the expense of taxation. Not only are the expenses of a suit liable to taxation, but other kinds of miscellaneous business which a solicitor does as a solicitor. It has often of late been made matter of complaint that solicitors are not allowed to fix their own charges, or to agree with clients upon an arbitrary charge, or a charge by commission, the tendency of the present system being to make the solicitor anxious to eke out his remuneration by lengthening the proceedings, so as to make a basis for chargeable items; but the legislature has steadily rejected hitherto all attempts to abolish the check provided by taxation.

TAXEL. See BADGER.

TAXICO'RNÉS, a family of coleopterous insects, of the section *Heteromera*, having the body generally square; the thorax either concealing or receiving the head; the antennæ short; the legs adapted for running. Most of them are found in fungi and beneath the bark of trees. They are widely distributed over the world.

TA'XIDERMY, the art of preparing the skins of animals for the purposes of the naturalist. The chief means employed in preparing the skin for stuffing in the case of small animals is to remove it carefully from the body, and, having cleaned away from it any adherent flesh, &c., to anoint it with arsenical soap; for the making of which there are several formulæ, the following being the most used: arsenic, 1 ounce; white soap, 1 ounce; carbonate of potash, 1 drachm; distilled water, 6 drachms; camphor, 2 drachms. This keeps the skin supple, and prevents decay and the attacks of insects. The larger skins are generally prepared with a composition called Preservation Powder, which is made of the following ingredients: Arsenic and burnt alum, each 1 lb.; powdered oak-bark, 2 lbs.; camphor, ½ lb. These substances are all reduced to a powder, mixed, and passed through a fine sieve. It requires to be carefully kept in well-stoppered bottles or jars, and when used, is thickly sprinkled over the flesh-side of the skin whilst still wet, and must be thoroughly rubbed in. Gloves should always be worn in this process, to prevent danger from the poisonous compound. Some skins are prepared with alum only, and others with the oak-bark liquor of the tanner's pits. This, in the case of very large skins, answers very well.—Besides the mere preparation of the skin, the art of taxidermy is held to mean also the stuffing and mounting of them. This requires much personal experience, and as almost every group of animals must be treated differently, it is impossible to explain the various methods fully in this short notice. Various works have been written upon the subject.

TAY, the largest river in Scotland, draining nearly the whole of Perthshire (q. v.), and pouring into the German Ocean a greater bulk of water than any other British river, has its source in the western part of the county of Perth. The Dochart, the principal feeder of Loch Tay, rises in Ben Lui, on the borders of Argyleshire, and flowing in a north-east direction, is joined by the Lochy, just before the united streams enter the lake. After leaving it, the Tay flows for some distance east-north-east, when turning southwards, it passes, with a very winding course, Dunkeld (q. v.) and Perth (q. v.); about a mile below the latter place, it again changes its direction to east-north-east, widening at the mouth of the Earn (q. v.) into an estuary—the Firth of Tay—which varies from three-fourths of a mile to three miles in breadth, and lies mostly between the counties of Fife and Forfar, joining the German Ocean about ten miles below Dundee (q. v.). From the north and east, the Tay receives the Lyon, the Tummel and Garry, and the Isia; and from the west, the Almond and the Earn; its entire basin comprises an area of about 2500 square miles. The salmon-fishings on the Tay and its tributaries are of considerable value. The Stormontfield ponds for the propagation of salmon are 5 miles above Perth. The tide flows up the river to about a mile above Perth; but the navigation up to Dundee is attended with very great difficulty on account of the numerous and shifting sand-banks. The railway bridge which spanned the estuary, near Dundee, at a point about two miles wide, was destroyed during a violent gale of wind in 1879.

LOCH TAY is a long and narrow lake, picturesquely situated in a basin scooped out of the bosom of the mountains, 355 feet above the sea-level, in length about 15 miles, and average breadth 1 mile, varying from 100 to 600 feet in depth. Ben Lawers (q. v.) lies on its west side. The loch is at times subject to violent and unaccountable agitations.

TAYLOR, BAYARD, an American author and traveler, born at Kennett Square, Chester County, Pennsylvania, January 11, 1825. Having received a common school education, he was apprenticed at 17 in a printing office, when he began his poetical contributions to periodicals. In 1844 he published a volume of poems under the title of *Ximena*, and soon after, started on a pedestrian tour of Europe, and in 1846 published *Views Afoot, or Europe seen with a Knapsack and Staff*. After his return, he edited a country newspaper, then went to New York, and wrote for the *Literary World* and *Tribune*. Of the latter, he became assistant-editor, and as its correspondent, made extensive travels in California and Mexico, recorded in *El Dorado*, or *Adventures in the Path of Empire*, 1850; up the Nile to lat. 12° 30′ N., and in Asia Minor, Syria, across Asia to India, China, and Japan—recorded in his *Journey to Central Africa, Lands of the Saracen*, and *Visit to India, China, Loo-Choo, and Japan* (1853). Later explorations are recorded in *Northern Travel, or Summer and Winter Pictures of Sweden, Denmark, and Lapland* (1856); and *Travels in Greece and Russia, with an Excursion to Crete* (1857). In 1862—1863 he was connected with the embassy at St. Petersburg; and in 1874 he visited Iceland. He resided some years in Germany, and in 1878 was appointed United States ambassador at Berlin, where he died in December 1878. In 1848, he published *Rhimes of Travel, Ballads and other Poems*:

Book of Romances, Lyrics, and Songs (1851); *Poems of the Orient* (1854); *Poems of Home and Travel* (1855); *At Home and Abroad* (1859—1862); *Hannah Thurston*, a novel (1864); *Beauty and the Beast*, and *The Masque of the Gods* (1872); *The Prophet, a Tragedy* (1874); *Home Pastorals*, &c. (1875); *Prince Deukalion*, a drama (1878). He translated *Faust* in 1871, and for the last twelve years of his life was engaged upon a life of Goethe.

TAYLOR, Brook, a celebrated English mathematician, was born at Edmonton, in Middlesex, August 18, 1685, of a Puritan family of good position, entered St. John's College, Cambridge, in 1701, at a time when mathematical science was the prominent pursuit among the learned, took his degree of LL.B. in 1709, became a Fellow of the Royal Society in 1712, and its secretary in 1714, in which latter year he also took the degree of LL.D. Though so young, he had become widely known in Britain and on the continent for great proficiency in mathematical knowledge, and power and versatility of mind, having already written various valuable treatises on capillary action, on the vibration of a string, on music, &c. In 1716, he visited Paris, and was received with warm demonstrations of regard by the French savans, who respected his ability and learning, and the prominent and distinguished part he had taken in the Leibnitzian controversy. On his return to England in 1717, he resumed his habits of severe study, but was forced by declining health to resign the secretaryship in 1718. For the next three years he wandered about, residing now on the continent, now in England. He died, December 29, 1731, at the age of 46. Besides his earlier works above mentioned, he contributed a series of able papers on higher algebra, dynamics, and general physics, published separately his *Methodus Incrementorum* in 1715, and a *Treatise on Linear Perspective*, the first general exposition of this subject, in 1719. During the last ten years of his life, he gave himself up almost entirely to metaphysical and biblical studies. His *Methodus Incrementorum* contains, besides the famous 'theorem' (see Taylor's Theorem), the first germs of the calculus of finite differences, various now common forms of infinitesimal series, with mechanical, physical, and algebraical applications. The chief use made by T. of his theorem is in a paper (1717) entitled 'Method of Approximation to the Roots of Equations.' The results of his investigations may be found in the *Phil. Trans.* (1713—1723), and in his two works above mentioned.

TAYLOR, Isaac, born at Lavenham, in Suffolk, 1787, died at Stanford Rivers, in Essex, 1865, eminent as a Christian philosopher, artist, and mechanician, was the third of his name who attained distinction—his grandfather and father (known as Isaac Taylor of Ongar) being both named Isaac, and each in his way distinguished. Charles Taylor, the editor of *Calmet*, was an uncle, and Jane Taylor (author of the *Q. Q. Papers*) and Ann Taylor (Mrs. Gilbert of Nottingham), joint authors of *Hymns for Infant Minds*, were sisters, of the subject of this article. The literary career of Isaac T. extended over nearly half a century. It began in 1818, in contributions to the *Eclectic Review*, for which Robert Hall, John Foster, and Josiah Conder then wrote, and ended in 1865, in contributions to *Good Words*, in which the name of the veteran figured with those of men who were unborn when he was in the height of his reputation. Between 1822 and 1827, he published *Elements of Thought; Characters of Theophrastus*, with illustrations etched by himself; *The History of the Transmission of Ancient Books to Modern Times. The Process of Historical Proof*, a translation of Herodotus, and the *Memoirs and Correspondence of Jane Taylor*, his sister, who has already been mentioned. In 1829, he published anonymously, *The Natural History of Enthusiasm*, which ran rapidly through several editions; and between 1829 and 1836, he published in succession *Fanaticism, Spiritual Despotism, Saturday Evening*, and *The Physical Theory of Another Life*. In 1836, appeared *Home Education*. Thereafter, he was a long time occupied upon a new translation of Josephus, undertaken jointly with the Rev. Dr. Traill, and which was illustrated by etchings executed by himself. Within the last thirteen years of his life appeared *Loyola, Wesley, The Restoration of Belief, Logic of Theology, Ultimate Civilization*, and *The Spirit of Hebrew Poetry*. Besides these numerous works, Isaac T. wrote many articles for the graver quarterly reviews, which are as yet uncollected. He had been educated as an artist, and some of his designs, executed before he betook himself chiefly to literature, have evoked the warmest praise from the most scrupulous critics, who have wondered how one with such a genius for art could have deserted it. It would be impossible to give here any account that would be intelligible of his numerous mechanical inventions; it must suffice to say, that, by two of his inventions, he revolutionized the art of calico-printing. Isaac T. married in middle life, and had a large family, whose home education, as liberal-minded but pious Christians, was among, and not one of the least of, the tasks of his life.

TAYLOR, The Rev. Isaac, M.A., vicar of Holy Trinity, Twickenham, and eldest son of the preceding, was born at Stanford Rivers, March 3, 1829. He is the author of *The Liturgy and the Dissenters*, and one or two other theological pamphlets; but has best maintained the literary distinction of his family by his works on philology. His *Words and Places, or Etymological Illustrations of History, Ethnology, and Geography* (1864), of which a second edition, revised and enlarged, was published in 1865, is a work of great research as well as erudition, and has done more towards the elucidation of the local names of English places than any book yet published. In *Etruscan Researches* (1874), T. tries to prove that the Etrurians were allied to the Turkish or Mongolian races. This proposition, however, is not well established, and the work has received severe handling from critics, especially from Prof. Max Müller. In 1876 T. published *The Etruscan Language*.

TAYLOR, Jeremy, one of the greatest names in the English Church, was the son of a Cambridge barber, and was born in that town, August 15, 1613. At the age of 13, he entered Caius College as a sizar, and after seven years' strenuous and brilliant study in classics and theology, took the degree of M.A. Like Archbishop Usher, he was admitted to holy orders before he had reached his 21st year. Soon after he attracted the notice of Laud (who had a regard for learning, if none for liberty), and was preferred by him to a fellowship at All Souls, Oxford (1636). About the same time, he was appointed chaplain in ordinary to the king; and in 1638, rector of Uppingham, a preferment which he retained till the successes of the Parliamentarians deprived him of it. The first notable publication of T.'s was a defence of the church, entitled *Episcopacy asserted* (Oxford, 1642). It procured for him the honor of D.D.

During the next three years, T. probably accompanied the royal army; but when fortune had unmistakably declared against the king, he withdrew into Wales (1645—1646), and, in conjunction with Mr. W. Wyatt of St. John's College, Oxford, opened a school at Newton, in Caermarthenshire. It appears to have been a pretty successful adventure, and many of his scholars, we are told, 'having, as it were, received instruction from this prophet in the wilderness, were transplanted to the universities.' T. also found a patron in the Earl of Carbery, who was then living at the family seat of Golden Grove, in the same county, and who appointed him his domestic chaplain. But if this period of T.'s life had become to the outward eye obscure and mean, it is rendered illustrious by the splendor of his literary achievements. Between 1647 and 1660, the long 13 years of his enforced seclusion, appeared all his great works, and remembering their unsurpassed merits, we are almost disposed to feel grateful to those who expelled him from his rectory, and drove him to strictly literary pursuits. In 1647, was published the *Liberty of Prophesying*, a work written on behalf of the clergy of the Church of England, who were being expelled from their livings by the victorious Puritans, but in which the pleadings are based on principles far more comprehensive and tolerant than the age was disposed to acknowledge; in 1650, the *Life of Christ* (2 vols.), one of the most popular of his productions, and *The Rule and Exercises of Holy Living;* in 1651, *The Rule and Exercises of Holy Dying*, a portion of his *Sermons*, and the *Discourse of the Divine Institution, Necessity, and Sacredness of the Office Ministerial;* in 1652, a *Discourse on Baptism, its Institution, and Efficacy upon all Believers;* in 1653, 25 additional *Sermons;* in 1654, *The Real Presence and Spiritual of Christ in the Blessed Sacrament;* in 1655, *The Guide of Infant Devotion, or the Golden Grove*, and the *Unum Necessarium, or the Doctrine and Practice of Repentance*, a decidedly Pelagian treatise, which involved him in a considerable controversy; in 1657, a *Collection of Polemical and Moral Discourses*, a *Discourse on Friendship*, &c.; and in 1660, his famous *Ductor Dubitantium, or the Rule of Conscience in all her General Measures*, the most learned, subtle, and curious of all T.'s works. It was dedicated to Charles II. T. was a stanch royalist, a splendid scholar, a consummate theologian, and a man of wonderful literary genius, and so it was in the nature of things almost impossible that he should escape preferment.

Before 1660 had expired, he was elevated to the bishopric of Down and Connor, a dignity which he only retained some seven years, dying August 13, 1667. T. was not happy in his Irish see. Before a year was over, he was anxious to be delivered from it as from 'a place of torment.' The Scotch Presbyterian ministers were 'incendiaries'—they robbed him of the 'people's hearts;' they even 'threatened to murder' him; his only hope was in the government and the military. Altogether, it is a melancholy spectacle to behold the finest ecclesiastical genius of the time half broken-hearted by petty squabbles with intolerable fanatics, who had, nevertheless, in the points at issue between them and T., something like justice on their side. No modern mind would hesitate for an instant to acknowledge that the Scotch-Irish Presbyterian clergy were perfectly entitled to act as they did, and yet we fear it is too plain that the good bishop would have gladly seen them prohibited by an Episcopalian soldiery. Nay, the author of the *Liberty of Prophesying* went a step further; and on one occasion, only three months after his consecration, actually deposed 36 Presbyterian ministers occupying livings which the Restoration

had inconsiderately and tyrannically declared to be Episcopalian. Some very interesting information in regard to this all but unknown period of T.'s life is to be found in *Notes and Queries* (November 11, 1865).

T., sometimes styled the modern Chrysostom (q. v.), on account of his golden eloquence, has no equal in the whole series of ecclesiastical writers for richness of fancy. All other divines —patristic, medieval, and modern—show poor and meagre beside him in this respect. Some are more logical, or penetrating, or profound; some grasp more clearly the spiritual significance of doctrine, or display a deeper knowledge of human nature; but T. ranks among the first men of his age in point of learning, subtlety of argument, elevation of devout feeling, and philosophic largeness of view, while his inexhaustible imagery, shining 'like the glossy purples of a dove's neck,' and full of all tender and pathetic beauty, reminds us of Spenser and Shakspeare, of Sidney and Fletcher, rather than of the sombre order of theologians.—The best edition of T.'s works is by the Rev. C. P. Eden, M.A., Fellow of Oriel College, Oxford (10 vols., London, 1854).

TAYLOR, ZACHARY, twelfth President of the United States, was born in Orange County, Virginia, November 24, 1784, son of Colonel Richard Taylor, an officer of the War of Independence, and one of the first settlers of Louisville, Kentucky, where T. was taken in early childhood, and grew up to his 24th year, working on a plantation, with only the simplest rudiments of education. His elder brother had received a lieutenancy in the army, and died in 1808, when T. was appointed to the vacant commission. In 1810, he was promoted to a captaincy; and in 1812, with 50 men, two-thirds of whom were ill of fever, he defended Fort Harrison, on the Wabash, against a large force of Indians led by the famous chief Tecumseh. Promoted to the rank of major for his gallantry, he was employed during the war in fighting the Indian allies of Great Britain. In 1822, he built Fort Jesup; in 1832, he served as colonel in the Black Hawk War; and in 1836, was ordered to Florida, where he gained an important victory over the Seminole Indians at Okechobee, for which he was appointed brigadier-general, and made commander of the United States forces in Florida. In 1840, having been appointed to the command of the south-western department, he purchased an estate at Baton Rouge, Louisiana. On March 1, 1845, the United States Congress passed the resolution for the annexation of Texas, formerly a province of Mexico, and for some time an independent republic. Texas claimed the Rio Grande for her south-western boundary; Mexico insisted that there could be no claim beyond the Nueces, and prepared to defend the disputed, if she could not reconquer the whole, territory. General T. was ordered to Corpus Christi, which point he occupied in November with a force of 4000. On March 8, 1846, he moved towards the Rio Grande, across the disputed territory, and built Fort Brown, opposite and commanding the Mexican port of Matamoras. General Ampudia, the Mexican commander, demanded that he should retire beyond the Nueces, pending negotiations; and on the refusal of General T., his successor, General Arista, crossed the Rio Grande with a force of 6000. On May 8, he was defeated at Palo Alto by General T., with a force of 2300; and a few days after, driven from a new position at Resaca de la Palma across the Rio Grande.

War was declared by Congress to exist by the act of Mexico; 50,000 volunteers were called for, T. made major-general, reinforced, and ordered to invade Mexico. On September 9, with 6625 men, he attacked Monterey, which was defended by about 10,000 regular troops. After 10 days' siege and 3 days' hard fighting, it capitulated. General Scott having been ordered to advance on the city of Mexico by Vera Cruz, withdrew a portion of the troops of General T., leaving him only 5000 volunteers and 500 regulars, chiefly flying artillery, to meet an army of 21,000 commanded by President Santa Anna. He took a strong position at Buena Vista, fought a desperate battle, and won a decided victory. This victory, against enormous odds, created the utmost enthusiasm; and General T., popularly called 'Old Rough and Ready,' was nominated for President of the United States over Henry Clay, Daniel Webster, and General Scott; and this 'ignorant frontier colonel, who had not voted for forty years,' and was a slaveholder, was triumphantly elected, over General Cass, the democratic, and Martin Van Buren and Charles Francis Adams, free-soil candidates. Entering upon the presidency in 1849, he found a democratic majority in Congress, with a small but vigorous free-soil party holding the balance of power, while the most exciting questions connected with the extension of slavery, as the admission of California, the settlement of the boundaries of Texas, the organization of the newly-acquired Mexican territories, &c., were agitating the country, and threatening a disruption, postponed by the compromises introduced by Mr. Clay. Worn down by the unaccustomed turmoil of politics, the rough, good-natured old soldier did not long enjoy his honors. On July 4, 1850, sixteen months after his inauguration, he was attacked with bilious cholic, and died on the 9th.

TAYLOR'S THEOREM, so called from its discoverer, Dr. Brook Taylor (q. v.), is a general method for the algebraic development of a function of a quantity, x, in powers of its increment h, and may be thus briefly explained and illustrated. Let $f(x+h)$ denote *any* function of $x+h$ (subject to the limitations below), then $f(x+h) = f(x) + f'(x)\frac{h}{1}+f''(x)\frac{h^2}{1.2}+f'''(x)\frac{h^3}{1.2.3}+\ldots$, where $f(x)$ is the same function of x, as $f(x+h)$ is of $x+h$, and $f'(x), f''(x)$, &c., are the first, second, &c., differential coefficients of $f(x)$. By a supplementary theorem, due to Lagrange, who was the first to appreciate to the full the value of Taylor's discovery, it was shown that the sum of all the terms of the series after n terms, could be represented by $f^n(x+\theta h)\frac{h^n}{1.2\ldots n}\ldots$, where θ is some positive fraction less than unity. The theorem supposes that between certain limits indicated by $h=o$, and $h=$ some finite quantity, neither $f(x)$ nor any of its derived functions vanish, or all of them do not become infinite; and the cases in which these conditions are not satisfied are often spoken of as instances of the 'failure of Taylor's theorem.'

An important particular case of this theorem, known as *Maclaurin's*, or (more properly) *Stirling's Theorem*, was independently discovered; it is that case of the general theorem in which the various functions of x are made functions of zero, and is written $f(o+h) = f(o) + f'(o)h + f''(o)\frac{h^2}{1.2}+$, &c. The best illustrations of these theorems are the binomial, exponential, logarithmic, and circular series; thus, if the function be $(x+h)^n$, then $f(x) = x^n, f'(x) = nx^{n-1}, f''(x) = n(n-1)x^{n-2}$, &c.; and by substitution of these values we obtain Newton's *binomial* theorem; if the function be a^{x+h}, Taylor's series gives us as its equivalent $a^x(1 + h \cdot \log. a + \frac{h^2}{1.2}(\log. a)^2 + \ldots.)$; and Maclaurin's gives $a^h = 1 + h \cdot \log. a + \frac{h^2}{1.2}(\log. a)^2 + \ldots.$, which latter is the *exponential* theorem, and may be obtained from Taylor's series by division; if the function be $\log.(1+x+h)$, ($\log. x+h$ being one of the cases in which Taylor's theorem fails), then Maclaurin's series gives the *logarithmic* theorem, $\log.(1+h) = h - \frac{h^2}{2}+\frac{h^3}{3}-$, &c.; and the same theorem gives the various series expressing the values of sin. h, cos. h, sin. ^{-1}h, &c. &c.

The history of this celebrated theorem is remarkable. On the first publication of the *Methodus Incrementorum*, it was entirely neglected by Leibnitz, who, in ignorance of its value, severely criticised the whole work; while the bitter hostility of John Bernouilli to British men of science, blinded him to the existence of any merit in any part of the work. The theorem never appeared in any of the works on the calculus published before D'Alembert's *Recherches*, and after that, was given only in the French *Encyclopædia;* but neither D'Alembert nor Condorcet seems to have known that it was Taylor's, or to have fully appreciated its importance; and it was not till Lagrange, in the *Berlin Memoirs* for 1772, gave the name of its true author, and proposed to make it the foundation of the differential calculus, that it assumed that important position which it deserved to hold.

TCHAD, or TSAD, LAKE, a large lake in Sudan, Northern Africa, lat. 12° 30′—14° 30′ N., long. 13°—15° 30′ E. Its size varies with the time of year; it has an area of 10,000 sq. miles in the dry season, and is sometimes four or five times as large in the rainy months. According to Rohlfs, it is 1150 feet above sea-level. The shores are low, and for the most part unattractive; and a strip of swampy ground surrounds the fine open sheet of water which is the actual T., and the margin of which is lined by papyrus and tall reeds, of from 10 to 14 feet in height. Its depth in ordinary years is from 8 to 15 feet, but in some years the waters rise much higher; and of the islands, of which there are many densely peopled, only the more elevated afford shelter to the inhabitants. River-horses and crocodiles swarm in the lake and fish and water-fowl are abundant. There are several affluents. From the west, the large river Yaobe enters the lake; and from the south, the Shari, which in its lower course is upwards of 1800 feet broad. Lake T., whose waters are perfectly fresh, has no regular outlet. But Dr. Nachtigal has proved that it sometimes overflows towards a great depressed plain lying 300 miles to the north-east.

TCHELYUSKIN, CAPE, the northernmost point of Asia. It was rounded by Nordenskjöld and his party in 1878, and found by them to be in lat. 77° 41′ N. It used to be called Cape Severo.

TCHERKA'SI, a town of Russia, in the gov. of Kiev, 100 miles south-east of the town of Kiev, on the Dnieper. Pop. (1880) 14,000.

TCHERKA'SK, STAROI (Old Teherkask), a town of South Russia, formerly the capital of the Don Cossacks, stands on the right bank of the Don, 12 miles south of Novotcherkask, the present capital. Pop. 15,000.

TEA (*Thea*), a genus of shrubs of the natural order *Ternstræmiaceæ*, very nearly allied to the genus *Camellia* (q. v.), and distinguished from it only by the not deciduous calyx, and by the dissepiments remaining connected in the center of the capsule after it opens. The genus seems to derive its importance entirely from a single species, the dried leaves of which are the tea of commerce, one of the most important articles of commerce in the world, and yielding the most esteemed and extensively used of all non-alcoholic beverages. This species, the tea shrub or CHINESE TEA (*T. Sinensis*), is 20—30 feet high, but in a state of cultivation only 5—6 feet high, with numerous branches and lanceolate leaves, which are 2—6 inches long. The flowers grow singly or two or three together in the axils of the leaves; they are rather large, white, and fragrant, with 5-parted calyx, 6—9 petals, and many stamens. By cultivation for many centuries, numerous varieties of this plant have been produced in China, some of which have been reckoned as distinct species, particularly *T. viridis*, formerly supposed to yield green tea, *T. Bohea*, formerly supposed to yield black tea, and *T. stricta*. Of these, the first-named has the longest, and the last has the shortest leaves. The Assam Tea, which has been called *T. Assamensis*, appears also to be a mere variety of the same species.

Tea Plant (*Thea Sinensis*).

The cultivation of tea in China is chiefly confined to the regions between N. lat. 24°—35° and E. long. 115°—122°. Tea for domestic use is, however, cultivated both in more southern and more northern regions. The plant is to be accounted subtropical, but bears a tropical climate well, and can also accommodate itself to cold winters. In the neighborhood of London it often endures all the frost of winter without protection. In few of the countries into which it has been introduced, however, is the flavor of the dried leaf such as it is in China. The use of tea is said to have been introduced into China itself from the Corea about the 4th c. of the Christian era, and to have extended to Japan about the 9th century. The Chinese cultivate it chiefly on the southern slopes of hills. A new plantation is made by sowing the seed in holes at proper distances, two or three seeds being put into a hole to secure a plant. The first crop is obtained in the third year, when the shrub is by no means full-grown. When about seven years old, it yields only a scanty crop of hard leaves, and is cut down, when new shoots rise from the root, and bear fine leaves in abundance. This is repeated from time to time, till the plant dies at about the age of thirty years.

History and Commerce.—All that can be affirmed regarding the early history of this beverage is, that it appears to have been used for ages in China, where it is believed by the natives to be indigenous. It first became known to Europeans at the end of the 16th c., though it is only mentioned by the Portuguese writer Maffei in his *Historiæ Indicæ*, who refers to it as a product both of China and Japan. The first reference to it by a native of Britain is in a letter dated 27th June 1615, written by a Mr. Wickham, which is in the records of the East India Company; and it is curious to observe that both the Portuguese and English writers referred to use their own rendering of the native name, which is *tcha*. Maffei calls it *chia*, and Mr. Wickham, *chaw*. From this time, it became gradually known to the wealthy inhabitants of London, in the form of occasional presents of small quantities from India, obtained from China, or by small lots in the markets from time to time, but always exorbitantly dear, fetching sometimes as much as £10 the lb., and never less than £5.

A rather large consignment was, however, received in 1657; this fell into the hands of a thriving London merchant, Mr. Thomas Garraway, who established a house for selling the prepared beverage; and that house, under the name of 'Garraway's Coffee-house,' is still a famous establishment in that city. From 1660 until 1689, a duty was levied on the drink made with tea at the rate of 8*d*. per gallon; but from the latter date a duty of 5*s*. per lb., with an addition of 5 per cent. *ad valorem*, was levied. For many years, the duties, although occasionally changed, were always very high, and were levied by both the Customs and the Excise. The expiration in 1833 of the charter of the East India Company, which had held a complete monopoly of the tea-trade, produced a change; the *ad valorem* duty was abolished, and differential duties of 1*s*. 6*d*., 2*s*. 2*d*., and 3*s*. per lb. were substituted; but they worked badly, and were abandoned in 1836 for one uniform rate of 2*s*. 1*d*. per lb., to which, in 1840, was added an additional 5 per cent. From that time to the present, several changes, always reductions, have taken place, until now, when the duty is only 6*d*. per lb. The import for the year 1875 was nearly 200,000,000 lbs., value about £14,167,000; the import for 1876 was 185,668,190 lbs., value £12,812,832; for 1880, 206,971,000 lbs., value £11,613,398.

Much mystery and error for a long time existed upon the subject of the species producing the tea of commerce. By many it was said that the qualities known as black teas were produced by the species known to botanists as *Thea Bohea*, and the green teas from *T. viridis*. Others held that only one species was used to make both the black and green varieties, and that the difference arose from the method and time of preparation.

The eminent botanical traveler, Mr. Robert Fortune, has, however, entirely set the question at rest by investigating the matter on the spot. He found that in the Canton district, where black teas alone are prepared, only the *T. Bohea* is grown; whilst in the province of Che-kiang only *T. viridis* is grown, and green teas made. But the cultivation of the latter plant he also found to be absolutely universal in the Fokien district, although the inhabitants make only black teas. The tea-farms are mostly in the north of China, and are usually of small size, and require much attention; for the plant will only thrive in well-matured or very rich soil, and the spaces between the plants, which are four feet apart, must be kept in good order, and free from weeds. The farms always occupy the hill-sides, where the soil is deep and well drained. Although an evergreen, the leaves can only be gathered at certain seasons: the first is in April, when the new leaves begin to burst from the buds; and some of these in their most tender state are gathered and made into young hyson of the finest quality; so fine, indeed, that it has rarely been brought to England, because it is said to lose flavor by the sea-voyage. Much is, however, sent overland to Russia, where it fetches an exorbitant price. The ordinary picking begins just after the summer rains are over, at the beginning of May; and later in the season, a third picking takes place, the produce of which is inferior, and used only by the poorer classes of the country. The later gatherings are more bitter and woody than the earlier, and yield less soluble matter to water. The leaves, when freshly plucked, possess nothing of the odor or flavor of the dried leaves, these properties being developed by the roasting which the leaves undergo in the process of drying. Moreover, different qualities of tea are prepared from the same leaves, which may be made to yield green or black teas at will.

For a description of the processes for obtaining the green and the black teas, we refer to Fortune's *Tea Countries of China*, Johnston's *Chemistry of Common Life*, and Money's *Cultivation and Manufacture of Tea* (3d ed. 1879). It is sufficient here to remark, *first*, that, in the process of drying, the leaves are roasted and scorched in such a way as necessarily to induce many chemical changes in them; the result of such changes being to produce the varieties of flavor, odor, and taste by which the different kinds of teas are distinguished; and *secondly*, that the different colors of green and black teas are due to the mode in which the leaves are treated. For *green teas*, the leaves are roasted in pans almost immediately after they are gathered. After about five minutes' roasting, during which they make a cracking noise, become moist and flaccid, and give out a good deal of vapor, they are placed on the rolling-table, and rolled with the hands. They are then returned to the pans, and kept in motion by the hands: in about an hour, or rather more, they are well dried, and their color, which is a dull green, but becomes brighter afterwards, has become *fixed*. The essential part of the whole operation is now over, nothing more being required than to sift and re-fire it. For *black teas*, the leaves are allowed to be spread out in the air for some time after they are gathered; they are then further tossed about till they become flaccid; they are next roasted for a few minutes, and rolled, after which they are exposed to the air for a few hours in a soft and moist state; and lastly, they are dried slowly over charcoal fires, till the black color is fairly brought out. Hence the dark color and distinguishing flavor of black teas seem due to the long exposure to the atmosphere in the process of drying, and the oxygen of the air acting rapidly upon the juices of the leaf, and especially upon the astringent principle during this exposure. For the purpose of giving special scents to different varieties of tea, numerous odoriferous plants are employed in different parts of China; the cowslip-colored blossoms of the sweet-scented olive (*Olea fragrans*) communicate an especially fragrant scent to tea.

The adulteration of tea, when the duty was very high, was

probably carried on to a great extent, but notwithstanding the terrible tales of alarmists, it may be asserted that very little adulteration of tea is now carried on in Great Britain. In China, spurious teas have been prepared and sent to this country under the name of 'Lie teas,' but they had no sale, and of course were discontinued. The Chinese give an artificial coloring to the green teas sent to Europe because it pleases the eye, but the coloring matter is very innocuous, and is never produced by heating over copper plates—a popular error, which has been persisted in for a long time without a shadow of truth for its foundation. Prussian blue in very minute proportion, and a species of native indigo and gypsum, are the real materials employed for giving the face, as it is called.

In 1836, the culture of tea was attempted on a large scale in India, under the direction of the able and indefatigable botanists, Dr. Royle and Dr. Falconer; and after some difficulty, a good supply of plants was introduced to the districts of Kumaon and Gurhwal, and in the meantime plantations formed at an earlier period in Assam were making great progress. From these sources a steadily increasing supply is received, the value of which in 1880 was £3,072,922. The quality, too, is superior to many of the Chinese teas, a fact which is testified by the large quantity of Indian teas now used. Japan and Java export tea to Australia. In the Brazilian high lands, tea of most excellent quality is produced in large quantities. A little has of late been grown in New Zealand and in Sicily, near Messina.

The varieties of tea are very numerous; the following are those found in the shops of Great Britain:

GREEN TEAS.—*Chinese:* (1) Gunpowder sorts—viz., Shanghae, Ping-Suey or Pin's Head, Moyune, Imperial Moyune, and Canton; (2) Hyson sorts—viz., Shanghae, Shanghae young, Moyune, Moyune young, Canton young, and Twankay or Imperial Hyson. *Japanese:* Gunpowder and Young Hyson. *Java:* Gunpowder.

BLACK TEAS.—*Chinese:* (1) Congo sorts—viz. Canton, Foochow-foo, Hung-muey, Oopack, Kaison, and Oonam; (2) Pekoe sorts—viz., Plain Orange, Foo-chow, Scented Orange, Canton Scented Orange, and Flowery Pekoe, Oolong, and Souchong. *Assam:* Congo, Orange Pekoe, and Souchong. *Java:* Congo and Imperial. The latter is made up into little balls about the size of a pea, and is rather rare.

The use of the infusion of the leaves of tea as a beverage is general in the south-eastern parts of Asia, and has become prevalent also amongst the British—at home, and in all their colonies—the Americans, and the Dutch. In Scandinavia, tea is also much used by all who can afford it. In other parts of Europe, the use of tea is much less general, and is chiefly confined to maritime districts, towns, and the wealthy. The importation of tea overland through Russia is inconsiderable, and the sea trade is chiefly to Britain and North America.

The *substitutes* for tea, in countries where it is difficult to obtain it, are of two sorts: those which contain theine, and which consequently have the same stimulating effect; and those which are destitute of that principle, and only resemble the true tea in flavor or smell, or which possess some other stimulating principle. Of the former class are—(1) Maté (q. v.): (2) Guarana (q. v.); so rich is this material in theine that it has lately been used in this country for obtaining that principle; and it has been introduced into Austria and France as a powerful medicine: (3) Coffee-leaves, which are occasionally prepared as a substitute in the West Indies; they would be more generally used were it not for the disagreeable smell of the infusion: (4) the Kola-nut, the active principle of which was some years ago ascertained to be theine.*

The second class, or those which do not possess that principle, are very numerous; but only a few can be said to be of any importance from being in general use in the countries producing them. These are the Siberian tea—leaves of *Saxifraga crassifolia;* the Appalachian tea—leaves of *Prinos glabra;* the Labrador tea—leaves of *Ledum buxifolium;* the Chilian tea—leaves of *Eugenia ugni;* Trinidad pimento tea—leaves of *Eugenia pimenta;* and the leaves of the Patridge-berry, which are used in some parts of North America. The Faham tea of Mauritius, and a great many more, should be regarded in the light of medicines, rather than as ordinary beverages; although they are generally classed with the substitutes for ordinary tea.

Tea, in its Chemical, Physiological, and Medicinal Relations.—On submitting the ordinary commercial tea* to analysis, we find that it contains (1) a volatile or essential oil; (2) theine or caffeine, described in this work under the latter name; (3) a nitrogenous compound analogous to caseine or gluten; (4) a modification of tannin; besides gum, sugar, starch, fat, woody fibre, salts, &c. *The volatile oil* gives to tea its peculiar aroma and flavor. The proportion in which it exists is, according to Miller, about 0·79 per cent. in green, and 0·6 per cent. in black tea. It may be obtained by distilling the tea with water, and is found to exert a most powerfully stimulating and intoxicating effect.

In China, tea is seldom used till it is a year old, on account of the well-known intoxicating effects of new tea, due probably to the larger proportion of essential oil which it usually contains. The headache and giddiness of which tea-tasters complain, and the attacks of paralysis to which, after a few years, persons employed in packing tea are found to be liable, are due to the action of this oil, which, according to Johnston, 'does not exist in the natural leaf, but is produced during the process of drying and roasting.'—*Chemistry of Common Life*, vol. i.

The theine or *caffeine*, an alkaloid of weak basic properties, varies considerably in different kinds of tea. Peligot found it to range from 2·2 to 4·1 per cent. in ordinary green teas, while very rarely it amounted to 6 per cent.; whereas from the researches of Stenhouse it appears that not more than 2 per cent. is usually contained in the ordinary teas in the English market. It may readily be obtained by the following simple experiment. When dry finely-powdered tea-leaves, or a dried watery extract of the leaves, are put on a watch-glass covered with a paper cone, and the whole is placed upon a hot plate, or exposed to the heat of a spirit-lamp, a white vapor gradually rises and condenses on the interior of the cone, in the form of small crystals, which consist of theine. As it has no odor, and only a slightly bitter taste, it obviously has little to do with the taste or flavor of the tea from which it is extracted; it is, however, to the presence of this ingredient that the peculiar physiological action of tea on the animal economy is due. This substance is represented by the formula $C_{16}H_{10}N_4O_4 + 2Aq$, and is remarkable for the large quantity of nitrogen (28·83 per cent.) which it contains; and which is nearly double the amount contained in albumen, fibrine, &c. It is also remarkable as occurring in plants very unlike each other, and growing in remote countries, which have by instinct been selected by different nations for the purpose of yielding a slightly exciting and very refreshing beverage (see above).

From numerous experiments, it appears that the introduction into the stomach of a small quantity of theine (such as three or four grains, which is the quantity contained in about one-third of an ounce of good tea) has the remarkable effect of diminishing the daily waste or disintegration of the bodily tissues, which may be measured by the amount of solid constituents contained in the urinary secretion. And if the waste be lessened, the necessity for food to repair that waste will obviously be diminished in an equal proportion. 'In other words,' says Professor Johnston, 'by the consumption of a certain quantity of tea, the health and strength of the body will be maintained in an equal degree upon a smaller supply of ordinary food. Tea therefore saves food—stands to a certain extent in the place of food—while at the same time it soothes the body, and enlivens the mind.'—*Op. cit.*, p. 173. It should, however, be stated, that the generally accepted view, that

* Dr. Daniell's observations on the kola-nut (see the article COLA NUT, Vol. II.) are of such importance as to demand a notice here. From time immemorial, the seeds of the kola-nut have been held in inestimable value as a luxury by the inhabitants of the vast tract between the west coast and the region of Central Africa known as Sudan; and the trade in these nuts has extended to various markets on the Mediterranean. The Portuguese, Dutch, and subsequently the English voyagers, fell into the negro predilections for this fruit; and eventually the due gratification of this want became a matter of imperative necessity. Dr. Daniell's knowledge of the tonic and astringent properties of these nuts was gained during his residence on the Gold Coast, where the white inhabitants were in the habit of taking a decoction of the fresh nuts, with apparent benefit, in a particular form of endemic diarrhœa, arising more from local relaxation of the mucous membranes than from constitutional debility. On taking the medicine late, two evenings in succession, when he was afterwards suffering from an attack of this kind in Jamaica, he found that he was deprived of sleep during the remainder of the night. On intermitting the decoction, the natural rest returned, and on returning to it, the insomnia again occurred. Hence, he was led to suspect that a substance analogous to theine must be present; and a chemical analysis of the nuts yielded crystals in all respects resembling those of theine, and subsequently proved by the more careful investigations of Dr. Atfield to be composed of that alkaloid. Wherever the slave-trade prevailed, the tree yielding the kola-nut (*Cola acuminata* of Robert Brown) followed as a matter of necessity, being imported and cultivated for the benefit of the negro. It was thus introduced into the Mauritius, Jamaica, and other West India Islands, Brazil, Mexico, &c. It was specially intended to act in warding off the predisposition to epidemic outbreaks of suicidal mania, which not unfrequently almost depopulated considerable districts. While Dr. Daniell's experiments disprove the statement (alluded to in the article COLA-NUT) that these seeds render bad water palatable, his investigations, confirmed as they are by Dr. Atfield's chemical analysis, show, that whatever may be their food-value (which Dr. Daniell estimates higher, from his observations, than Dr. Atfield from their analysis), they may be advantageously substituted for coffee. See the papers by Dr. Daniell, 'On the Kola-nut of Tropical West Africa,' and by Dr. Atfield, 'On the Food-value of the Kola-nut,' in the *Pharmaceutical Journal* for March 1865.

* The following comparative analyses of tea, coffee, and the dry kola-nut are interesting, as showing how nearly they contain the same organic constituents, although in different proportions:

	100 Parts of Tea contain	100 Parts of Coffee contain	100 Parts of Kola-nuts contain
Water	8	12	13·65
Theine	3	1·75	2·13
Caseine	15	13	6·33
Gum	18	9	10·67
Sugar	3	6·5	
Starch	a trace	a trace	42·00
Tannin	26·25	4	...
Aromatic oil	0·75	0·002	1·52
Fat	4	12	
Fibre	20	35	20·00
Mineral substances	5	6·7	3·20

theine checks the destruction of the tissues, has been recently called in question by an excellent experimental observer, Dr. Edward Smith, in various Memoirs published in the *Philosophical Transactions* and elsewhere. If double the above quantity of theine (or of the tea containing it) be taken, there is a general excitement of the circulation, the heart beating more strongly, and the pulse becoming more rapid; tremblings also come on, and there is a constant desire to relieve the bladder. At the same time, the imagination is excited, the mind begins to wander, visions appear, and a peculiar kind of intoxication comes on; the symptoms finally terminating, after a prolonged vigil, in a sleep arising from exhaustion. It is not definitely known what changes theine undergoes in the animal economy, but when oxidized artificially, it becomes decomposed into methylamine or methylia (C_2H_3,H_2N), hydrocyanic acid (C_2N), and amalic acid ($C_{12}H_7N_3O_8$).

The *nitrogenous compound* allied to caseine or gluten constitutes about 15 per cent. of the weight of the leaf. As hot water extracts very little of this substance, a large quantity of this nutritious matter, which forms about 28 per cent of the dried spent leaves, is thrown away. Much of it might be dissolved if a little carbonate of soda were added to the boiling water with which the tea is made; and in the brick-tea (the refuse and decayed leaves and twigs, pressed into moulds) used by the Tartars, most of this substance is utilized. They reduce the tea to powder, and boil it with the alkaline water of the steppes, to which salt and fat have been added, and of this decoction they drink from 20 to 40 cups a day, mixing it first with milk, butter, and a little roasted meal. But without the meal, mixed only with a little milk, they can subsist for weeks on this thin fluid food. To the *astringent principle*, or *tannin*, which forms from 13 to 18 per cent. of the dried leaf, tea owes its astringent taste, its constipating effect upon the bowels, and its property of communicating an ink-like color to water containing salts of iron. Whether this ingredient contributes in any degree to the exhilarating, satisfying, or narcotic action of tea, is not known. Professor Johnston thinks it probable that it does exert an exhilarating effect, from the fact, that a species of tannin is the principal ingredient of the Indian betel-nut, which, when chewed, produces a mild and agreeable form of intoxication.

It is usual to judge of the quality of a tea by its aroma, and by the flavor and color of the infusion which it yields; but to these tests should be added the determination of the amount of soluble matter which it readily yields to boiling water. It is stated by Miller that our ordinary tea contains about 45 per cent. of soluble matter; but the independent researches of Davy and Peligot show that boiling water seldom extracts more than one-third of the weight of the dry tea; while in J. Lehmann's experiments, only one-sixth (15·5 per cent.) was extracted. Good tea should, moreover, not yield more than 5 or 6 per cent. of ash when incinerated; and a portion of this is probably due to the coloring matter which the Chinese add to the green teas prepared for the foreign market. For this purpose, they used to employ a mixture of Prussian blue and gypsum, but indigo is now commonly used, which is probably harmless.

Drinkers of green tea who wish to know which of these adulterations they are swallowing, may easily determine the point by the following simple experiment. 'If a portion of the tea be shaken with cold water, and thrown upon a bit of thin muslin, the fine coloring matter will pass through the muslin, and settle to the bottom of the water. When the water is poured off, the blue matter may be treated with chlorine, or a solution of chloride of lime. If it is bleached, it is indigo; if potash makes it brown, and afterwards a few drops of sulphuric acid make it blue again, it is Prussian blue.'—Johnston, *op. cit.*

Much has been written regarding the dietetic and medical uses of tea. While some physicians have over-praised its value, others have regarded it as the source of numerous diseases, especially of the nervous system. In his admirable work on *Hygiene*, Dr. Parkes remarks that 'tea seems to have a decidedly stimulative and restorative action on the nervous system, which is perhaps aided by the warmth of the infusion. No depression follows this. The pulse is a little quickened. The amount of pulmonary carbonic acid is, according to Dr. E. Smith, increased. The action of the skin is increased; that of the bowels lessened. The kidney excretion is little affected; perhaps the urea is a little lessened, but this is uncertain, the evidence with regard to the urine being very contradictory.' Dr. E. Smith considers that 'tea promotes all vital actions.' Dr. Parkes regards it as a most useful article of diet for soldiers, and it is well known that cold tea is frequently preferred to beer or cider by sportsmen, reapers, and others engaged in laborious work in hot weather. As a general rule, tea is very prejudicial to young children, and is not a suitable drink till growth is completed; and adults of an irritable constitution, or a leuco-phlegmatic temperament, often suffer from its use.

Those with whom tea does not agree, will generally find cocoa the best substitute. Old and infirm persons usually derive more benefit and personal comfort from tea than from any other corresponding beverage. In fevers, tea, in the form of a cold weak infusion, is often of great service. In persons of a gouty and rheumatic tendency, and especially in such as are of the *Lithic Acid Diathesis* (q. v.), weak tea, taken without sugar, and with very little milk, is the best form of ordinary drink. In some forms of diseased heart, tea proves a useful sedative, while in other cases it is positively injurious; and a cup of strong green tea, especially if taken without sugar or milk, will often remove a severe nervous headache. It is nearly as powerful an antidote in cases of opium-poisoning as coffee; and very strong tea has been the means of preserving life, in cases of poisoning by tartar emetic, the tannin being in these cases the active agent. It is impossible to speak too strongly against the habit occasionally adopted by students of keeping off their natural sleep by the frequent use of strong tea. Such a habit is certain to lead to the destruction of both bodily and mental vigor. See Money, *The Cultivation and Manufacture of Tea* (3d. ed. 1879).

TEAK, the name of two kinds of timber, valuable for ship-building and other purposes, one of which is known as INDIAN T., and the other as AFRICAN TEAK. The trees which produce them belong to very different orders. INDIAN T. (*Tectona grandis*) is a tree of the natural order *Verbenaceæ*. It is found in the mountainous parts of Malabar, and elsewhere in Hindustan, and in the Eastern Peninsula, Ceylon, Java, &c. It has been introduced in some parts of India, in which it is not indigenous.

Dr. Roxburgh introduced it in the low grounds of the Circars as early as 1790. It has been planted in some parts of Ceylon, but not yet with much result, as it takes 60 or 80 years to grow to a large size. It is a beautiful tree, attaining a height sometimes even of 200 feet, and rising above all the other trees of the East Indian forests. It has deciduous oval leaves of 12—24 inches long, covered with rough points; great panicles of white flowers, with 5—6-cleft corollo, and 4-celled drupes about the size of a hazelnut. Its flowers are used medicinally in cases of retention of urine, and its leaves by the Malays in cholera. Silk and cotton stuffs are dyed purple by the leaves. The timber is the most valuable produced in the East Indies; it is light and easily worked, strong, durable, and not liable to the attacks of insects. It abounds in silex, and resembles coarse mahogany. It is extensively used for ship-building, for which purpose it is imported into Britain. All the finest ships built in India, and many built in England, are of teak. The most extensive T. forests are in Pegu. The T. generally rather grows in clumps in forests than forms forests of itself.—AFRICAN T., sometimes called AFRICAN OAK, is a timber similar to East Indian teak. It is now believed to be the produce of *Oldfieldia Africana*, a tree of the natural order *Euphorbiaceæ;* but the leaves of many different trees have been brought to botanists as those of the African teak.

Indian Teak (*Tectona grandis*).

TEAL (*Querquedula*), a genus of ducks (*Anatidæ*) with very slightly lobed hind-toe, narrow bill, as long as the head, the sides

Common Teal (*Querquedula crecca*), male and female.

nearly parallel, or widening a little at the end, the wings pointed, the tail moderately large, and wedge-shaped. Some naturalists divide the genus into two—*Nettion*, in which the bill has parallel

sides, and a small nail at the tip; and *Querquedula* in which it is widened, and has a larger nail. The species are numerous, the smallest of the ducks, and widely distributed over the world. They generally frequent rivers and lakes, feeding principally at night on aquatic insects, worms, molluscs, seeds, &c. The COMMON T. (*Q. or N. crecca*) is plentiful in Britain and in most parts of Europe. It is occasionally but rarely seen in North America. Its whole length is about 14 inches. It is a very beautiful bird; the head of the male brownish red, the body transversely undulated with dusky lines, a white line above, and another beneath the eye, the speculum black and green. It makes its nest on the margins of lakes or rivers, of decayed vegetable matter lined with down, and lays eight or ten eggs. Its flesh is extremely delicate. It was domesticated by the ancient Romans, and seems capable of being advantageously introduced into our poultry-yards.—The GARGANEY (q. v.) is another British species.—The GREEN-WINGED T. (*Q.* or *N. Carolinensis*) of North America is very similar to the Common T., but it is at once distinguished by a white crescent in front of the bend of the wings. It is occasionally seen in Europe. In its summer migrations, it visits very northern regions.—The BLUE-WINGED T. (*Q. discors*) is very abundant in many parts of North America. It is rather larger than the Common Teal. It is easily domesticated.

TEAR-PITS. See DEER.

TEA'SEL (*Dipsacus*), a genus of plants of the natural order *Dipsaceæ* or *Dipsacaceæ*. This order consists of herbaceous and half-shrubby exogenous plants, with opposite or whorled leaves, and flowers in heads or whorls, surrounded by a many-leaved involucre. About 150 species are known, natives of the temperate parts of the Old World. In the genus *Dipsacus*, the flowers are separated from each other by long, stiff, prickle-pointed bracts. The only valuable species of the order is the FULLER'S T., or CLOTHIER'S T. (*D. fullonum*), a native of the south of Europe,

Fuller's Teasel (*Dipsacus fullonum*).

naturalized in some parts of England. It is a biennial, several feet high, with sessile serrated leaves, the stem and leaves prickly; and with cylindrical heads of pale or white flowers, between which are oblong, acuminated, rigid bracts, hooked at the point. The heads are cut off when the plant is in flower, and are used in woollen factories, and by fullers and stocking-makers, for raising the nap on cloth. No mechanical contrivance has yet been found to equal T. for this purpose; to which the hooked points, the rigidity, and the elasticity of the bracts are admirably adapted. The heads of T. are fixed on the circumference of a wheel or cylinder, which is made to revolve against the surface of the cloth. T. is cultivated in many parts of Europe, and is imported into Britain from Holland and France. It is cultivated to some extent in England, particularly in Somersetshire and Yorkshire. The seed is sown in March, on well-prepared strong rich land, and the plants thinned out to a foot apart. In August of the second year, the heads are ready to be cut. They are packed in bundles of 25 each, and about 160 such bundles are the usual produce of an acre. The flowers of T. abound in honey, and the seeds are used for feeding poultry. The root was formerly in use as a diuretic and sudorific.

TE'CHNICAL EDUCATION (Gr. *techné*, art) is education in applied art and applied science, and comprehends scientific and artistic instruction combined with practical training in industries and trades. This subject has only of late years received much attention in this country, public sense of its importance having been stimulated by comparisons drawn between the manufactures of Great Britain and those of other countries shown in the great international exhibitions held in London, Paris, Vienna, and Philadelphia.

The Exhibition of 1851 showed the industrial art of Great Britain at a very low standard, very far below that of the Queen Anne period, when Flaxman designed for Wedgwood. At that time (the time of the first London Exhibition, and, indeed, throughout the first half of the present century), when an art-workman was needed in England, he had to be fetched from Paris, and at a date no further back than living memory, no lace-manufacturer at Nottingham dreamt of employing an English designer. Since 1851, technical education has been prosecuted with ever-increasing zeal on the Continent, threatening to overtake, and in some instances surpass, England in industries which had hitherto been deemed peculiarly and pre-eminently her own. The first grant made by the government of this country, expressly in aid of art-training among the classes practically engaged in industries and manufactures, was in 1836, when £1500 was granted to the Board of Trade, who administered the increasing annual grant down to 1854, when the trust devolved on the Science and Art Department. This latter body have since that date organized local technical committees in places wanting or demanding instruction in science or art; have established schools of their own throughout the country; and by means of prizes, payment on results to certified teachers of ordinary elementary schools, and scholarships, have efficiently subsidized instruction in science and art in the kingdom.

The subjects of examination, upwards of 20 in number, include the ordinary branches of science, as also mining, metallurgy, navigation, nautical astronomy, steam, agriculture, and physiography; and the examinations are conducted annually all over the country, the questions being framed by a staff of eminent scientific men; the main center of the whole machinery being at South Kensington. In 1862, the Science and Art Department spent on this object £12,000; in 1871, £30,000; in 1877, £62,000; and in 1881, £70,000. The persons receiving art-instruction in elementary schools numbered in 1857, 30,000; in 1862, 71,000; in 1871, 166,000; in 1877, 541,000; in 1881, 850,000. Of provincial and national schools of art there were in 1852, 11,000; in 1863, 13,000; in 1871, 21,000; in 1877, 29,000; and in 1881, 32,000. Among the colleges subsidized by the Science and Art Department, may be mentioned Owens College, Manchester; Sir Josiah Mason's College, Birmingham; and Firth College, Sheffield.

The Government School of Mines and Metropolitan School of Science applied to Mining and the Arts was organized anew in 1881 under the title of the 'Normal School of Science and Royal School of Mines.' Its primary purpose is the instruction of teachers and of students of the industrial classes selected by competition in the science schools of the United Kingdom. Through the exhibitions attached to the yearly examinations of the Science and Art Department, this institution places a training in science within the reach of promising students in all parts of the country. The instruction comprises chemistry, biology, geology, agriculture, metallurgy, and mining.

It must be borne in mind that the instruction of the Science and Art Department is exclusively theoretical, and thus only indirectly infuses the principles of science and art into the industries and trades of our country.

In 1878, a number of the city guilds of London associated to promote or organize, or, it might even be said, initiate technological education proper, an association which has since been joined by successively more of the city guilds, and latterly by the corporation. In November of that year (1878) was provisionally constituted 'The City and Guilds of London Institute for the Advancement of Technical Education.' 22 of the Livery Companies, including 9 out of the 12 great guilds, are represented on the Council of the Institute, and jointly contribute £21,000 annually to its funds. At first the Association limited its functions to subsidizing technical education in schools and colleges in London; University and King's Colleges, London, in particular, receiving grants towards the support of professorships of Technical Science and Art. Latterly, the Institute has planted schools of its own for technical instruction, and has assisted in the development of technical education in a large and ever-increasing number of towns throughout the land. At Kennington, it has established a South London Technical Art School, where to an ever-augmenting number of pupils, likely soon to require additional accommodation, lectures and practical instruction, both in day and evening classes, are given in modelling, design, wood-engraving, and china-painting. For several years past, the City and Guilds of London Institute has with most marked success been conducting in class-rooms in the middle-class school, Cowper Street, London, technical classes for the instruction of artisans in applied chemistry and applied physics. In 1881, these classes counted 422 students, mostly artisans.

In May 1881, the foundation-stone of a great technical college

was laid in Tabernacle Row, 'Finsbury College,' estimated to cost £27,000, and expected to be finished, and wholly or at least partially open for classes by the autumn of 1883. This college, large and commodious, which will be fully equipped with all appliances, is intended to discharge 'the functions of a finishing school for those entering industrial life at a comparatively early age; of a supplemental school for those already engaged in the factory or workshop; and of a school preparatory to the Central Institution.' Its four departments are: (1) Mathematical and Mechanical; (2) Physical; (3) Chemical; (4) Applied Art. At the head is the principal or superintendent of studies. Over each department is a professor, assisted by demonstrators. There are, in addition, lecturers and teachers in special subjects. Skilled artisans, moreover, will be employed in the workshops by way of guidance to the students. Examinations in technology, initiated by the Society of Arts, having been taken over by the City and Guilds of London Institute in 1879, have provoked efforts in different parts of the country to establish and equip local technical schools. At Manchester, Preston, Dewsbury, Hawick, Sheffield, Leicester, &c., schools are being organized to instruct artisans and others in the application of science and art to particular industries. At Nottingham, £500 (with an annual grant of £300 for a limited time) has been given by the Institute towards establishing technical classes there in connection with the University College; and Manchester has been promised by it £300 a year towards the conversion of the Mechanics' Institute there into a technical school. The following table shows the rapid development both in area and bulk of the technical examinations conducted under the auspices of the City and Guilds of London Institute:

TECHNOLOGICAL EXAMINATIONS.

Year.	Number of Centers.	Number of subjects of examination.	Number of Candidates.	Number of Candidates who passed.
1879	23	7	202	151
1880	85	24	816	515
1881	115	28	1563	895
1882	147	37	1972	1222

To crown the whole, the head guardians of technical education in the United Kingdom have taken in hand the building, establishment, and equipment of a great Central Institution at South Kensington, on a valuable site leased at a nominal rental for 999 years by the Commissioners for the Exhibition of 1851. The foundation-stone of this building—the estimated cost of which was £75,000, mostly already subscribed and guaranteed—was laid in July 1881; and the whole edifice will, it is anticipated, be finished towards the end of 1884. It will be fully furnished with laboratories on the most complete scale, with workshops, lecture-theaters, and class-rooms. It is designed to supply a professional training to sons of manufacturers hitherto compelled to pursue their studies abroad, and to complete the training of artisans who have won distinction in branch or provincial colleges, and who, by scholarships from the Institute, or by the aid of their home colleges, or local societies, or of public-spirited individuals, are enabled to avail themselves of the finishing instruction in the Central Institution. Lastly, this college is intended to train a competent body of technical teachers, of whom the country is at present so much in want, to diffuse to the remotest parts of the land the highest theoretical and practical knowledge of the crafts and industries.

A royal commission, appointed in 1880, and on which the City and Guilds of London Institute was represented by Professor Roscoe and Mr. Philip Magnus, instituted inquiries into the comparative state of the manufactures, trades, &c. of this country and the Continent.

The certificates awarded by the Institute on examination are diplomas of both theoretical and practical efficiency in the subjects for which they are given. Candidates for the Institute's full technological certificate must have passed the Society and Art Department's examinations in two specified subjects in the elementary stage; and for the Institute's full technological certificate with honors (required of technical teachers), two specified subjects in the advanced stage.

The results of all this popular education in art and in technology, directly and indirectly, are already most patent and gratifying. No Nottingham manufacturer need any longer seek a designer on the Continent, but is able, with home skill, to hold his own aggressively against any lace-manufacturer in the world. At the Paris Exhibition in 1878, the French saw themselves outstripped by the English in the production of some art-manufactures. The development of artistic taste in England has caused a great increase in our export trade.

We have thus established among us a widespread and rapidly-extending system of education, already in near prospect universally national, which addresses the immediate wants and capacities of even the lowest stratum of society. This education is of more immediate benefit, and more immediately and widely intelligible and applicable, than any book-learning; it ennobles with an intellectual and artistic character the common day-labor of the nation, and puts the lowest section of the people into vital communication with its science and æsthetics. Giving, so far, free scope to all men to achieve, each for himself, that place in the national organization which is his by inward title, this system, moreover, directly tends to raise the material status and well-being of our country. The elementary schools are subsidized on one hand to teach pure science and art under the guidance and aid of the Science and Art Department; on the other hand, to teach scientifically, artistically, and practically, the useful arts, industries, and trades of the country, under the head superintendence of the City and Guilds of London Institute. The more promising pupils, again, are by means of prizes and scholarships enabled to prosecute their studies at colleges in London and elsewhere, and to complete their technical education in the Central Institutions. Finally, the students receive diplomas of their attainments, diplomas which will pass muster all over the land.

That a practicable career is now brought home to the lowliest laborer's son in the country, and that the poorest day-drudge may in this way become the executor of the nation's wisdom and taste: what an incalculable boon is implied in that alone! It will not do, however, for Britain to relax her efforts in this direction if she is to hold her own with the Continent. The Continent is making, and has long been making, much greater exertions than ourselves in the cause of technical education. In Paris, gratuitous instruction in art is offered to all workmen employed in certain trades. In 1881, the municipality of Paris spent £32,000 for this purpose, and last year still more—altogether, spent double the amount on educating its 1,900,000 inhabitants which London spent on its 4 millions. The Technical School of the Ecole Centrale, in Paris, is about to be removed to the neighborhood of the celebrated *Conservatoire des Arts et Métiers*, and the cost of the new building, according to the plans already approved, is to be 6 million francs, or nearly £240,000. All over France, art and technical shools are supported by the government and the several municipalities. At Liege, in Belgium, again, 6000 young men are engaged every night in the art and science schools. Switzerland and Germany are equally active, and equally lavish of expenditure in this direction.

Among the most successful of the older art institutions are the Watt Institution (School of Arts) at Endinburgh, and Anderson's College at Glasgow. The former was established in 1821, and for more than 30 years the principal subjects taught were mathematics, natural philosophy, chemistry, and mechanical drawing. Within the last 20 years other subjects have been added, and the total number of students is now between 1000 and 1500 annually. The evening courses of Anderson's College, where much the same subjects are taught, are likewise very largely attended by artisans.

The Journal of the Society of Arts, the Reports of the Science and Art Department, and the Reports of Select Committee and the Royal Commission above referred to contain much interesting information on this ubject.

TECHNO'LOGY (Gr. *techne*, art) is the name given to the science or systematic knowledge of the industrial arts. In its widest sense, it would embrace the whole field of industry, but it is restricted in usage to the more important manufactures (spinning, weaving, metallurgy, brewing, &c.). Technology is not an independent science, having a set of doctrines of its own, but consists of applications of the principles established in the various physical sciences (chemistry, mechanics, mineralogy, &c.) to manufacturing processes. A complete course of instruction in technology could only be of the most superficial kind. The essential preparation for any branch of the manufacturing arts is the study of the fundamental physical sciences which are taught in schools and universities; and the special applications to the branch which the student has to pursue professionally can be best be learned from special treatises on the subject in connection with practice in a manufacturing establishment. A general knowledge, however, of the arts of manufacture is interesting and instructive to all, and hence the museums of industry recently established by the British government, and yet in their infancy, promise to be of great benefit to the public in general, as well as to the manufacturer. See TECHNICAL EDUCATION.

TECTIBRANCHIA'TA, an order of gasteropodous molluscs, having the gills arranged only on one side, resembling pinnatifid leaves, and covered by the mantle and a small shell. The T. feed mostly on sea-weeds, but some of them also eat animal substances. To this order belongs the Sea-hare of the Mediterranean (*Aplysia depilans*), which is sometimes a foot in length, and was in former times an object of superstitious dread, on account of its

grotesque form, and of a violet-colored fluid which it ejects from the inner surface of the mantle when molested, and which was supposed to be poisonous.

TE DEUM (*Te Deum laudamus, Te Dominum confitemur*), a well-known hymn (so called from its first words) of the Roman Catholic Church, sung on all occasions of triumph and thanksgiving, and a theme upon which the most celebrated composers have from time immemorial exercised their musical genius. The hymn is one of the most simple, and at the same time the most solemn and majestic in the whole range of the hymnology of the Roman Catholic Church. Its authorship is uncertain. An ancient chronicle (long posterior, however, to the supposed date of the composition of this hymn, and otherwise destitute of authority) describes the Te Deum as the joint production of Sts. Ambrose and Augustine, into which they both burst forth by a common inspiration on occasion of the baptism of Augustine. From this supposed origin, the Te Deum is commonly called the Ambrosian Hymn. It is ascribed by other authorities to Hilary of Poitiers, but is most probably considerably later. Besides its general use on occasions of joyous celebrations, the Te Deum forms part of the daily 'Matins' of the Roman Breviary, and is recited at the end of 'Matins' on all festivals, and on all Sundays except those of Advent and Lent, to which, as being seasons of penance, the Te Deum is considered inappropriate. Its use is very ancient. It is universally admired by Protestants as well as Roman Catholics, and exhibits none of the peculiarities of Roman Catholic theology.

FEEL-SEED. See OILS and RAM-TIL.

TEES, a river in the north of England, is 90 miles long, flows east, forming the boundary between the counties of Durham (q. v.) and York (q. v.), and falls into the North Sea, ten miles below Stockton, to which town it is navigable for vessels of 60 tons burden.

TEETH, THE. A tooth is described by Professor Owen, a very high authority on this subject, as 'a hard body attached to the mouth or commencement of the alimentary canal, partially exposed when developed. Calcified teeth are peculiar to the vertebrates, and may be defined as bodies primarily, if not permanently, distinct from the skeleton, consisting of a cellular and tubular basis of animal matter containing earthly particles, a fluid, and a vascular pulp.'—*The Anatomy of Vertebrates*, 1866, vol. i. p. 359. 'They present,' says the same writer, 'many varieties as to number, size, form, structure, position, and mode of attachment, but are principally adapted for seizing, tearing, dividing, pounding, or grinding the food.* In some species, they are modified to serve as formidable weapons of offence and defence; in others, as aids in locomotion, means of anchorage, instruments for uprooting or cutting down trees, or for transport and working of building materials. They are characteristic of age and sex; and in man they have secondary relations, subservient to beauty and to speech. Teeth are always intimately related to the food and habits of the animal, and are therefore highly interesting to the physiologists; they form, for the same reason, important guides to the naturalist in the classification of animals.'—*Circle of the Sciences; Organic Nature*, vol. i. p. 264.

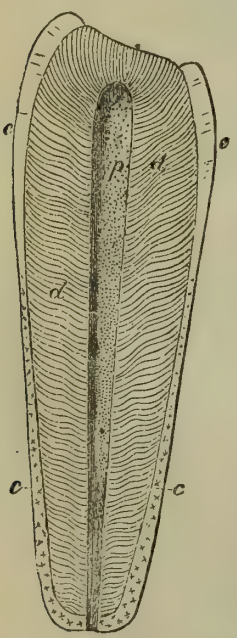


Fig. 1.—Section of Human Incisor Tooth, magnified.
c, c, the cement; *d, d*, the dentine; *e, e*, the enamel, partly chipped off on the crown; *p*, the pulp-cavity.

True teeth consist of one, two, or more tissues, differing in their chemical composition and in their microscopical appearances. 'Dentine,' which forms the body of the tooth, and 'cement,' which forms its outer crust, are always present; the third tissue, the 'enamel,' when present, being situated between the dentine and cement. The *dentine*, which is divided by Professor Owen into hard or true dentine, vaso-dentine, and osteo-dentine, consists, according to that physiologist, of an organized animal basis, disposed in the form of extremely minute tubes and cells, and of earthy particles; these earthy or calcareous particles being either blended with the animal matter of the interspaces and walls of the tubes and cells, or contained in a minutely divided state in their cavities. The tubes and cells contain, besides the calcareous particles, a colorless fluid, which is probably transuded blood plasma, or *liquor sanguinis*, and contributes to the nutrition of the dentine. In hard or true dentine, the *dentinal tubes* proceed from the hollow of the tooth known as the *pulp cavity*, in a slightly wavy course, nearly at right angles to the outer surface (see fig. 1). 'The hard substance of the tooth is thus arranged in hollow columns, perpendicular to the plane of pressure, and a certain elasticity results from these curves; they are upright where the grinding surface of the crown receives the appulse of the opposing tooth, and are horizontal where they have to resist the pressure of contiguous teeth. The tubuli, besides fulfilling the mechanical ends above stated, receive the plasma transuded from the remains of the vascular pulp, which circulates by anastomosing branches of the tubuli through the dentine, maintaining a sufficient, though languid vitality of the system.

'The delicate nerve-branches on the pulp's surface, some minute production of which may penetrate the tubuli, convey sensations of impressions affecting the dentine—sensations of which every one has experienced the acuteness, when decay has affected the dentine, or when mechanical or chemical stimuli have "set the tooth on edge;" but true dentine has no canals large enough to admit capillary vessels with the red particles of blood.† When a part of the primitive vascular pulp from which the dentine is developed, remains permanently uncalcified, red blood is carried by 'vascular canals' into the substance of the tissue. Such dentine is called *vaso-dentine*, and is often combined with true dentine in the same tooth, as, for example, in the large incisors of certain rodents, the tusks of the elephant, and the molars of the extinct megatherium. Another modification of the dentine is when the cellular basis is arranged in concentric layers around the vascular canals, and contains 'radiated cells,' like those of bone: this is termed *osteo-dentine*, and resembles true bone very closely. The *cement* always corresponds in texture with the osseous tissue of the same animal, and wherever it occurs in sufficient thickness, as on the teeth of the horse or ox, it is traversed like bone by vascular canals. Moreover, when the osseous tissue contains minute radiated cells, precisely similar cells are likewise present in the canal, and constitute its most marked characteristic. The relative densities of dentine and cement vary according to the amount of earthy matter. In the complex grinders of the elephant and some other animals, the cement, which forms nearly half the mass of the tooth, wears down sooner than the dentine. The *enamel* is the hardest of all the animal tissues, and contains no less than 96·4 per cent. of earthy matter (mainly phosphate of lime), while dentine contains only 72 per cent., and cement and ordinary bone only 69 per cent. of earthy matter. The earthy matter is contained in comparatively wide canals, composed of animal membrane of extreme tenuity.

In tracing the teeth upwards from their simplest to their most complicated forms, we find a very few examples (solely among fishes—as, for example, the wrasse), in which teeth consist of a single tissue—a very hard kind of non-vascular dentine. Teeth

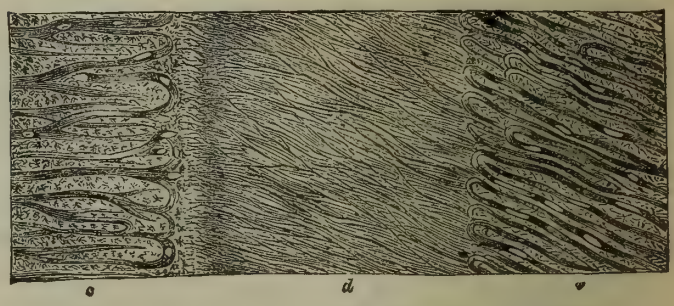


Fig. 2.—Magnified Section of a Molar Tooth of the Megatherium.
v, vaso-dentine; *d*, dentine; *c*, cement.

consisting of dentine and vaso-dentine are very common in fishes, the hard dentine being external, and performing the office of enamel. Dentine and cement, the latter forming a thick outer layer, constitute the grinding teeth of the dugong. In the teeth of the sloth, the hard dentine is reduced to a thin layer, and the chief bulk of the tooth consists of vaso-dentine internally, and a thick crust of cement externally. 'The human teeth and those of the carnivorous mammals appear at first sight to be composed of dentine and enamel only; but their crowns are originally, and their fangs are always covered by a thin coat of cement. There is also commonly a small central tract of osteo-dentine in old teeth. The teeth called compound or complex in *Mammalia* differ as regards their composition from the preceding only by the different proportion and disposition of the constituent tissues. Fig. 3 is a longitudinal section of the incisor of a horse; *d* is the dentine, *e*, the enamel, and *c*, the cement, a layer of which is reflected into the deep central depression of the crown; *s* indicates the colored mass of tartar and particles of food which

* Hence the division of the teeth into incisors, or cutting teeth; molars, or grinding teeth; &c.

fills up the cavity, forming the "mark" of the horse dealer.'—*Organic Nature*, vol. i. p. 267. Far more complex forms of teeth than this may be produced by peculiar arrangements, chiefly inflections, of the tissues.

Fig. 3.—Longitudinal Section of the Incisor of a Horse.

Certain fishes, and a family of gigantic extinct batrachians, to which Owen has, from this remarkable peculiarity, given the name *Labyrinthodons* (q. v.), exhibit this kind of complexity in a remarkable degree. Another kind of complication is produced by an aggregation of many simple teeth into a single mass. These compound teeth are most common in fishes, but are occasionally met with in mammals. The teeth of the Cape ant-eater (*Orycteropus*), depicted and described by Owen in *The Circle of the Sciences*, are of this kind, each tooth being composed of a congeries of long and slender prismatic denticles of dentine, which are cemented together. In the elephant, the compound molars belong to this class, the denticles being in the form of plates vertical to the grinding surface, and transverse to the long diameter of the tooth. When the tooth is bisected vertically and longitudinally, the three substances, dentine, *d*, cement, *c*, and enamel, *e*, are seen blended together (see fig. 4).

Our limited space forbids our entering into any details regarding the teeth of *fishes*, further than to remark, that, in regard to their

Fig. 4.—Longitudinal Section of part of an Elephant's Grinder.

c, the cement; *d*, the dentine; *e*, the enamel; *p*, the common pulp-cavity; *r*, one of the roots of this complex tooth.

number, form, substance, structure, situation, or mode of attachment, they offer a greater and more striking series of varieties than do those of any other class of animals. In all fishes, the teeth are shed and renewed, not once only, as in mammals, but frequently during the whole course of their lives; and, as Professor Owen observes, 'this endless succession and decadence of the teeth, together with the vast numbers in which they often coexist in the same fish, illustrate the law of vegetation or irrelative repetition, as it manifests itself on the first introduction of new organs in the animal kingdom.' While comparatively few fishes are entirely devoid of teeth, we find that in the class of *Reptiles*, the whole order of *Chelonia* (tortoises and turtles), the family of toads (*Bufonidæ* in the order *Batrachia*), and certain extinct genera of *Sauria* (lizards), are toothless. Frogs have teeth in the upper, but not in the lower jaw. Newts and salamanders have teeth in both jaws and upon the palate; and teeth are found on the palate as well as on the jaws of most serpents.

In most lizards, and in crocodiles, the teeth are confined to the jaws. The teeth in reptiles are for the most part simple, of a conical form, and adapted, as in the case of most fishes, for seizing and holding, but not for dividing or masticating the food. In no reptile does the base of the tooth branch into fangs; and, as a general rule, the base of the tooth is anchylosed to the bone which supports it. The completion of a tooth is soon followed by preparation for its removal and succession, the faculty of developing new tooth-germs being apparently unlimited in this class. For further details regarding the teeth of fishes and reptiles, the reader is referred to Professor Owen's invaluable *Anatomy of the Vertebrates*, 1866, vol. i. pp. 359—409. Birds having no teeth, we proceed to the consideration of the dental system of *mammals*—a class which includes a few genera and species that are devoid of teeth. The true Ant-eaters (*Myrmecophaga*), the Pangolins or Scaly Ant-eaters (*Manis*), and the Spiny Monotrematous Ant-eater (*Echidna*), are strictly toothless. The Ornithorhynchus has horny teeth, and the Whales (*Balæna* and *Balænoptera*) have transitory teeth, succeeded in the upper jaw by whalebone. The female Narwhal exhibits nothing more than the germs of two teeth in the substance of the upper jaw; in the male, one of these germs becomes developed into the remarkable weapon which specially characterizes the animal, and to which its generic term, *Monodon* (single tooth), is due. In the Great Bottle-nose Whale, in the adult state, there are only two teeth (here occurring in the lower jaw); whence the name *Hyperoödon bidens*. The elephant has never more than one entire molar, or parts of two, in use on each side of the upper and lower jaws; to which are added two tusks, which are modified incisors, more or less developed, in the upper jaw. Some rodents have 2 grinders on each side of both jaws, which, added to the 4 cutting-teeth, in front, make 12 in all; but the common number of teeth in this order is 20, although Hares and Rabbits have 28 each.

The number of teeth, 32, which characterizes man, the apes of the old world, and the true ruminants, is the average one of the class Mammalia; but according to Professor Owen, 'the typical number is 44.' 'I have been led,' he observes, 'chiefly by the state of the dentition in most of the early forms of both carnivorous and herbivorous mammalia which flourished during the eocene tertiary periods, to regard 3 incisors, 1 canine, and 7 succeeding teeth on each side of both jaws, as the type-formula of diphyodont* dentition.'—*On the Classification and Geographical Distribution of the Mammalia*, 1859, p. 18. A few of the Monophyodonts possess from 80 to 100 teeth. See the article MAMMALIA. The hog, the mole, the gymnure, and the opossum, are among the few existing quadrupeds which retain the typical number and kinds of teeth. The formula expressing the number of the different kinds of teeth—viz., the incisors or cutting-teeth, the canines or dog-teeth, the premolars, and the molars or true grinders, commonly known as the *dental formula*, is described in the article DENTITION, in which the *milk* or *deciduous* teeth, and the order in which they appear, are also described. It is only in the Mammals that we have a well-marked division of the teeth into the four kinds of incisors, canines, premolars, and molars, each of which claims a brief description.

The *incisors*, or cutting-teeth, are situated in front, and possess a single conical root or fang, and a vertical crown bevelled behind, so as to terminate in a sharp cutting edge. These teeth are specially fitted, as their name implies, for cutting the food. In man, there are two of these incisors in each side of each jaw. In herbivorous animals they crop the herbage; in rodents (the rabbit, hare, rat, beaver, &c.), these teeth are very much developed, and differ from any other teeth occurring in Mammals in this respect, that their growth continues throughout life; and if their length does not constantly increase, it is because their free ex-

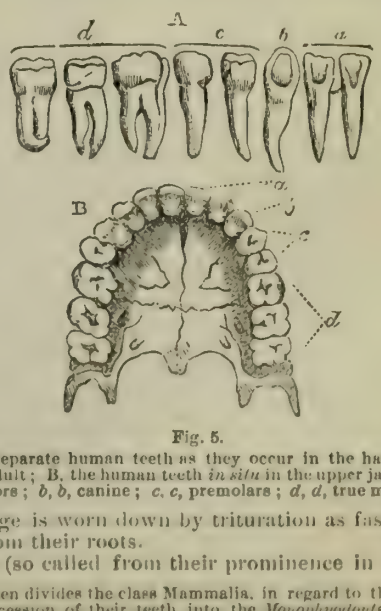


Fig. 5.

A, the separate human teeth as they occur in the half-jaw of the adult; B, the human teeth *in situ* in the upper jaw: *a*, *a*, incisors; *b*, *b*, canine; *c*, *c*, premolars; *d*, *d*, true molars.

tremity or edge is worn down by trituration as fast as they grow at the base from their roots.

The *canines* (so called from their prominence in the dog) come

* Profess r Owen divides the class Mammalia, in regard to the times of formation and the succession of their teeth, into the *Monophyodonts* (Gr. *mono-*, once; *phy-*, generate; and *odont*, tooth), or those that generate a single set of teeth, as the sperm whales, dolphins, porpoises, armadillos, and sloths; and the *Diphyodonts* (derived from *di*, twice, &c.), or those that generate two sets of teeth, as the Mammals generally, with the above exceptions.

next to the incisors. Their crown is rather conical than wedge-shaped, and their fang sinks more deeply into the jaw than in the case of the incisors. In all carnivorous animals, they are largely developed, being obviously formed for tearing the flesh of their prey. In man, there is one canine tooth in each half-jaw; and there is never more than this number in any of the lower animals.

The *premolars* (known also as bicuspids and false molars) come next in order to the canines; they are smaller than the latter, and their crown presents two pyramidal eminences. In man, there are two premolars in each half-jaw. Their function more nearly approaches to that of the true molars behind them, than to that of the canines.

The *true molars* (or multicuspids) are placed most posteriorly. They are remarkable for their comparatively great size, the square form of the upper surface, on which are from three to five elevations or cusps, and for their short root, which is divided into from two to five branches, each of which is perforated at its extremity. In man, there are three molars in each half-jaw, the posterior one being termed the wisdom-tooth, from its being cut the latest: they are especially employed for grinding the food, under the action of the muscles of the lower jaw.

The teeth are so admirably adapted for the special purposes which they are called upon to fulfil, that it is generally easy, from a careful examination of them, to say to what class of animals they belong, and to draw various conclusions regarding the habits and structure of the class generally. Thus, in carnivorous animals, the molars are not grinding-teeth, but present sharp cutting edges, and those of the upper and lower jaw overlap each other; resembling a pair of scissors in their action. In insectivorous animals, the molars have a tuberculated surface, with conical points and depressions, so arranged as to lock into each other. In frugivorous animals, living on soft fruits, these teeth are provided with rounded tubercles, while in herbivorous animals, they have a broad, rough surface, resembling a millstone.

There is also a close connection between the articulation or joint of the lower jaw and the nature of the food used by the animal. Thus, in purely carnivorous animals, in which the teeth simply tear and cut the food, no grinding motion is required, and the jaw is capable only of a simple hinge-motion in the vertical plane; while in herbivorous animals, the joint is so constructed as to allow of extensive sliding and lateral motion of the lower molar teeth upon the upper. In man, both the form of this articulation and the general character of the teeth, point to an intermediate position in relation to food, and form a good physiological argument for the mixed diet which general custom has decided to be most favorable and natural to our species.—For further information on this subject, the reader is referred, not only to the three works of the professor from which quotations have been made in this article, but to his splendid *Odontography* (1844), and to his article 'Teeth,' in *The Cyclopædia of Anatomy and Physiology;* to F. Cuvier, *Sur les Dents*, &c.; and to De Blainville's *Osteographie*.

DISEASES OF THE TEETH.—The dangers to which infants and children are exposed during the process of teething, are noticed in the article DENTITION; and we shall therefore here confine our remarks to the affections of the permanent teeth, of which the following are the most important:

1. *Caries of the teeth* usually commences in the dentine immediately below the enamel, a yellow or brown spot being observed on the surface of the tooth over the affected part. The tissue soon becomes softened, and a small cavity is formed, which, after a time, presents an external opening, in consequence of the unsupported enamel giving way. The substance of the tooth now decays more rapidly, and the caries gradually approaches the central or pulp cavity, which at length is opened. Hitherto, there has been little or no suffering, but now pain is experienced under the action of irritant substances, heat, cold, &c. Inflammation proceeding to suppuration takes place; the pulp is gradually destroyed by ulceration; and the body of the tooth, thus deprived of its nourishment, decays, and leaves nothing but the outer coating of enamel, which then breaks away by degrees, till nothing but the fangs of the tooth remain, and these usually cease to give pain. Caries is not only a common cause of toothache, but frequently gives rise to obstinate headache, pain in the ear, deafness, squinting, impossibility of bearing the light (photophobia), and other anomalous symptoms, which immediately disappear upon the removal of the diseased tooth. In these cases, the tooth may never have ached, but will be found painful when pressed up or smartly struck. The primary cause of caries is constitutional, and it especially occurs in scrofulous and ill-nourished persons, or in those whose health is broken down by too frequent pregnancies, prolonged lactation, the abuse of mercury, &c.

The direct or exciting causes are usually described as: (1) Such as destroy the integrity of the enamel, and thereby expose the dentine to the influence of irritant substances; or (2) such as operate upon the vital susceptibilities of the dental tissues. Among the former are acids and other corrosive substances taken into the mouth, sour eructations, the attrition of opposing surfaces of the teeth, and all kinds of mechanical violence; while among the latter may be mentioned hot and cold drinks, especially when taken in quick alternation. The excessive use of sugar is also commonly regarded as a cause of the disease. Many of the best dentists, however, deny that acids (when taken medicinally) or the abrasion of the enamel can give rise to caries.

With regard to treatment, it may be observed, that if the caries be slight and recent, the decayed portion must be removed, and the cavity filled up with gold, as described in the article DENTISTRY. 'But,' says Dr. Druitt, who on dental matters always quotes the opinion of Mr. Tomes, one of the greatest scientific authorities on the diseases of the teeth, 'if the decay has advanced far towards the pulp-cavity, or has laid that open, it may be necessary first to employ aperients and tonics, and use some application to deaden the sensibility of the tooth, so as to enable it to bear the stopping, and to protect it meanwhile from contact with food and saliva.' Many a useless visit to the dentist might be avoided, if the patient would take an aperient dose of Epsom salts two or three consecutive mornings; and after cleansing out the cavity with dry cotton-wool, would insert twice a day a plug of that substance, moistened in Eau de Cologne, or, still better, in either of the following solutions: (1) Mastic solution, formed by dissolving a drachm of mastic in an ounce and a half of Eau de Cologne; or (2) Ethereal tincture of tannin, formed by dissolving a drachm each of tannin and mastic in an ounce and a half of sulphuric ether. By these means, a painful tooth may be often brought into a state in which it will bear stopping. The patient's sensations will warn him against drinking very hot or cold, or sweet or acid fluids, and against exposure to cold draughts of air. Whenever the teeth exhibit a tendency to rapid decay, general tonic treatment is indicated.

2. *Necrosis* is an affection which is characterized by blackness of the tooth and looseness in its socket. It may be caused by violence, accompanied with destruction of the nutrient vessels, or by inflammation of the pulp. If the tooth gives trouble, it must be extracted. Necrosis of the teeth is quite distinct from the very destructive necrosis of the dental alveolar processes and of the jaws generally, which results from the poisonous action of phosphorus fumes, or from the very similar affection which sometimes follows the eruptive fevers. For an account of the singular and terrible disease from which artisans employed in making lucifer-matches suffer, in consequence of their inhaling the fumes of phosphorus (probably in the form of phosphorus acid), which was first noticed in 1839, we may refer to a review of Von Bibra and Geist's exhaustive treatise (in German) on the subject in the *British and Foreign Medico-chirurgical Review* for April 1848; and to an article on 'Phosphorus Workers,' in the Fifth Report of the Medical Officer of Health. Reference is also made to the disease in the article PHOSPHORUS in this work. The necrosis and exfoliation of the alveolar processes and portions of the jaws in children, consequent upon the eruptive fevers, is accompanied by the shedding of the teeth; and according to Mr. Salter, surgeon-dentist to Guy's Hospital, who was the first to describe its true nature, is essentially the same as the necrosis in phosphorus-poisoning, and, like it, is the result of the local application of a specific poison, generated within the individual to the vascular parts of the teeth. For a description of this remarkable disease, and of the treatment to be adopted, we must refer to Mr. Salter's article on 'Exanthematous Jaw-necrosis,' in Holmes's *System of Surgery*.

3. *Alveolar abscess* may be defined as a suppuration around the fang or fangs of a tooth, usually carious, accompanied by absorption of the bony walls of the alveolar process, and enlargement of the little sac of pus or matter, which gradually makes its way to the surface, 'either along a canal by the side of the fang of the tooth opening at the edge of the gum, or through the gum itself at a point corresponding to the end of the root (or roots) of the tooth implicated. When, however, the fangs are unusually long, or the reflection of the mucous membrane from the gum to the cheek or lip is very superficial, this same discharge may burrow still more outwardly, and find its exit upon the surface of the face.'—Salter, *op. cit.*, p. 2. When the discharge bursts, as it most commonly does, through the gum, the alveolar abscess is reduced to its simplest form, and is known as a *gum-boil*. When the discharge takes place in the region of the cheek or chin, the true nature of the case may easily be mistaken by a careless surgeon, who might refer the symptoms to bone-disease. The cause of this affection is either caries or necrosis. In its earliest stage, the disease may be cut short by the extraction of the affected tooth, or even by the removal of the stopping, if the tooth is a stopped tooth. If it is desirable to save (for appearance' sake or otherwise) a threatened tooth, the gum should be freely leeched, and hot fomentations applied to the swollen part of the face, and the system should be briskly purged. As soon as matter can be detected, it should be allowed to escape by a puncture made through the gum—an operation which is followed by im-

mediate relief, and by rapid subsidence of the swelling, although pus continues to be discharged for a considerable time. Indeed, the disease seldom ceases altogether till the offending tooth is removed. When the abscess shows symptoms of pointing on the face, the tooth must be at once extracted, and more serious surgical interference will probably be necessary.

4. *Toothache* is not so much a disease as a symptom of various morbid states of the affected part, which, for convenience, may be classed under this single heading. 'Toothache,' says Dr. Wood, 'offers every possible variety in degree, character, and duration. The pain runs through all the grades which intervene between a slight sensation of uneasiness and unsupportable agony. It may be dull, aching, heavy, sharp, pungent, throbbing, grinding, or lancinating. It may be continued or paroxysmal, remittent or intermittent, and regular or irregular in its recurrence. It may come in flashes, and as suddenly disappear; or may continue a long time with little variation.'—*Practice of Medicine*, 4th ed. vol. i. p. 512. According to the various conditions which give rise to it, toothache may be divided into: (*a.*) *Inflammatory toothache*, which is almost always dependent upon caries. The inflammation may be seated in the pulp of the tooth, in the nerve-twig entering the pulp-cavity, or in the periosteum investing its roots, and reflected over the interior of the alveolar cavity. There is generally some external swelling after the pain has continued for some time, and it occasionally extends to the salivary glands. The tooth is at the same time very tender, and any force applied to it aggravates the pain, which is also increased by hot and cold liquids taken into the mouth. When, as in the great majority of these cases, the pain is associated with caries, the best treatment is as follows: 'Let the patient have a dose of calomel and colocynth; confine him to spoon-diet; let him wash out the mouth with a solution of carbonate of soda in tepid water; let the gum around the tooth, and between it and its neighbors, if tumid and tender, be deeply scarified with a fine lancet; then let the cavity be filled loosely with a little bit of cotton-wool, dipped into the solution of tannin and mastic (for which the formula has been already given); and if the toothache be curable at all, this plan, with a little patience, will be almost sure to succeed. If the pain is very violent, half a grain of powdered acetate of morphia may be taken up with the cotton imbued with the tannin, which should be warmed before it is put into the cavity. As soon as the pain is relieved, the tooth, if of use, should be stopped with gold or amalgam; or if of no use, it should be extracted.

It may be added, that most of the violent, burning, empirical nostrums, such as creosote, oil of thyme, &c., although they may be of service when introduced in small quantity by a skilful hand into the carious tooth at the right time, can do nothing but mischief when employed indiscriminately, as they are by the vulgar.' —Druitt's *Surgeon's Vade-mecum*, 8th ed. p. 458. (*b.*) *Neuralgic toothache* may occur either in sound or in carious teeth. It may be recognized by its occurrence in paroxysms at more or less regular intervals, and by its being attended with little or no swelling of the external parts. It is very common in the earlier months of pregnancy, and in persons of a general neuralgic tendency, and is often excited by changes in the weather. The treatment is the same as for neuralgia generally. After the bowels have been freely opened, chalybeates and quinine must be given in large doses, and frictions with veratria or tincture of aconite (both of which are energetic poisons) may be carefully applied to the gum. (*c.*) *Rheumatic and gouty toothache* may occur in sound or in carious teeth in rheumatic or gouty persons. The constitutional treatment applicable to these diseases must be tried, together with the local applications already noticed.

5. *Falling of the teeth*, due to absorption of the socket, may be regarded as almost an ordinary consequence of old age; but it frequently occurs under the popular name of *scurvy of the gums* in middle age, although very seldom before the 30th year. True scurvy, gangrene of the mouth, or mercurial inflammation of the gums, may cause the loosening of the teeth at any age; but there are two other conditions which lead to the same result. In one of these affections, the gums swell, and assume a deep red color, and the inflammation appears to be propagated into the alveoli, producing a thickening of the periosteum, and a consequent elevation of the tooth above its ordinary level. By frequently recurring attacks of this inflammation, the tooth is lifted out of its socket, while the gum retreats from the neck, and leaves a portion of the roots exposed. The tooth thus deprived of its support at length falls, after which the gum heals, and the patient is relieved. The remedies indicated are those tending to relieve inflammation of the gum, but they are seldom successful. In the other affection, there is conjoined suppuration of the gums and sockets, and the disease first shows itself by an oozing of pus from behind the edges of the gums when they are pressed. From the absorption of the sockets, and the simultaneous retreat of the gums, the teeth, as in the previous case, at length fall out, if they have not, for the patient's comfort, been previously extracted. Little can be done in the way of treatment in this form of the affection.

6. *Painful and difficult eruption of the wisdom-teeth* requires a few remarks. The cutting of these teeth is often accompanied by distressing symptoms, which may be protracted for months, or even years, unless surgical aid is called in. The difficulties 'arise from the position occupied by these teeth, so close to the joint of the lower jaw, where the mucous membrane is reflected from the gums to the cheek and fauces, combined with the very common condition, that the jaw is not sufficiently elongated backwards to allow the *dentes sapientiæ* to range in the horizontal series with the other teeth.' This mechanical difficulty not only holds back these teeth in their bony bed, but it often prevents their proper direction of growth. As a consequence of these displacements in the upper jaw, it often happens that when the jaws are brought together, a bit of mucous membrane is nipped and pinched, leading first to ulceration and extreme tenderness, and subsequently to cicatrization and stiffness of the parts. From insufficient room in the lower jaw, the crown only partially emerges through the gum, the first cusp coming through it, while the hinder cusps remain covered. This produces a terrible pinching of the mucous membrane over the tooth every time the jaws are brought in contact. Another troublesome symptom, often associated with the painful cutting of a lower wisdom-tooth, is spasmodic but continuous contraction of the masseter muscle, so as to keep the jaws nearly closed, and capable of only slight separation. The most distressing result, however, is the suppuration that often attends the difficult eruption of the tooth. Even in ordinary cases, when none of these complications are present, there is often a good deal of diffuse and erratic pain in cutting a wisdom-tooth. It is unnecessary to enter into the treatment, which must be left entirely to the surgeon-dentist.

7. *Hæmorrhage after extraction of teeth* has occasionally proved fatal, and is not very unfrequently a troublesome and even dangerous complication of the operation. In most of the recorded cases, there has been distinct evidence of the existence of the hæmorrhagic diathesis, or, in other words, of a liability to bleeding profusely from the most trivial wounds. No better local treatment can be recommended than that which was suggested by John Hunter nearly a century ago. 'In general, it will be sufficient to stuff the socket with lint, or lint dipped in oil of turpentine, and to apply a compress of lint or a piece of cork thicker than the bodies of the adjacent teeth, so that the teeth in the opposite jaw may keep up a pressure.' Matico and saturated alcoholic solution of tannin may be equally efficacious as styptics, but are not superior to oil of turpentine. In some cases, the extracted tooth has been successfully replaced as a plug. The internal administration of astringents, such as tannin and oil of turpentine, should be combined with the local treatment.

8. The subject of *Tartar* on the teeth has been considered in a special article.

TEFF. See MEADOW GRASS.

TE'FSA, TA'DLA, or TEDLA, a town of Morocco, 135 miles north-east of the city of that name, stands in the fertile, well-peopled district of Tadla, on the banks of the Um-er-Beg. It is one of the oldest towns of the country, and its manufactures of woollen cloths and shawls are important. Together with the small town or suburb of Efza, T. contains 10,500 inhabitants, 2000 of whom are Jews.

TEGNER, ESAJAS, a Swedish poet of high reputation, was born in 1782 at Kyrkerud, in the Swedish province of Wermland, and educated at the university of Lund, where he took the degree of M.A. in 1802. In 1805 he was appointed sub-librarian to the university, and lecturer on æsthetics. In 1811, the Academy prize was awarded to T.'s poem of *Svea*, or Sweden, which at once raised him to the rank of one of the most popular writers of his country. Prior to the appearance of this successful poem, he had written several spirited war-songs and national odes, which had attracted the favorable notice of the king and government. In 1812, he became professor of Greek, and at the same time was ordained to the pastoral care of the parish of Stäfje. During the next ten or twelve years of his life, he devoted himself to the prosecution of his clerical duties, and the acquisition of theological learning, with an earnest and unwearying zeal which was scarcely to be expected from his previous indulgence in the pleasures of society, and his natural inclination towards the exhibition of a taste for coarse humor and equivocal puns. During this period, he composed his two famous religious idyls of *Prestvigelsen*, or the 'Consecration of a Priest,' and *Nattvardsbarnen*, or 'The Young Communicants,' and wrote his *Axel*, a poetic romance, which is regarded by some Swedish critics as even superior to his *Frithiof's Saga*, of which the first cantos appeared in a literary journal, edited by the historian Gejer, under the title of the *Iduna*, and conducted under the auspices of the Gothic Society, the leading object of which was to foster national literature, and put down the prevalent taste for the pedantic classical or foreign school of writing.

In 1825, T. published the closing parts of *Frithiof's Saga* which

rather errs in the opposite direction, and follows too closely the ancient saga on which the tale is founded. But notwithstanding the inharmonious character of the composition, which may be regarded rather as a collection of many ballads and odes in various metres than as a complete epic, the *Frithiof's Saga* became the most popular poem of Sweden, and attracted to its author the admiration and notice both of his fellow-clergy and of the sovereign, as was evinced in 1824 by the clergy of the diocese of Wexio nominating him for the vacant bishopric, and the king at once appointing him to the see. In his place at the Diet, as a member of the Chamber of the Clergy, he made himself conspicuous for his support of ultra-conservative views, in opposition to the extreme liberal doctrines which he had advocated in early life. His speeches in the Chamber and on numerous other public occasions have a great reputation in Sweden and Norway, and are devoted to the discussion of questions of education, literature, and finance. In 1839, T. was proposed for the archbishopric of Upsala; but in the following year, he was seized with unmistakable symptoms of insanity, which had been strongly manifested in two of his brothers and other members of his family. Although, after a few months confinement in an asylum, he was able to return to his work, his health soon broke down; and after lingering for many months in a paralytic condition, he died in 1846. His collective works were edited by his son-in-law, Professor Böttiger, and published in 6 volumes (Stock. 1848). All his large and more popular poems have been translated into German, French, and English; the English translations of his *Frithiof* are very numerous, three or four new ones having appeared between 1873 (Spalding's) and 1879. Longfellow's is well known.

TEGUCIGA'LPA, a town of Honduras, Central America, is situated on a table-land 3426 feet above the sea, 25 miles south-east of Comayagua. T. is the largest and finest city in the state. Near it are gold, silver, and copper mines. Pop. 12,000.

TEHRA'N, frequently spelled TEHERAN, capital of Persia, and of the province of Irak-Ajemi, 70 miles south of the shore of the Caspian Sea. It stands on a wide plain, dotted here and there with mud-built villages, and pierced with many circular pits, which reach down to the great subterranean water-courses, on which, in this region, the life of animal and plant is altogether dependent. On the north-east runs the lofty range of the Elburz Mountains, rising in Demavend to the height of 22,000 feet above sea-level, and giving dignity to an otherwise tame and unattractive scene. The town is built almost entirely of mud-houses, packed within a mud-wall 20 feet high, and 4 miles in circumference. The principal buildings are the British and Russian residences; the bázár of Taki Khan, finished in 1850—1851, at a cost of £30,000; the Ark, or Citadel—in the suburbs—is the Shah's palace, and about 2½ miles north of these, the Castle of the Kajars (Kasr-i-Kajar), the 'Windsor' of the Persian rulers. Carpets are manufactured; but the chief trades are shoemaking and the manufacture of hats and linen goods. Several telegraph lines have been recently constructed, which center at T.; and they have compelled a number of European engineers and telegraph clerks to reside in T., the number of European inhabitants in 1872 being estimated at about 50. Pop. in summer, 80,000; in winter, 120,000.—In the vicinity of T. are the ruins of Rei, the *Rhages* of Scripture, known in the time of Alexander the Great under the name of *Ragæ*, and the birthplace of Harûn-al-Raschid. —See Eastwick, *A Diplomate's Residence in Persia* (2 vols., Lond. 1864); *History of Persia*, by Clements R. Markham (1874).

TEHUANTEPE'C, a river-port of the south of Mexico, in the territory of the same name, and 10 miles above the mouth of the river Tehuantepec, in the bay also of that name. The inhabitants, 15,000 in number, are engaged in manufacturing salt and cotton fabrics, and in indigo-planting. Pearl-fishing is carried on, and a purple dye is procured from a shell-fish which abounds in the vicinity.

TEÏ'DÆ. See MONITOR.

TE I'GITUR, one of the service-books of the Catholic Church. It is properly but an extract from the Roman Missal, and contains the canon of the mass, and certain other portions of the Liturgy which do not vary with the variety of festivals or of the ecclesiastical seasons, but are always the same. It is so called from the first words of the canon, *Te Igitur, Clementissime Pater*. This service-book, as distinct from the missal, was used, and is still used by bishops, prelates, and other dignitaries; and as the 'canon' is the most sacred part of the service, oaths upon the Te Igitur were regarded as especially solemn. The Te Igitur appears to have been used as the ordeal 'of compurgation.'

TEI'GNMOUTH, a seaport, market-town, and favorite watering-place on the south coast of Devonshire, on the north side of the estuary of the Teign. In front, on the sea-side, is the wide esplanade known as the *Den*, formed of a huge bank of sand, accumulated in the course of ages at the river's mouth—one of the chief features of the place. The harbor is safe and commodious, though difficult of entrance, the channel of the river being obstructed by a shifting bar of sand. The chief imports are coal and culm; the exports, granite from Dartmoor, and china-clay; there is also a considerable sea and river fishery. T. is connected with Shaldon, on the other side of the river, by a wooden bridge (completed in 1827) of 34 spans, 1671 feet in length, with a swing over the main channel for the passage of ships. A large convent and educational establishment, founded by Miss English, was completed in 1865. The climate is mild and salubrious, and the country beautiful. It is a station on the South Devon Railway. Pop. (1871) 6751; (1881) 7100.

TEINDS, the name given in the Law of Scotland to Tithes (q. v.). In Scotland, tithes were only paid from the produce of land or cattle. The teinds of corn, called *decimæ garbales*, greater teinds, or parsonage teinds, were generally exigible from all landed property, and originally paid to the rector or parson serving the cure, a small portion being claimed by the bishop. The tithe of the produce of animals, as wool, milk, cheese, was called lesser teind, or vicarage teind, because, where due, it was paid to the vicar; but vicarage teind was only legally exigible where a usage of paying it could be shown. The teinds, supposed to be due at common law to the incumbent of the parish, had, previously to the Reformation, been largely diverted elsewhere (see COMMENDATORS); in some instances, they had been bestowed on some favorite religious house by the patron, who seemed to consider himself their absolute proprietor; in others, they had been feued to some layman. In many cases the religious house which had acquired the teinds, profited, or at least saved itself from odium, by selling them to the crown or to a lay subject; and not unfrequently the pope, who was viewed as patron of all benefices to which no one else could claim a right of presentation, granted to the lands of churchmen an exemption from the payment of teind. At the Reformation, the church-lands were claimed by the crown; those that had belonged to the religious houses were erected into temporal lordships, whose proprietors, called *Lords of Erection*, or *Titulars*, were nominally burdened with the support of the clergy, by salaries modified out of a third part of the benefices. At the majority of James VI., it was found advisable to check the practice of granting the lands of religious houses to laymen; and the church lands were declared, with certain exceptions, to be inalienably annexed to the crown.

The right to tithes was, in Scotland as elsewhere, originally made effectual by their owner drawing the *ipsa corpora*, separating every tenth sheaf after the crop was reaped. But this proceeding often became an instrument of oppression, as the proprietor was obliged to allow his crop to remain on the ground exposed to all the vicissitudes of the season, until the beneficiary chose to draw his teind; and prior to the Reformation, agreements had become common by which a certain quantity of grain, called *Rental Bolls*, was accepted in full value of teind, while leases were sometimes granted of the teinds for a money payment.

Various not very successful attempts were made during the reign of James VI. to regulate the conflicting interests of heritor and titular, and to provide the clergy with stipends which would not be illusory, out of the teinds of their respective parishes. Charles I., soon after his accession, issued, without the intervention of parliament, a revocation of all appropriations of church lands and teinds made during the two proceeding reigns. The powerful barons who were possessors of church property at first menaced resistance, but eventually showed a desire for compromise, and the parties principally concerned entered into four submissions, in which they accepted his majesty's arbitration. The decrees arbitral pronounced by the king resulted in the establishment of valuations of teinds, and sales of them to the proprietor of the lands, by which the division of the produce between the owner of the land and the owner of the teind was avoided; and the teinds were made available to their utmost extent for the support of the parochial clergy. A commission, appointed to carry out the decrees arbitral, was continued from time to time till the Union, when its authority came to be vested in the Court of Session, as Court of the Commission of Teinds, the same tribunal which still exercises jurisdiction, both judicial and ministerial, in questions relating to teinds. A heritor, and in some circumstances the minister, may pursue an action of valuation of teinds; and the heritor may also insist on purchasing the teinds of his lands when valued, that is, in paying the value of the annuity in a slump sum.

The modifying of reasonable stipends to the clergy, out of the teinds of their respective parishes, is one of the functions of the Court of Commission of Teinds. The practice of augmenting stipends after they have once been modified was introduced with some hesitation; confined at first to stipends below the minimum, it afterwards became general; and was recognized by act 48 Geo. III. c. 138, which provides that no stipend can be augmented till 20 years have elapsed from a previous augmentation. By 50 Geo. III. c. 54, it was provided that the minimum annual value of any stipend should be £150; and if such amount cannot be made up by the teinds, it is supplied from the Exchequer. See STIPEND.

The present position of the tithes of Scotland is as follows: In the majority of cases they have been purchased by the proprietors of the respective lands, after the modification of stipends to the ministers, and are held liable to the burden of augmenting those stipends to the extent or their value; in other words, there are no tithes, but part of the rent of the proprietors constitutes minister's stipend, and an additional part is liable to augmentation of stipend. A part of the tithes are in the hands of titulars, also liable to stipend and augmentation—they are, however, no longer drawn in kind, but paid according to valuation, or compounded for in the few cases where they remained unvalued. The teinds which were held before the Reformation by the bishops and other dignified clergy, are in the hands of the crown, liable to augmentation of stipend. The teinds which remained in possession of the parochial clergy, still belong to them, but are commuted; and those belonging to colleges and hospitals have in most cases been valued, and are paid by composition, but have not been sold to the owners of the lands.

TEKELI (more properly, *Tökely*), EMERIC, COUNT, a celebrated Hungarian patriot, was descended from a noble Lutheran family, and was born at the castle of Kasmark, in the county of Zips, in 1656. His father, Count Stephen, had been implicated in the conspiracy of Zriny and Ragotsky to free Hungary from the rule of Austria; and, after his death, and the execution of Zriny, and others, young T. sought an asylum in Poland, where he had large possessions. After vain endeavors to recover from the emperor his patrimonial estates, he repaired to the court of Abaffi, Prince of Transylvania, who put him at the head of an army of 20,000 men, with which, in 1678, he invaded Hungary. Being joined by numbers of the malcontents, he rapidly extended his conquests, made predatory inroads even into Austria, Styria, and Moravia, till Leopold I. was forced (1681) to temporize with the insurgents, and thus gained over a portion of them. But T. distrusting, with good reason, the emperor's sincerity, refused to disarm, and being joined by the Transylvanian prince and the Turks, he was declared by the Sultan Mohammed IV. (1682) king of Upper Hungary, and again recovered most of the country. T. joined Kara Mustapha in his celebrated inroad upon Austria; but after the failure of the expedition many of his followers fell off from him, and his patron the sultan being prejudiced by his enemies against him, he was twice imprisoned by the Turks; and during his detention, Hungary was wholly overrun by the Austrians, and Transylvania separated from the Turkish alliance. T., however, was favored by a brilliant though ephemeral change of fortune in 1690, when, at the head of a Turkish force, he burst into Transylvania, routed the combined Austrians and natives repeatedly, and woke up the energers of his partisans in Hungary; but the imperialists, under the Markgraf of Baden, routed his allies the Turks at Salankemen (August 19, 1691), and under Prince Eugene of Savoy, so completely demolished them at Zenta (September 11, 1697), that they gladly agreed to the peace of Carlovitz (November 14, 1697), by which all aid to the Hungarian malcontents was withdrawn.

From this time, T. lived in retirement in Turkey, at first being munificently entertained by the Turkish government, but afterwards so completely neglected that he was forced to adopt the occupation of a vintner. He died at Constantinople in 1705.—His wife, Helena, the widow of Ragotsky, was celebrated over all Europe for her beauty, but was no less distinguished for her heroic gallantry, as was proved by her obstinate defence of her castle of Mongatz (Hung. *Munkacs*) against an army of imperialists. Forced to surrender, to save the lives of her children and the property of her (Ragotsky's) family, she was afterwards exchanged for an Austrian general whom T. had captured; and joining her husband at the cost of abandoning her children, shared the vicissitudes of his fortune, and died in 1703.

TELAMO'NES (see ATLANTES), statues employed as columns, to support a wall, cornice, &c.

TELEDU (*Mydaus meliceps*), a quadruped of the Weasel family (*Mustelidæ*), a native of the mountains of Java, at an elevation of 7000 feet and upwards; remarkable, like the Skunk (q. v.) of America, for the excessive fetor of a volatile secretion formed in glands situated a little within the rectum, the emission of which is its principal means of defence.

TE'LEGRAM, a communication sent by Telegraph (q. v.). This word, which was coined some years ago by a writer in the *Times* newspaper, was objected to at the time by Greek scholars as a barbarous formation. According to the law of Greek compounds, *grapho*, compounded with anything but a preposition, becomes *grapheo*; therefore, with *tele*, it would be *telegrapheo*, the noun from which would be *telegraphema*. The convenient conciseness of *telegram* has, however, made it triumph over the more correct *telegrapheme*.

TE'LEGRAPH (Gr. *tele*, far off, and *grapho*, to write) is a general name for any means of conveying intelligence other than by voice or writing. The idea of speed is also implied. Alarm-fires (see BEACON), the Semaphore (q. v.), and the Signals (q. v.) used at sea, are among the earlier forms of telegraph. But all other agents are now thrown into the shade by the Electric Telegraph. It has been reserved for our own day to develop into practical use the capabilities of electricity and magnetism as a means of distant communication; although in earlier times, the possibility of such a use of this natural power has been frequently suggested. The public use of the electric telegraph dates not earlier than 1846; but the idea that magnetism could be applied for distant communication is at least two centuries and a half old. Galileo, in one of his dialogues on the rival astronomical systems written in 1632, puts in the mouth of one of his speakers, a reference to a secret art, by which, through the sympathy of a magnetic needle, it would be possible to converse across a space of two or three thousand miles. In 1753, a letter appeared in the *Scots Magazine*, bearing the initials C. M., and headed 'An Expeditious Method of Conveying Intelligence,' in which we must recognize the first perception of the uses to which telegraphy might be put. This interesting letter starts with the remark that it 'is well known to all who are conversant in electric experiments, that the electric power may be propagated along a small wire from one place to another without being sensibly abated by the length of its progress;' and it goes on to describe an arrangement of wires corresponding in number to the letters of the alphabet, to be fixed in glass or jewellers' cement at intervals of 20 yards, and to convey, from an electric machine or rubber, a current which would lift each letter, 'marked on bits of paper, or other substance that might be light enough' to rise to the electrified ball which formed the terminal of each wire. The apparatus proposed is crude and clumsy, yet we can hardly fail to recognize, in the letter of this Renfrew man, the full appreciation of what the electric telegraph might become.

From a period shortly anterior to the date of the letter in the *Scots Magazine*, down to 1837, a large number of proposals, more or less ingenious, are on record. The space at our command will not permit us to describe all those inventions, or to enter upon the much vexed question as to who is entitled to the name of inventor of the electric telegraph. We must be content to furnish a description of the more important instruments in use, some statistics of the more recent history of telegraphy generally in this country, and a notice of the progress of submarine telegraphy. In our description of instruments, &c., we shall assume the reader to be familiar with the chief facts of GALVANISM (q. v.) and electro-magnetism (see MAGNETISM).

Telegraph instruments may be classed under two heads, namely, those which record the signals, and those which only give passing signals to the observer or listener. Among the former are several kinds, namely, those giving a record in arbitrary signs (*i.e.*, in the dots and dashes of the Morse alphabet); those which print in ordinary characters, such as the Hughes type-printing instrument; and lastly, a class of instruments giving a *fac-simile* of the message. The latter two classes are not much used, and the number of Hughes instruments in use in this country has somewhat decreased. The great bulk of the telegraphing of the world is done either by the Morse printer, or by the non-recording instruments; and to those we shall therefore devote the major part of our description.

The Morse.—The leading principle in the Morse and other allied instruments is, that by the depression of a key or other method, an electric circuit is 'closed' or completed, and a signal is transmitted along the wire to the distant station, where, on its arrival, it reproduces the signal by the action of an electro-magnet or otherwise. Electrically, the Morse consists of the transmitting key (fig. 2) and the electro-magnet and armature (fig. 1); while mechanically, it consists of a lever, with circular

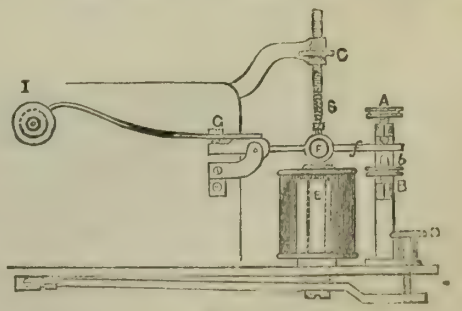


Fig. 1.

wheel or disc, attached to the armature, and a clock-work arrangement, by which the paper tape to be printed upon is carried forward under the disc. Fig. 1 represents the electro-magnet and armature by which signals are received. On the current being received from the distant station, it traverses the coils of the

electro-magnet E, and the armature F. is drawn down by the action of the current. A and B are screws for regulating the play of the armature, and of the inking-disc I, at the other end of the lever. The instrument clerk is first required to adjust B so that the upper edge of the disc shall press gently against the paper tape (which is not shown in the engraving) and the screw A, so that the under surface of the disc shall dip into the ink-well or reservoir (likewise omitted in the diagram). B having been adjusted, the screw D is turned so that when the brass stop *f* rests upon the stud *b*, the poles of the magnet shall clear the armature without actually touching it. A thin streak of light should be seen between the armature and the poles. Screw C is used to adjust the spiral spring above, by which, on the cessation of the electric current, the armature is drawn back and the disc ceases to mark the paper.

In the first Morse instruments the marks were made on the paper with a pointed style (the instrument being thus known as the *embosser*); but by the invention of the ink-writing arrangement of Siemens, which we are now considering, the legibility and permanence of the record were secured, besides the advantage that a very light current will serve to make the marks. The case containing the clock-work, the arrangement of wheels by which the paper tape is unwound and carried forward, and the switch, by which the running of the tape is stopped, are not shown in the figure. The passage of a current draws down the armature, and elevates the disc, causing a straight mark on the tape so long as the current flows. When it ceases, the spring S. draws back the armature as already described, and the mark is discontinued. Thus the duration of the current determines the nature of the mark, a momentary passage causing a dot, a longer depression of the key a dash; and as the alphabet invented by Professor Morse consists of dots or dashes, or a combination of the two, the above figure and explanation disclose the whole mystery of this system of telegraphy to those who have mastered the phenomena of electricity.

The Morse Alphabet.—Before going further, the details of this alphabet, universally recognized as a masterpiece of cryptography, may be given. The signals, as given below, are arranged in the groups, and accompanied by the mnemonic phrases, adopted by the British Post-office when, in 1870, the transfer of the telegraphs to the government rendered necessary the rapid training of thousands of telegraphists throughout the kingdom:

Group 1.		Group 2.	
.	E, Earwigs	—	T, Turnips
. .	I, infest	— —	M, make
. . .	S, summer	— — —	O, oxen
. . . .	H, houses.	— — — —	Ch, cheerful.
Group 3.		**Group 4.**	
. —	A, A	— .	N, No
. — —	W, wet	— . .	D, difficulty
. — — —	J, jacket's	— . . .	B, baffles
. . —	U, uncomfortable,	— — .	G, great
. . . —	V, very!	— — . .	Z, zeal.
Group 5.		**Group 6.**	
. — .	R, Remember!	— . —	K, kindness
. — . .	L, law	— . — .	C, conciliates
. — — .	P, preserves	— . — —	Y, youth
. . — .	F, freedom.	— . . —	X, extremely
		— — . —	Q, quickly.

The arrangement for the numerals is equally ingenious. Each figure is represented by five signals, thus:

1, . — — — —	6, — . . . .
2, . . — — —	7, — — . . .
3, . . . — —	8, — — — . .
4, ... —	9, — — — — .
5, ...	0, — — — — —

These are the numerals printed long, but on busy circuits expert clerks adopt the practice of 'sending short,' omitting all after the first dash in 1, 2, and 3, four of the dots in 5, and all before the last dash in 7, 8, 9, and 0. It is stated that Prof. Morse founded his alphabet upon information given him by his brother, a journalist, as to the numerical relation of the letters in the English alphabet, the simplest signal (a dot) being given to E, and the next simplest (a dash) to T, those letters occurring most frequently in our language.

The Transmitting Key.—The 'key' or hammer by which signals are transmitted from the operator at the sending office, is shown in fig. 2, in one of its earliest and most simple forms. The lever *l, l* turns on its axis A, and has on its under side two platinum nipples, *m* and *n*. L is the line-wire, connected with the axis; E, the 'earth'-wire (passing through the Morse on its way to earth, and producing its signal there); and C, a wire connecting the stud *a* with the battery. As the key stands in the figure, it is in the position to receive a current from the distant station, the course of the current being L, A, *l*, *n*, *b*, and thence to the electro-magnet of the Morse *en route* to earth. When it is desired to send a

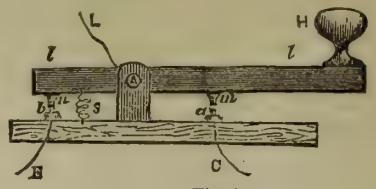


Fig. 2.

current, the handle H is depressed, and the current, generated in the Battery, then comes by the wire C, and passing through *a*, *m*, and A, proceeds by the line-wire to the distant station. Various modifications of this key are in existence, but in all the principle remains the same, that the electric circuit is closed or completed by the depression of the key. The length of time during which the handle is depressed, determines the length of the mark produced at the other end. Thus, if the clerk presses down the handle while he says, 'one—one two three,' the ink-disc at the other end gives the mark · — (dot dash) or the letter A, and so on through the various letters of the alphabet.

The Battery.—For the generation of power in the electric telegraph, Daniell's batteries (see GALVANISM) are chiefly employed in this country. Various forms of the Bunsen battery are also used, especially on the continent. The power employed varies with the length of line, the condition of the wires as regards insulation, and the nature of the instruments used.

The Circuit.—The mode of joining up two stations by means of earth-wires, batteries, instruments, and line-wires, is shown in fig. 3. Assuming S and S 1 to be telegraph stations, P and P 1 are the 'earth'-plates (see subsequent paragraph), B and B 1 the batteries, *n* and *n* 1 the electro-magnets and armatures, and *b*, *k*, *g*, the transmitting keys and galvanometers. L, L show the line-wire, supported on poles and insulated. The key at station S is shown depressed, so that a current of electricity may be supposed to be passing from the battery B through the key and galvanometer along the line-wire, and thence through *k* 1 and *n* 1 to the earth-plate P 1. Supposing, then, that the clerk at S desires to send a message to S 1, he depresses the key *k* several times so as

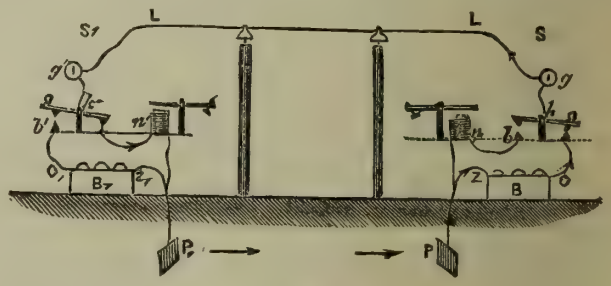


Fig. 3

to send a series of dots and dashes corresponding to the name (or rather the code signal representing the name) of the distant station. The attention of the clerk being gained by the clicking of the Morse, he turns the switch to set his paper tape in motion, gives the signal that he is ready, and the message is then sent.

The Line.—From fig. 3, some idea may be gained as to the mode of carrying a wire or series of wires over posts, these posts being carried along the sides of a road or railway. In towns, wires are carried 'over-house,' or by underground pipes, the wires in the latter case being insulated by means of a guttapercha or other suitable covering. The subterranean method is being applied to extended lines, especially in Germany, and is found to answer as well as the overhead system, while it avoids many of the casualties to which the latter is liable. In pole and over-house lines, the wires are kept from each other and from contact with the earth by insulators of various kinds. White porcelain and brown stoneware are the chief materials used. The former, when of good quality, well glazed, and well burned, is perhaps the most perfect of all insulating materials, and does not deteriorate with age.

The fewer the poles are in number on which the wires are suspended, the better is the insulation, and the less the cost, but the liability to accident is probably greater. The number of poles used varies from 16 to 30 per mile, and is governed by the number of wires carried, the configuration of the track, and other considerations. On road lines, the number of poles is generally larger than in the case of telegraphs carried alongside railways, the greater levelness and straightness of the latter reducing the number of supports required. The wire chiefly used for inland tele-

graph purposes is of iron, galvanized, and of No. 8 (⅛ inch) gauge. The conductivity of a wire increases in the ratio of the square of its diameter (the resistance decreasing in the inverse ratio), and the advantage of using a thicker wire on the longer lines is thus seen. No. 4 wire is, for this reason, used on some of the longer lines.

The Earth—Earth Currents.—Mention has been made of the 'earth,' in the preceding description. This is the technical expression used in relation to the fact discovered by Steinheil in 1838, that the earth itself serves the purpose of completing the circuit, and renders the employment of a second or return wire unnecessary. The 'earth' may consist of a buried plate of metal connected with the battery or line-wire, and of sufficient surface to afford the necessary diffusion. The gas or water pipes of a town form excellent 'earths,' care being taken that the connection is made with the pipe itself, and not with a branch, where a badly made joint might spoil the connection. Where dissimilar 'earths' are in use, as for instance, a copper plate at one end, and an iron pipe at the other, a *quasi* battery is created, and vexatious currents pass along the line. Hence the 'earths' on a circuit should be made alike.

The earth, being regarded as a large reservoir of electricity, offers no sensible resistance to the passage of the current, in the same way as the ocean would receive or supply at any point an indefinite quantity of water. While this quality of the earth is one of the most valuable aids to telegraphy (reducing so materially the cost of wire erection), it presents at times those embarrassing interruptions known as *earth currents*. These currents, at all times unwelcome visitors to a telegraph office, are very variable, changing rapidly at times from positive to negative, altering their direction with the hour of the day, and leaving one circuit to appear on another in a manner not explainable. The lines most liable to such disturbances are those running N.E. and S.W.; that is, connecting places separated in a straight line in those directions, and without reference to the actual direction of the wires. The easiest remedy for earth currents, when they are of sufficient strength to affect the lines, is to dispense with the earth connection, and revert to the original plan of using two wires. Thus between places where there are two wires, both may be disconnected from 'earth,' and used as a complete metallic circuit. Another remedy has been found in extending the circuit by joining to it a further wire, the terminal point of which lies beyond the direction or line in which the earth current is flowing. We must refer to the larger treatises on telegraphy for information regarding lateral induction, the velocity of electric discharge, the tests for resistance, insulation, &c., and also for notices of some of the less prominent pieces of apparatus now found in the instrument-room of the electrician.

The Relay.—We now proceed to notice several methods by which the transmission of signals is facilitated or accelerated. First among those may be placed the *relay*, of which an excellent form is shown in figs. 4 and 5. This is Siemen's Polarized Relay,

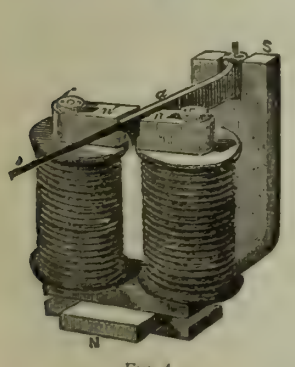


Fig. 4

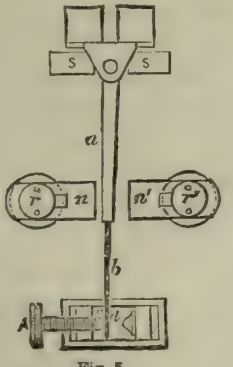


Fig. 5.

now in very extensive use in this country. In the previous description of the Morse, we have assumed the instrument to be worked directly by the current sent along the line. On long circuits, however, direct working could only be accomplished by great battery power, as, owing to inevitable loss by leakage, a current loses greatly before it reaches its destination. It is found to be a much better arrangement to have the instrument worked by a 'local current,' derived from a local battery at the receiving station. The mode by which this is accomplished will be seen from the diagrams. In the figures, N S is a hard steel permanent magnet, whose south end S has a slit, in which the soft iron armature, *a*, is pivoted. To this armature a thin aluminium tongue, *b*, is attached, which, by making contact at the point *c* (fig. 5), completes the local circuit. To the north end, N, of the permanent magnet the soft iron cores of the electro-magnet are fixed, as shown in the sketch. When the armature is equidistant from the poles of the electro-magnet, it is equally attracted by both; but if it be brought nearer to one than to the other, it will be held there, because it is under the influence of a more powerfully attracting force. Since the relative distance between the armature and the two pole-pieces may be increased at will, the attraction between either pole and the armature may be regulated with any degree of nicety. The electrical contacts for the local circuit are seen in fig. 5, which is shown with the local circuit completed.

When two stations far apart are to be connected by telegraph, it is usual to transmit the signal to a half-way station, and thence to retransmit it to its destination. The retransmission is not effected by manipulative skill, but by mechanical contrivance, so that, while the half-way station may read the message sent, no time is lost in the transmission. This is effected by making the intermediate instrument act as a relay in transmitting a message to the next station. The system, to be fully explained, would require more detail than we can here give to it. We shall only show how it is effected, leaving out of account how all the stations can communicate as in one circuit. The current, C_1 (fig. 6), from the sending-station enters the coil M, and goes thence to earth P, and returns as shown by arrow C_1. The instrument may record or not as required, but its doing so in no way interferes with translation. The copper pole C, of the battery CZ, is connected with the lever *l l'* of the register, and the zinc pole is to earth. When the lever is drawn down by the current C_1, it strikes against the point at the top of the pillar *p*, that checks its motion. The pillar *p* is joined to line L_2, running to the further station, and when the lever falls, a second circuit—viz., that of the battery CZ—is closed, in which C, the lever, the pillar, L_2, the further station, the earth, P, and Z are all included. Thus, as *l l'* prints at the intermediate station, it at the same time sends a new printing-current to the next. When it ceases to print, so does the instrument at the distant station.

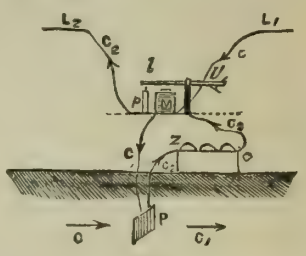
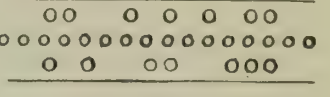


Fig. 6.

Wheatstone's Automatic Transmitter.—The speed of the ordinary Morse instrument is limited to the rapidity with which the hand of the operator can move the key, so as to preserve the proper spacing between the marks at the receiving instrument. We are indebted to Sir Charles Wheatstone for an apparatus which trebles, and in some cases quadruples the carrying capacity of a wire, securing, at the same time, mechanical accuracy in the relative size of the dots, dashes, spaces, &c. To effect this, three different instruments are required: First, there is a perforator, by which holes are punched in a paper slip to correspond with the signals required. The operator strikes three discs, the central one producing a central hole, which is of no avail electrically, only carrying forward the paper; the left-hand disc producing two holes, directly opposite to each other, on the sides of this central row; and that on the right producing two holes, placed diagonally to each other. The passage of the electric current is regulated by the position of the outer holes. Those opposite each other admit of a momentary passage of the current through the 'transmitter'—used in sending the message—while the holes diagonally placed produce a lengthened mark, corresponding to the dash. The following diagram represents the word 'and,' as shown on the punched slip:



As printed at the other end, this reads:

. — — . — . .
a n d.

The third portion of this instrument is the 'receiver,' in which the currents sent by the action of the punched slips in the transmitter are reproduced in the dots and dashes of the Morse code—the printing being, moreover, done with a mathematical accuracy which keying by hand cannot attain.

The speed of transmission depends on the length of line and state of the atmosphere; but the movement of the clock-work, both of transmitter and receiver, is capable of adjustment to any speed below 120 words per minute. When the Post-office took possession of the telegraphs in this country, the Wheatstone automatic instrument was in use at only four stations in the kingdom. It has since come into extended use; and one of its most successful applications is in the simultaneous transmission of news from London to a large number of towns. The punched ribbon is carried from one transmitter to the other, the circuit to Birmingham, Manchester, and Liverpool (on which the highest speed is attained) sending it first, and from that instrument it passes to

several others, each serving several towns. The adjustment of 'resistance,' by which a message is run off simultaneously at Edinburgh, Glasgow, Dundee, and Aberdeen by one sending from London (and so through the various transmitters, where this system of 'express news circuits' is adopted), forms one of the most interesting objects of study in the practical working of the telegraph in this kingdom. By combining the automatic transmission with Bain's principle of producing marks on chemically prepared paper, an American inventor has accomplished still higher speed, the lever action of the inkling disc (fig. 1) being saved.

Other Instruments.—All that has been said as to the battery, the earth insulation, &c., is applicable to nearly every instrument now in use; the exception being several magneto-electric instruments, such as Wheatstone's 'ABC,' in which the use of a battery is dispensed with, power being generated by two bobbins coiled upon an armature rotating continuously over the two poles of a permanent magnet. On the upper surface of this instrument is seen a circle of buttons corresponding to the letters of the alphabet, by means of which levers, arranged vertically in a circle, may be pressed down. These levers press a pitch-chain into a series of indentations on the periphery of a metal disc, the chain having sufficient slack, so that, when a second lever is depressed, the first must be raised. A series of currents, corresponding to the number of letters between each lever pressed down, is sent into the line, and operating on two little bent magnets, moves forward a ratchet wheel, having a pointer on the same axis which shows the letter on a dial card. In this way the message is spelled out letter by letter, and as the instrument gives not an arbitrary sign, but the letter itself, it is much used in private telegraphs and for the smaller post-offices throughout the kingdom. The non-recording instrument most used in this country (excluding private telegraphs) is the single-needle instrument of Cooke and Wheatstone. It consists of an upright galvanometer, with astatic needles, one of which moves within the coil, and the other upon the front of the dial. The needles are loaded at the lower end, to maintain them perpendicular when no current is passing. The instrument is worked by means of two keys, like those of a piano, a deflection of the needle to right or left being effected by depressing one or other of the keys. The signal is shown both on the sending and receiving instrument. The Morse alphabet is used, a deflection to the left corresponding to the dot, and one to the right representing the dash.

Acoustic Telegraphy.—Before the introduction of high-speed automatic instruments for the more important circuits, expert telegraphists in many cases dispensed with the reading of the printed slip, reading by the sound, which, by long practice, became a language perfectly intelligible to them. The great advantage of this was, that the use of the eye was obtained exclusively for the task of writing down the message. In Sir Charles Bright's 'bell' instrument, most admirable results, in point of speed, have been attained. The bells, different in sound, are placed at the two sides of an upright instrument, so that the clerk, bending forward to write, may concentrate his attention on that duty, translating in his mind the tinkle of the hammers as they ring out their message. The bells are now worked in the Morse code—the left bell a dot, and the right bell a dash; but when first introduced, the instrument had a code of its own, based on the desire to complete each letter as much as possible on one bell. A simpler acoustic telegraph has been brought into use in America (hence called the 'American Sounder') and in this country. This instrument is, shortly stated, the Morse without its wheel-work and ink-printing apparatus; and its whole construction is shown in fig. 1, omitting the inking disc. The use of the 'Sounder' has greatly increased in this country owing to its cheapness and efficiency. For a description of the type-printing and *fac-simile* instruments, on which great advances have been made of late years, we must refer our readers to the larger treatises on the telegraph and its history.

Duplex Working.—The fact that two currents may be sent simultaneously (one from each end) has been long recognized by electricians, but the principle of the duplex was revived and patented by Stearns, an American, in 1872. At first the duplex working was only tried on short circuits of 40 to 60 miles; but it has now become a matter of daily use on every busy circuit, long or short, both in this country and abroad. The principle of the duplex system is, that the current sent on the depression of the key is divided into two parts, one-half being carried through one pair of coils in a differential galvanometer to the line, and the other half through the other pair of coils to a resistance coil, and thus to earth. The resistance of the latter is made exactly equal to that of the line-wire, and the instrument of the sender being so placed that this divided current presses equally in each direction, this instrument remains unaffected, while the armature at the other end responds to the signal sent. At the same time, a telegraphist at the other end is sending a current, which is divided in like manner, and leaves his own instrument unaffected while operating on the armature of the first instrument. The two currents on the line-wire assist or oppose each other in such a way as to affect the equilibrium in the differential galvanometer, but each operates only on the distant instrument. Duplex-working led to *diplex*, that is, two messages passing over a wire in the same direction at once, and to this has followed quadruplex and multiplex telegraphy. Quadruplex working was first perfected in 1876 by Prescott, Edison, and Gerritt Smith, but the possibility of its being accomplished was suggested by Stark of Vienna, in 1855. It was introduced into Britain as a practical branch in 1878, and is now used from London to Liverpool, Dublin, and other towns. An illustration of the value of these additions to the wire power is afforded by a wire from Chicago to Pittsburg, 550 miles, which is quadruplexed, and at Pittsburg branches off in two duplex circuits to Baltimore and Philadelphia, giving Chicago duplex communication with these two places. In the same way Middlesborough and West Hartlepool have been duplexed to London, on separate wires as far as Leeds, and quadruplex on one wire thence to London.

Multiplex Telegraphy and 'Phantom' Circuits.—The most original feature of the telegraph section of the Paris Exhibition of 1878, was the Harmonic Telegraph of Haskins and Gray, based on principles laid down by Cromwell Varley in 1870. In one application it occupies a place midway between duplex and multiplex telegraphy, namely in the 'way duplex,' or as it was felicitously termed by the late Mr. Orton, the 'phantom circuit.' A wire may be occupied by the ordinary business of a series of intermediate offices, while there may be superimposed on that a through traffic (which can be duplexed) between the terminal stations. Thus between Chicago and Dubuque, a wire provides for seventeen intermediate stations, working ordinary Morse sounders, while the harmonic telegraph (the principle of whose action is vibratory currents sent and received by musical forks tuned in unison) works between the terminals. By an extension of this principle we have the multiplex telegraph, each fork taking off at the receiving end those vibrations corresponding to its own tone.

The Electric Pen.—Amidst many endeavors to introduce an autographic telegraph, that of Cowper, made public in 1879, is the most successful. It has the drawback of requiring two wires, but is so beautiful in its action as to deserve notice here. Two series of resistances are ranged like the letter L, one series affected by lateral, the other by the up-and-down motion of the sender's pen. At the other end, a siphon recorder moves in accordance with the currents thus sent, giving on a moving slip of paper an exact *fac-simile* of the writing or other marks of the person sending the message.

Statistics.—In Great Britain, the first public introduction of telegraphy was made in 1846 by the Electric and International Telegraph Company. Subsequently, the British and Irish Magnetic Company was established, and afterwards the United Kingdom Company, the last named being started on the footing of a low uniform rate, but eventually yielding to the opposition of the other companies, and adopting a sliding scale of rates. The charges were from 1s. to 6s., according to distance, for a message of 20 words. Besides these companies, there were the London District Company, the Universal Private Telegraph Company (which established a series of public telegraphs, connecting Glasgow with places on the west coast of Scotland), and a large number of railway companies, carrying messages between their own stations, besides acting as agents to collect business for the other companies. In 1868 and 1869, after some agitation of the question, acts were passed transferring the property of the telegraph companies to the Post-office, and giving that department a monopoly in the conduct of telegraph business within the kingdom. The task set before the Post-office was to reduce and simplify the charges, to separate entirely the public wires from wires used for railway purposes, to extend the telegraph to outlying places and to business parts of towns, and to establish free trade in press telegraphy—the meaning of the latter being that, instead of collecting and supplying news as the companies had done, the department should only arrange to transmit news, at specified rates, for all comers, leaving the newspapers to make their own arrangements for obtaining information. The great progress of telegraphy in the hands of the Postal Telegraphs Department is one of the social features of the time. Including a large number of new offices prepared for opening on the occasion, the Post-office started in 1870 with 1007 telegraph stations, with about 1900 railway stations receiving messages. In 1880 the number of offices belonging to the Post-office was 3924, making, when the railway stations are added, a total of 5331 offices. The railway offices only take in from the public 7 per cent. of the messages sent. The number of telegraphic messages sent in the year 1880–81 was 29,966,965.

The mileage of telegraphs increased between 1870 and 1880 from 5651 miles (48,990 miles of wire) to 23,156 (100,851 of wire), besides about 6000 miles of private wires, for which rents are paid to the department. The number of messages before 1870 was estimated as reaching six millions annually, and the following gives the totals for three years since the telegraphs passed into the hands of the Post-office.

	No. of Messages.	No. of Offices Open.	Weekly Average for each Office.
Year ended March 1871,	9,850,177	3926	46
" " 1873.	15,535,780	5540	53
" " 1878.	22,171,783	5311	80

These statistics show that the growth of business had been so large as to raise the weekly average over the whole number of offices, the closing of many small railway stations also helping this result. So far as the cost to the public is concerned, it is shown that, while under the *régime* of the companies the cost per message averaged 2s. 1½d., the cost under the Post-office reaches an average of under 1s. 1d., per message. Writing in May 1872, Mr. Scudamore, under whose direction the transfer and extension of the telegraph system was conducted, says: 'If the messages of the current financial year were to be paid for at the old tariff, they would cost the senders at least £400,000 more than they will cost.' The revenue for 1879—1880 was £1,469,795, including in this private-wire rentals, newspaper special wires, &c. The capital invested in the undertaking amounts to about ten millions sterling. The cost of working in 1877—1878 was £1,164,131: the staff consisting of 406 persons in the central control of the system (secretary's and accounting offices); 650 in the engineering department (for maintenance and extension of the system); a staff of 1770 in the central office at London; and the services of postmasters, telegraphists, &c., throughout the kingdom, making a total of above 11,400 persons engaged in the service. Of these, 4981 were messengers engaged in the delivery of messages, the larger portion of whom were supplied with uniform.

In addition to electric means of communication, the Post-office uses pneumatic tubes in London and other cities, to connect the larger branch offices with the principal station in each case. As those tubes, although forming an interesting branch of the apparatus, are not, strictly speaking, electrical, we must refer to other sources for information as to their construction, mode of working, power used, &c. The result of the transfer from private hands to the control of the government may be summed up in saying that for efficiency, comprehensiveness, and public appreciation, the telegraph system in Great Britain is now second to none in the world. The continent of Europe forms one vast network of telegraph lines. By means of submarine cables (as afterwards noticed), the offices in this country are connected with all the four continents, while recent extensions have brought the Australian colonies also into connection with the other sections of the globe. While each kingdom fixes its own internal tariffs and regulations, the rules for the interchange and transmission of telegraph messages between the various countries of the world, are regulated by telegraph conventions agreed to at Paris, Vienna, Rome, St. Petersburg, and London (the last named being held in 1879); and all official intimations in connection with international telegraphy are issued from a central bureau in Berne, Switzerland. To the mountain republic the world is indebted, not only for the example of an excellent and cheap internal system, but for the suggestion of this central administration, where all international matters are conducted. In France and Belgium internal telegraph arrangements are complete and cheap; while the United States of America for many years held a place far in advance of other countries in the ordinary every-day use of its great telegraph organizations. Perhaps the most striking instance of telegraph enterprise is that by which the daily newspapers of San Francisco are enabled to give, by means of a line of telegraph carried over the Rocky Mountains (on the line of the Central Pacific and Union Pacific Railroads), not only the news from New York, but the parliamentary news from London, the prices of all the continental exchanges, and quotations from Calcutta and China, of the previous day.

Submarine Telegraphy.—From the year 1850, when a copper wire insulated with gutta-percha, submerged between Dover and Calais, continued in use for one day, the progress of submarine telegraphy has been as remarkable as that of telegraphy on *terra firma*. Fig. 7 gives a view (full-size) of the Malta-Alexandria cable, laid in 1861, and continued in use till 1872, when, from repeated breakages in shallow water, its use was discarded. The different layers are peeled off to show the construction. C is a strand of seven copper wires; G, three layers of gutta-percha; H, a serving of tarred yarn; and I, eighteen iron wires constituting the sheathing. This was the first long cable successfully laid (its total length, in three sections, being 1331 miles); and it was also the first properly tested under water before being laid, and carefully constructed with constant watchfulness as to its electrical and mechanical conditions. This cable was thrown out of use because the chafing it underwent in shallow water made it too expensive in maintenance. So far as construction goes, it corresponds very nearly with Sir James Anderson's typical 'successful iron-covered cable.' With careful testing and supervision, and with the weight of cable, &c., duly proportioned to the strain, &c., a cable forms a permanent property of much value. A new form of cable, with lead as the conductor, has been suggested. In 1877, the task of duplexing a submarine cable was accomplished by Muirhead on the Aden and Bombay cable of the Eastern Telegraph Company, and the 'artificial line' or balance has been since applied successfully to other cables, including two crossing the Atlantic. In view of the enormous cost of submarine telegraphy, the attainment of a means by which the carrying capacity of a cable is nearly doubled, is of vast importance.

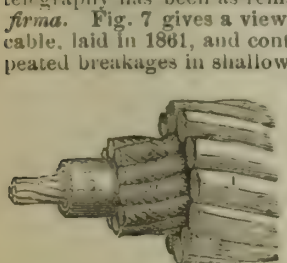


Fig. 7.

In 1877, the Marseilles-Algiers cable, belonging to the French system, was duplexed by M. Ailhaud. The *Journal Télégraphique* gave in 1877 a list of 149 cables belonging to companies, and 420 belonging to government systems, existing at that date. In point of number, Norway stood first, with 193 cables, but the total length of these is only 233 nautical miles. The total length of the 420 government cables was 4442 nautical miles, of which Britain possessed 49, measuring 1338 miles. The longest of these (excluding cables to the continent) is to Guernsey 70, and to Shetland 63 miles. The company cables (of which 96 per cent. had their administration in London) measured 59,547 nautical miles. The longest cable is that from France to America, 2585 nautical miles, and the largest organization that of the Eastern and Eastern Extension Companies, embracing 48 cables of a total length of 21,883 nautical miles, to which since 1876 several thousand miles have been added in new routes or duplicate cables. In 1879, Great Britain was connected with Europe by eighteen cables, and with Ireland by five cables. From Europe to America seven cables crossed the Atlantic (five from Ireland, one from France, and one from Portugal to Brazil). A cable from Nagasaki to Shanghai joins the internal system of Japan with the outer world; while by cables of 557 miles from Singapore to Batavia, and 1082 miles from Java to Australia, and by the East African cable from the Cape to Aden, the distant colonies are brought into the telegraph system of the world. In 1882 was completed a submarine line, 3100 miles in length, between Lima and Vera Cruz in Mexico, crossing the isthmus of Tehuantepec by a land line of 220 miles; it thus connects the South American Pacific coast with the United States.

See works on *Practical Telegraphy* by Culley, Sabine, Preece and Siveright, &c.; *Journal of the Society of Telegraph Engineers;* Sir James Anderson's Lecture before the Statistical Society, London, June 1872; Mr. Scudamore's Reports to the Postmaster-General, 1870 and 1872; Estimates for the telegraph service, laid annually before Parliament; &c.

TELE'MACHUS, son of Odysseus (see ULYSSES) and Penelope (q. v.), was an infant when his father left home to join in the war against Troy, but during the latter's long absence of about 20 years grew into manhood. At the instigation and under the guidance of Athene (Minerva), who had assumed the appearance of Mentes (commonly known as Mentor, Lat. 'the thoughtful one'), king of the Taphians, his father's dearest friend, T. set out in search of his long-lost sire, after having vainly endeavored to eject his mother's troublesome suitors from the house. Having visited Pylos and Sparta, at both of which places he was most hospitably entertained, T. returned home to Ithaca, where he found his father in the guise of a beggar, living with the swineherd Eumæus. After mutual recognition, father and son proceeded to slay the suitors. In modern times, T. is known chiefly as the hero of Fénelon's (q. v.) romance, *Télémaque*, once very popular as a school-book.

TELEO'LOGY, the doctrine of ends, is derived from the Greek *telos*, an end, a word brought into philosophic discussion by Aristotle. The idea of an end entered into the Aristotelian conception of physical science, but more properly into ethical science or morality. All the ancient sytems of morality, from Socrates downward, correctly regarded it as a *practical* science; they started with the inquiry, 'What is the proper and final end of all human conduct?' and the answer given by each school was the characteristic doctrine of the school. Aristotle answered, 'Happiness, in a peculiar sense;' the Stoics said, 'A regard to the whole universe of being;' the Epicureans, 'Pleasure and the absence of pain.' John Stuart Mill, in the concluding chapter of his *Logic*, entitled, 'The Logic of Practice, or Art; including Morality and Polity,' adopts the ancient point of view, and observes that there should be a science of ends, or a reasoned statement of the final purpose of all human action; for this science he suggests the name Teleology, remarking that it corresponds to what the Germans call the practical reason. There would be comprehended under it, the art of living or happiness, taste or the beautiful, morality, and politics. See CIVILIZATION. The word Teleology is applied to the argument from design in proof of the Deity. This is in keep-

ing with Aristotle's employment of the word in physics. When a natural philosopher assigns the purpose or end of any natural arrangement, as the offensive or defensive weapons of an animal, he is said to give a teleological explanation.

TELEOSAU'RUS, a genus of fossil crocodiles, the remains of which occur in the Oolitic rocks. They are found associated with marine fossils, and the peculiar modification of their skeleton seems to have specially fitted them for an aquatic life. Both surfaces of the vertebræ were slightly concave, the hind-legs were large and strong, and the anterior portion of the body gradually tapered into the long and slender jaws, giving the animal the aspect of the gavial of the Ganges, only the jaws were more attenuated, and the nasal aperture, instead of being oblique, opened vertically on the truncated end of the upper mandible. The jaws were armed with numerous equal and slender teeth, slightly recurved, and admirably adapted for the capture of fishes, with which the Oolitic seas abounded. No less than twenty species have been described, and these present so many striking differences, that they have been arranged under six sub-genera.

TE'LEPHONE. This instrument is designed to convey sounds to a distance by means of electricity. In 1860, Reis of Frankfurt first recognized the principle of the T., using a membrane which, vibrating under the action of sound, caused pulsations of electricity to pass along the wire, and actuated the armature of an electro-magnet, which, mounted on a sounding-board, reproduced a sound corresponding in pitch and rhythm with the original. The quality of the sound was however entirely lost. There are several claimants for priority in the discovery of the principle of the articulating T., and the discoveries of Gray of Chicago, and Graham Bell, an Edinburgh gentleman resident in America, appear to have been nearly contemporaneous, and attained by different lines of study. The articulating T., of Bell, which was first shown at the Philadelphia Centennial Exhibition, is now of very simple construction. A small bar magnet, with a coil of wire round one end, is placed close behind a diaphragm of ferrotype, the whole being enclosed in a case furnished with a mouthpiece. Words spoken into the T. are reproduced faithfully on a similar instrument at great distances, and by the use of the Microphone (q. v.), the most minute sounds have been distinctly heard and even magnified. Many extraordinary results have been achieved in conveying and reproducing sounds, and self-caught sounds from 'induction' in the wires have produced interesting results. While the T. is already very largely used in America for domestic and business communication, it has been less successful in Britain, the busier lines increasing the difficulties arising from induction. Three requirements appear to be demanded to bring the T. into general use—namely, a simple and reliable call or *avertisseur*, an increase of the sound to render it unnecessary to hold the T. to the ear, and the removal of induction currents. Various methods for accomplishing each of these ends have been proposed, but the difficulties are not yet wholly overcome. A controversy exists whether the sounds in the receiving T. are vibratory or molecular, or a combination of both.

TELE'PHORUS, a genus of coleopterous insects, of the suborder *Pentamera*, and section *Serricornes*. The body is long, narrow, depressed, soft, and somwhat flexible. The species are numerous, and some of them abound in Britain in summer, chiefly in meadows and pastures. The larvæ dwell in moist earth, and devour small insects and their larvæ. The perfect insect feeds on similar food.

TELE'RPETON, a remarkable genus of fossil reptiles, the relics of which have been found in fine-grained whitish sandstone quarried at Cummingston, near Elgin. A single species, or rather a single specimen, is all that has as yet been detected. It exhibits the skeleton complete, with the exception of the termination of the tail, but the bones have disappeared, and left only the casts as dark-colored cavities in the pale gray rock. Nearly perfect casts of their form were taken by Dr. G. Mantell from these hollow casts. The impressions are so well defined as clearly to show that there were twenty-six vertebræ between the skull and the sacrum two sacral vertebræ, and the portion of the tail preserved on the slab consists of thirteen others. The ribs, of which there are twenty-one pair, are very slender; they are short near the head, but quickly lengthen as they leave it. The reptilian nature of this fossil is evident. By Dr. Mantell it was considered to be a batrachian, and described as *Telerpeton Elginense;* but Professor Owen has more correctly referred it to the lacertine type, because of the numerous ribs, the structure of the sacrum, and the form of the pelvis. He has named it *Leptopleuron lacertium.* It has been matter of debate whether the rocks in which the T. was found belong to the Old Red Sandstone measures or to the Trias.

TE'LESCOPE (Gr. *tele-skopos*, far-seeing) consists essentially of a lens or mirror, to form, within our reach, an image of a distant object; and a Microscope (q. v.), to examine this image in detail. Its invention is ascribed to various individuals living about the end of the 16th c.; but there is no doubt that Galilei (q. v.) was the first to apply it to any purpose other than the gratification of mere curiosity.

The space at our disposal will not allow of our entering into any minute details, so we propose to give, *first*, a general idea of the mode in which a telescope acts, in the course of which we shall incidentally show how the magnifying power and the brightness of the image depend on the dimensions of the various parts of the instrument; *second*, to point out the various causes of imperfection, which in all telescopes are unavoidable, and how these are reduced to as small an amount as possible; *third*, to mention the most important of the many forms which have been devised, and the processes by which these delicate instruments are practically constructed.

When a lens is employed, as in a camera obscura, to form an image of an object, as AB in fig. 1, the distance of the image from

Fig. 1.

the lens depends on the focal length of the lens, and also on the distance of the object. Practically, with telescopes, the distance of the image from the lens is, on account of the remoteness of the object, the focal length of the lens. Also the image of any point, A, of the object lies in the prolongation of the line joining A with the center, C, of the lens. Join AC, and produce it to *a*, C*a* being made equal to the focal length of the lens, *a* is the point at which the image of A is formed. Similarly at *b* the image of B is formed.

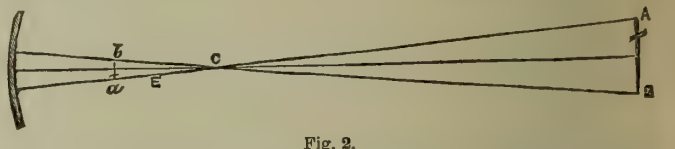


Fig. 2.

Thus the image is *inverted;* and, seen from C, the image and the object subtend equal angles, or look equally large. When a concave mirror forms an image, the effect is as in fig. 2, where C is now the center of the sphere of which the mirror is a portion. When the object, AB, is at a great distance, the image, *ab*, is *inverted*, and is formed half way between C and the mirror. As before, object and image subtend equal angles at C. In order to see these images, the eye must be placed at some such point as E in each of the figures.

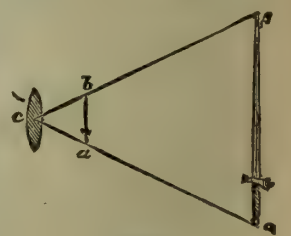


Fig. 3.

So much for the formation *within our reach* of an image of a distant body. We must next show the action of a lens when employed to magnify this image. When an object, as *ab* in fig. 3, is placed rather nearer to a lens than its focal length, rays which pass from the object through the lens appear to have come, not from the object, but from an enlarged image as $a\beta$, at a greater distance from the lens—but subtending, as before, the same angle at the center, *c*, of the lens. In practice, the lens is so adjusted as to form the image, $a\beta$, at a distance of about ten inches from *c*, in which case the eye sees it most distinctly, and the distance of *ab* from the lens is then (practically) the focal length of the lens.

We now combine the first and third diagrams, and we have the *Common Astronomical Telescope.* The magnifying power is obviously to be measured by the increase in the angle which is subtended by the image, $\alpha\beta$ (fig. 4), over that which is subtended by

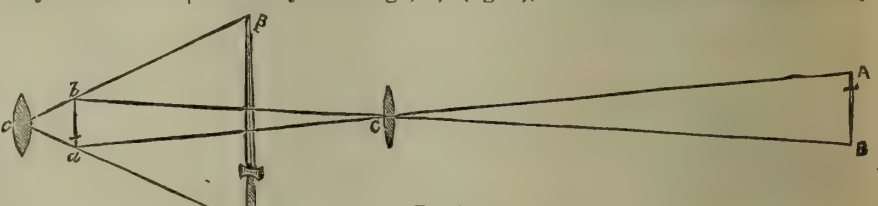


Fig. 4.

the object, AB. The angle at C is the measure of the apparent size of the object; that at *c*, of the apparent size of the image. And it is easy to see from the quadrilateral C*acb* in the figure that these angles are inversely as the sides C*a* and *ac*. (For instance, if C*a* have six times the length of *ac*, the angle at C will be only one-sixth of that at *c*.) Hence the magnifying power is to be

found by dividing the focal length of the object-lens by that of the eye-lens. In practice, the lenses are so mounted in tubes that their distance may be increased or diminished at pleasure. When the object, AB, comes nearer the observer, its image, *ab*, is formed *further* from the lens C. Hence, for near objects, the telescope requires to be pulled out. Again, the distance of most distinct vision differs for different people, so that even when AB is at a fixed distance, short-sighted and long-sighted eyes require the eye-lens to be removed from, or advanced to, *ab*, so that for each eye $\alpha\beta$ may be formed at the distance at which it can be most distinctly seen.

To estimate the relative brightness of the image and object, suppose, for simplicity, all the light which enters the telescope from the object to reach the eye. Then the quantity of light which enters the eye from the image, is greater than that which would enter the unaided eye from the object, in the ratio of the aperture of the object-glass, C, to the apertue of the pupil of the eye. But it is spread over a magnified image. If the image be as much larger than the object as the object-glass is larger than the pupil of the eye, the object and image will appear equally bright. Taking the aperture of the pupil as $\frac{1}{10}$th inch, the object-lens would require an aperture of 10 inches, with a magnifying power of 100 times, in order that brightness should not be lost. Practically, the most formidable difficulty in attaining very high magnifying powers, is that due to the enormous sizes of lenses and mirrors which are required to give the necessary brightness to the enlarged image. It is easy to see that it is impossible to render the final image brighter than the object, by any increase of dimensions in the object-lens.

After what we have said about the common astronomical telescope, the reader will have no difficulty, from a combination of figures 2 and 3, in understanding the construction of the Newtonian or Herschelian reflecting telescope.

We proceed to the second part of our proposed scheme of treatment of the subject, viz., the unavoidable imperfections of the telescope, and their reduction to a minimum.

In the first place, then, even with a mirror—where we are not annoyed by the breaking up of white light into its component colors, since the Law of Reflection (q. v.) is the same for all rays—it is impossible to form a perfectly sharp image of more than *one* definite point at a time. In order to do even this, the mirror must be formed as part of the prolate spheroid produced by the rotation, about its longer axis, of an Ellipse (q. v.), one of whose foci is the object-point, the other the image. If the object-point be, like a star, practically at an infinite distance, the requisite form of the mirror is that formed by the rotation of a Parabola (q. v.) about its axis. The axis of the mirror must then be directed to the object-point, and all rays from it will, after reflection, pass accurately through the focus. But this is not strictly true for any other object-point in the field of view, although so nearly true that no inconvenience is practically found to result from it. But, if the mirror used be part of a sphere, no point can be found such that rays diverging from it shall all be brought after reflection accurately to one point of the image; and this defect, called *Spherical Aberration*, increases proportionally to the surface of the mirror; so that by increasing that surface, for the attainment of brightness, we increase proportionally the indistinctness of the image. To give an idea of the delicate manipulation required in the construction of a reflecting telescope, we take the case of a speculum of 4 feet aperture and 40 feet focus, as calculated by Sir J. Herschel. If this be first ground to a truly spherical form, it must have a radius of 80 feet, as we have seen above. Now, such a mirror will give a very indistinct image, even under the most favorable circumstances; yet to grind it to the parabolic form, which is practically perfect, leaving the middle untouched, and grinding more and more away from its surface as we proceed outwards to the edges, even at the edges we have to remove a film of metal of only the $\frac{1}{81,818}$d part of an inch, somewhere about the $\frac{1}{100}$th part of the thickness of the paper on which this is printed!

Lenses, whether the object-lens or the eye-lens, have this defect also; but, as a rule, the spherical aberration in lenses is almost negligible compared with *Chromatic Aberration*, which arises from the different refrangibilities (see REFRACTION) of the various colored rays; and leads to the formation, by a lens, of a separate image of a bright object for each colored ray. The remedy consists in *achromatizing* (see ACHROMATIC, REFRACTION) the lens,—i. e., forming it of two or more lenses of different kinds of glass—so that the colors, separated by one, shall be reunited by the others. With a double achromatic lens, in which a convex lens of crown-glass is united to a concave of flint-glass, the focal lengths of the separate lenses can be easily adjusted so as to bring, when in combination, any two assigned rays of the Spectrum (q. v.) simultaneously to a focus; and, by a judicious selection of these two rays, we may reduce the consequences of irrationality of dispersion (see REFRACTION) to a minimum. But this is not all. To construct a lens of a given material which shall have a given focal length, is an *indeterminate* problem; we may assign the curvature of either surface at pleasure, and then that of the other is definite, and can be calculated. Thus, the achromatism of a double-lens can be secured in an infinite variety of ways, and we may impose further conditions; i. e., that the curvatures of the convex and concave surfaces shall be adjusted so as to destroy as far as possible the spherical aberration. Other imperfections, such as those due to DIFFRACTION (q. v.), &c., cannot be here more than alluded to, as they do not admit, within any reasonable limits, of being popularly explained. Nor can we enter upon questions connected with the correction of chromatic and spherical aberrations in eye-pieces, which is effected by the combination of two or more lenses (generally of the *same* material) placed at a certain distance from each other. We may only mention that the defect (for terrestrial purposes) of the common astronomical telescope, the inversion of the image, is overcome by combining two such telescopes, the smaller to examine the image formed by the larger, and therefore to reinvert it. This practically comes to constructing the eye-piece of three lenses at a distance from each other; though, for greater distinctness, four are usually employed.

In the earliest, or Galilean, telescope, the eye-lens is concave; a construction only now used in opera-glasses. It has far less chromatic and spherical aberration than the common astronomical telescope, and is shorter, since the distance between the lenses is the *difference*, not the *sum* of their focal lengths; but it has a very serious defect in the smallness of its field of view. This can only be enlarged, as in opera-glasses, by making the diameter of the object-lens disproportionately great.

Before the discovery of the possibility of forming an achromatic lens, Huyghens, Cassini, and others, had endeavored, by enormously increasing the focal length of the object-glass of the common astronomical telescope in propertion to its diameter, to get rid as far as possible of chromatic aberration. This was called the *aërial* telescope, as the object and eye lenses were mounted separately on stands; the tube (which would have been 100, 200, or even 600 feet long) being dispensed with. Valuable work was done with some of these telescopes) of 125 feet focus, but the longer ones proved unmanageable. The principle involved in these constructions is, practically, the throwing the magnifying power more on the object-lens than on the eye-lens; as the image formed by the former was still so imperfect as not to bear much additional magnification; although achromatic eye-pieces could even then be made with one kind of glass. The great step required for shortening the unwieldly instrument was therefore the perfecting of the object-lens. We have already seen how this was effected. Various very ingenious improvements on achromatic combinations, even yet (we should be inclined to think) worthy the consideration of opticians, were devised by Dr. Blair. He obtained in solutions of mercury or antimony in hydrochloric acid, media, in which, while much more refractive and more dispersive than crown-glass, no irrationality of dispersion as compared with crown-glass could be detected. With these fluid lenses he was enabled to give the telescope an aperture of $\frac{1}{8}$d of its focal length without a trace of residual color.

The *dialytic* telescope, invented in 1828 by Mr. Rodger, and since made by Plössl, seems to promise very well. Its object is to obtain a large aperture for the telescope with a flint-lens (the obtaining of which, in large and perfect discs, is the great difficulty) of moderate size. In this telescope the object-lens is single, and of crown-glass; having, of course, all the defects of the single lens. These are corrected, at some distance in the cone of converging rays, by the interposition of a combination of a pair of much smaller lenses, whose focal lengths are equal for red rays; the first being a convex lens of crown, the second a concave of flint, glass. The adjustments of this instrument for exact correction are, a motion of the pair of lenses to or from the object-lens, to correct chromatic aberration; and a change of the distance between the two smaller lenses, to correct spherical aberration.

Chromatic being so much more serious than spherical aberration, it is not to be wondered at that the idea of substituting an object-mirror, in which the former is absent, for an object-lens, was early suggested. The first practicable scheme for the purpose seems to have been that of Gregory; in which, however, two mirrors are employed. In the skilful hands of Short, this instrument completely superseded the ordinary astronomical telescope. Its chief defects are, the great loss of light by two direct reflections, and the increase of the spherical aberration by the fact that both mirrors are concave. The first defect is incurable, the second was partially overcome by Cassegrain's plan of using a small *convex* mirror for the second reflection. To Newton is due the simple idea of using the combination of a single curved mirror with a plain mirror and an eye-piece; a construction differing only in slight particulars from that now universally adopted for reflecting instruments. Newton constructed several such telescopes with his own hands, some of which are still preserved, as in the apartments of the Royal Society at Burlington House.

The elder Herschel constructed for himself all the instruments, gradually increasing in magnitude and optical power, by means of which he made his grand discoveries; and his son worthily succeeded him, both as constructor and observer.

The gigantic telescopes of Lord Rosse and Mr. Lassell are wonderful examples of delicate art, and have had their full share, with the large achromatics of the present day, in the startling discoveries of modern astronomy.

The process of Liebig for depositing on glass an exceedingly thin film of silver, which, by careful polishing, can be rendered more highly reflective than any other material, has been taken advantage of by Steinheil in the construction of large specula. This is an immense step, since any disc of glass will do, its optical properties not being employed; while, if it be once brought to a true parabolic figure, the silvering may be renewed as often as may be required. One of the great difficulties in the construction and working of large reflectors has hitherto been the casting and annealing of metallic masses of a few tons' weight. This, in the silvered specula, is entirely avoided. We cannot here enter into a description of the processes, often extremely ingenious, which have been devised for the grinding, figuring, and polishing of lenses and specula. The reader who desires strictly scientific information, conveyed in a thoroughly popular form, on this and all other points connected with the subject, is referred to Sir John Herschel's article 'Telescope,' in the *Encyclopædia Britannica*, to which we have been largely indebted, and which has been reprinted in a separate form.

TELFORD, THOMAS, an eminent engineer, was born in the parish of Westerkirk, in Eskdale, Dumfriesshire, 9th August 1757. His father was a shepherd; and during the intervals of his attendance at school, young T. followed the same occupation, diligently employing his leisure moments in the perusal of whatever books were within his reach. At the age of 14, he adopted the trade of a stone-mason; and long years afterwards, when he had attained the summit of his profession, he confessed the advantages which he derived during this period from 'the necessity of making himself acquainted with every detail in the procuring, preparing, and employing of every kind of material, whether it be the produce of the forest, the quarry, or the forge.' In 1780, he removed to Edinburgh; and in 1783, he repaired to London, obtaining employment under Sir William Chambers, who was then engaged on his chief work, the erection of Somerset House. T.'s merits attracted the notice of his employer, and he was appointed in 1784 to superintend the erection of the resident commissioner's house at Portsmouth dockyard, a work which lasted over three years, and afforded T. the opportunity, of which he fully availed himself, of mastering the details of construction of docks, wharf-walls, &c. In 1787 he was appointed surveyor of public works for Shropshire; and his two bridges over the Severn at Montford (3½ miles west-north-west of Shrewsbury) and Buildwas (1½ miles west of Coalbrook Dale), a large number of minor bridges, and other county works, testified to the genius and industry of the rising engineer, and gained for him the planning and superintendence of the projected Ellesmere Canal, 103 miles in length, to connect the navigation of the Severn, Dee, and Mersey—a work which occupied ten years (1795—1805), and greatly added to the already eminent reputation of Telford. In 1790, he was appointed by the British Fishery Society to inspect the harbors at their various stations; and in 1801 he received a commission from government to report on the state of Scotland, and on the desirable public works for that country. As a consequence, the plan of a canal from Inverness to Fort-William was revived, and its planning and construction intrusted to T. (see CALEDONIAN CANAL).

In the same capacity of engineer to the parliamentary commission of roads and bridges for Scotland, he executed more than 1000 miles of road in the Highlands, Lanarkshire, and Dumfriesshire (see ROAD-MAKING), and erected about 1200 bridges, besides churches, manses, harbors, &c. In 1808, and again in 1813, he was invited to Sweden, to report on the projected scheme for connecting Lake Wener with the Baltic, and superintended the construction of the Gotha Canal, by which this was effected, receiving on his departure numerous and valuable marks of the royal approbation. His next great work was the construction of the road from London to Holyhead, including the erection of numerous bridges —among others, of the Menai *Suspension Bridge* (q. v.)—and the last was the execution of the St. Katharine's Docks in London, a work of remarkable merit. His other works are far too many to enumerate. We can only afford to state that, of bridges, the Conway (q. v.), the Broomielaw at Glasgow, the Dean in Edinburgh, the Over at Gloucester (an innovation on the ordinary form); of canals, the Glasgow and Paisley, the Macclesfield, the Birmingham and Liverpool Junction, the Gloucester and Berkeley, the Weaver system, the great tunnel (1¾ miles long) on the Trent and Mersey; of harbors, Peterhead, Banff, Fraserburgh, Fortrose, Cullen, and Kirkwall—were planned by this indefatigable genius, and wholly or partially erected under his superintendence. He was much employed by parliament to report on all public engineering schemes or works of importance, and was also occasionally consulted by the Russian government. For the last few years of his life, he retired from the active duties of his profession, employed himself in collecting and arranging materials for a complete history of his various works, and had the greater portion of the MS. ready when he was seized with a severe bilious attack, and died at Abingdon Street, Westminster, 2d September 1834. His life, entitled *The Life of Thomas Telford, Civil Engineer, written by himself*, was published in 1838, in 1 vol. 4to, accompanied with a companion volume of plates. While a mason in Dumfriesshire, he was known favorably as a writer of short poems, in the homely dialect of his district, which are to be found in the appendix to his autobiography. He completed his imperfect school education during the intervals of business, becoming an excellent linguist, and contributed to the *Edinburgh Encyclopædia*. He was elected a member of the Royal Society of Edinburgh in 1803, and of its more eminent southern sister in 1827.

TELL, a district in the extreme north-west of Africa, stretches along the shores of the Mediterranean, and comprehends the corn-growing tracts extending south from the Mediterranean to the Atlas Mountains, and from west to east through Morocco, Algeria, and Tunis. The T. is noticed under the articles AFRICA and SAHARA (q. v.).

TELL, WILLIAM, was, according to Swiss tradition, a patriot who, in the 14th c., rescued his native district from the tyranny of the House of Austria. His story has been variously told, but that version which has found the widest currency is the following. In the beginning of the 14th c., Albert I. of Austria was striving to annex the three Waldstädte, Uri, Schwyz, and Unterwalden, to his family estates. Hermann Gessler, his bailiff (or *Landvogt*), lived at the castle of Küssnacht, and perpetrated on the people of the district the most atrocious cruelties. A league was formed of the principal men of the Waldstädte to resist the Austrian pretensions, and to it belonged Walter Fürst and William Tell, his son-in-law. Among other acts of tyranny, Gessler placed the ducal hat of Austria on the top of a long pole, erected in the market-place of Altorf, and gave orders that no one should pass without uncovering his head. T. and his little boy one day took no notice of the hat, and were at once dragged before Gessler. He, hearing that T. enjoyed great reputation as a cross-bowman, resolved to make his skill a means of punishing him. He was ordered to shoot an apple from his son's head, and told that if he missed it, he should die. To the amazement of all present, he hit the apple without injuring the child. But this did not satisfy Gessler. Turning to T., he asked him what he meant to have done with a second arrow he had in his girdle. 'To have shot you, if it had slain my son,' was the reply. T. was then seized, bound, and thrown into a boat on the Lake of Lucerne, to be taken with Gessler and his men to the castle of Küssnacht. A sudden Alpine storm sprung up. T. was the only man on board who knew the shore, and could manage a boat in such weather. He was allowed to take the helm, and he soon ran her towards a rocky ledge; he there seized his bow and arrows, sprang on shore, and pushed the vessel back into the water. The storm, however, abated, and Gessler and his party landed. T. lay in wait for them in a rocky defile, and as they passed, he shot Gessler through the heart. This befel in 1307 and was followed by the great Swiss war with Austria—the first of a series which lasted till 1499—in which however, T. took no prominent part. T. was drowned, it is added, in 1350, in attempting to save a friend during a great flood of the river Schächen.

There is evidence that, in 1387, a religious service was instituted to commemorate the act of T. at the place where he lived; and that, in the following year, Tell's Chapel was built on the spot where the boat was said to have landed. Russ and Etterlin, chroniclers who lived towards the end of the 15th c., told his story as true history. Tschudi, who wrote in the first part of the 16th c., repeated it in the form in which it is now familiar to us, and in which it was adopted by Schiller, in his well-known drama. So early as the end of the 16th c., however, doubts were expressed of its authenticity. Guilmann, who wrote a book, *De Rebus Helveticis*, called in question the very existence of Tell. What, he asks, has become of his family and relatives? Why was he not spoken of by his contemporaries? Grasser, the author of a Swiss *Heldenbuch*, pointed out a striking resemblance between T. and Toke, the hero of an old Scandinavian fable, recorded by Saxo Grammaticus. From that period, incredulity became general, and several books were published to show that the story was legendary. One of these, *Guillaume Tell; fable danoise*, was burned by the public hangman at Uri, and then a patriotic feeling was manifested on the subject, which, it is believed, made Swiss writers, including J. von Müller the historian, cautious in expressing farther doubt. Voltaire, in speaking of T., makes the remark, that '*l'histoire de la pomme est bien suspecte*,' and asserts that no

part of the tale had a foundation in fact. His opinion became known all over Europe; and since then, a whole library has been published on the story of T., in Switzerland, Germany, Denmark, and France. The most important works, however, bearing on the question, are (1) Ideler's work, *Die Sage vom Schusse des Tell*, published at Berlin in 1826, in which it is shown that the incident of the apple is purely legendary; (2) an edition of Russ's Chronicle, edited in 1834, by M. Schneller of Lucerne, in which it is proved that serious disparities exist between the different versions of the story as told by the Swiss chroniclers; and (3) a work containing a series of documents relating to eary Swiss history, published in 1835 by M. Kopp, also of Lucerne, in which it is as satisfactorily shown that, although a continuous series of charters exist relative to the bailiffs of Küssnacht in the 14th c., there is no Gessler among them.

T. is nowhere mentioned in contemporary records; but it need not, therefore, be inferred that an obscure peasant did not exist of the name, who shot an Austrian bailiff on the banks of the Lake of Lucerne, who by this act caused a revolt, and who lost his life in attempting to save that of a friend. If such incidents really occurred—and from the early foundation of Tell's Chapel, and other facts connected with it, we must presume they did—it would be easy to explain how they became connected with the old fable of the tyrant, the bowman, and the apple.—Ample information on the Tell controversy will be found in Hisely's *Recherches* (1843); and Vischer's *Die Sage von der Befreiung der Waldstädte* (1867).

TELLEZ, GABRIEL, better known by his literary pseudonym of *Tirso de Molina*, a Spanish dramatist of great reputation, was born at Madrid in 1585, became a monk in 1620, and died in 1648, prior of the order to which he belonged. T. was a friend and pupil of Lope de Vega, whom he almost rivaled in facility of execution. In the preface to his *Cigarrales de Toledo* (1621), a collection of novels and comedies, he reckons the number of the latter composed by him at 300; of which, however, only 68 have come down to us. Besides these, he wrote several Interludes, a great number of *Autos Sacramentales*, an *Acto de Contricion en Verso*, and a *Genealogia de los Condes de Sástago* (Mad. 1640). T. ranks next to Calderon and Lope de Vega as a dramatist. Although he generously affected to consider himself only a follower of the latter, he is really one of the most decisively original geniuses of his country, and imitated Lope in nothing except in cultivating the same national spirit in literature. His plays, deficient in artistic conception, are full of dramatic vitality. The 'situations' are numerous and captivating; the delineation of character fresh, piquant, and vigorous; the wit abundant, and the language richly poetical.—The best edition of T.'s works is that of Don Juan Eugenio Hartzenbusch, in the *Teatro Escogido* (12 vols., Madrid, 1839—1842).

TELLICHE'RRY, a seaport town and military station of British India, in the district of Malabar, 90 miles south-west of Seringapatam. The site of the town is very beautiful, and the neighboring country highly productive, the low lands producing two, and in some cases three, crops of rice in the year. The cocoa-nut tree also grows in great abundance, and is put to many uses by the inhabitants. On account of its salubrity, T. has been called the Montpellier of India. There is a natural breakwater, abreast of the fort, formed by a reef of rocks running parallel to the shore, having a depth within suitable for ships of 500 or 600 tons. Pop. (1871) 20,504.

TELLING FORTUNES is a criminal offence when accompanied with begging of money or with fraudulent objects. Every person going about pretending or professing to tell fortunes, or using any subtle craft, means, or device, by palmistry, or otherwise, to deceive and impose on Her Majesty's subjects, is deemed in law a rogue and vagabond, and may be committed to the house of correction for three months, with hard labor, by a justice of the peace.

TELLI'NIDÆ, a family of lamellibranchiate molluscs; having the mantle widely open in front; the foot tongue-shaped; the siphons separate, long, and slender; the shell usually equivalve and shutting close, the hinge toothed. The species are very numerous, and are found in almost all seas, mostly living in sand or sandy mud, some of them at a considerable depth. The fossil species are also numerous, and are found in the more recent formations. The genus *Donax* belongs to this family.

TELLU'RIUM (symb. *Te*, equiv. 64—new system, 128—spec. grav. 6·183) is a chemical element, which some authorities place among the metals, and others among the non-metallic bodies or metalloids. Although in its outward characters it closely resembles the metals, its close analogies with sulphur and selenium indicate that its true place is amongst the metalloids. It possesses a high metallic lustre, and resembles bismuth in color; it fuses at about 850°, and at a higher temperature is converted into a yellow vapor; it is a bad conductor of heat and electricity. When strongly heated in the air, it burns with a blue flame, and gives off white fumes of tellurous acid. Like sulphur and selenium, it is soluble in cold oil of vitriol, to which it gives a fine purple-red color, and on dilution it is precipitated unchanged; and in these respects differs from all metals. In nitric acid it dissolves with oxidation.

Tellurium forms two compounds with oxygen, viz., *Tellurius acid*, TeO_2, and *Telluric acid*, TeO_3. *Tellurous acid* exhibits very slight acid properties, and in the anhydrous state it combines with acids, and acts the part of a weak base. These salts have a metallic taste, and are said to act powerfully as emetics. The *telluric acid* has only a feeble affinity for bases, but it forms salts, which contain 1, 2, and 4 atoms of the acid to each atom of base. Tellurium unites with hydrogen to form telluretted hydrogen, TeH, which is a gaseous body, analogous to sulphuretted hydrogen, and precipitates most of the metals from their solutions in the form of tellurides, which have a close analogy with the corresponding sulphides.

In experimenting upon the action of the salts of tellurium, it has been found that they possess the power of forming, in the body of a healthy person, compounds which impart to the breath, to the perspiration, and to the gases generated in the intestinal canal, a disgusting fœtor, which makes him a nuisance to every one he approaches; and this smell may last for weeks, although the quantity of tellurium that was administered did not exceed a quarter of a grain.

Tellurium is a rare substance, found chiefly in Transylvania, but recently discovered in Hungary, in North America, and in the Altaï silver mines. It sometimes occurs native, but more commonly as a telluride of gold, lead, or silver. For the method of extracting it, we must refer to any of the larger works on chemistry, and especially to the *Lehrbuch* of Berzelius. It was discovered in 1782 by Müller von Reichenstein, but it was not till 1798 that its properties were accurately studied by Klaproth. The word tellurium is derived from the Latin *tellus*, the earth.

TEMBU (Abatembu, or Tambookie) is the name of an important tribe of Kaffirs, occupying the region east of the present boundary of the Cape Colony, where it forms the eastern limit of the district of Queenstown, formed by Sir Harry Smith in 1849—1850, a rather elevated plateau, from which flow the headwaters of the Kei, Bashee, Tsomo, and other important rivers. They number about 90,000 souls, and are of a less warlike and predatory nature than the adjoining tribes of the Amaxosa and Amagaleka Kaffirs. In the earlier Kaffir wars, and even in the great one of 1835—1836, the Tambookie Kaffirs remained neutral, and even friendly to the colonists; but in the war of 1848—1849, they were induced to join the other tribes, and were defeated with great loss by a small colonial force. In the war of 1851, they were much broken and scattered; but eventually submitting to the British authority, they have quietly located themselves in the unoccupied country east of the White Kei and Tsomo rivers, a good pastoral region, but rather bare of wood. Wesleyan missionaries have several stations amongst the Tambookie tribe, and many of them exhibit very pleasing features. A British resident, paid by the Cape Colony, also resides amongst them.

TEMESVA'R, a Hungarian city, seat of the commander of the Banatish-Servian military frontier, is a strongly fortified place on the Bega Canal, and is about 300 miles south-east of Vienna, with which it is connected by railway. The town is fortified with a triple wall and moat, and has four suburbs. Of the population about a half are German, only a seventh being Magyar, and the rest Rumanians, Jews, and Servians. In T. are a fine cathedral, an ancient castle, a magnificent episcopal residence, an armory, barracks, and a theater. There are manufactures of cloth, silk, paper, and oil, and a brisk transit trade in grain, wax, honey, and brandy, with Transylvania, Servia, and Rumania. T. has endured a vast number of sieges—the latest being that of 1849, when it was bombarded for 107 days by the Hungarian insurgents, but was relieved at the end of that time by Marshal Haynau. Pop. (1869) 32,223; (1880) 33,694.

TE'MPÉ, a narrow valley or gorge, about 4½ miles long, in the north-east of Thessaly, between Olympus (q. v.) and Ossa (q. v.), through which flows the river Peneus. The classic poets (none of whom, curious to say, appear to have ever seen the glen) praise it for its matchless beauty, and hence the name became with them a synonym for any lovely vale. In point of fact, however, the scenery of T. is characterized by wild grandeur rather than by soft sylvan charms.

TE'MPERA, in Painting, the same as *Distemper* (q. v.).

TE'MPERAMENT is a term which has been employed in Physiology ever since the time of Galen, to designate certain physical and mental characteristics presented by different individuals. Dr. Todd, in his article on this subject in the *Cyclopædia of Anatomy and Physiology*, observes that 'the temperaments the existence of which seems most consistent with observation, are those admitted by Cullen, namely, the *sanguineous* and the *melan-*

cholic, the *phlegmatic* being a degree or modification of the sanguineous, and the *choleric* of the melancholic.'

Individuals of the *sanguineous* or *sanguine* temperament are such, according to Cullen, as have the quantity of fluids in the body large in proportion to the solids; the habit of body soft and plump; the skin smooth, white, and readily sweating on exercise; the hair soft, and generally pale, passing from thence to a red tint; the complexion ruddy; the eyes blue; the bodily strength moderate; and the mind sensible, irritable, cheerful, and unsteady. In persons of the *melancholic* temperament, the habit of the body is somewhat hard and meagre; the skin and complexion coarse, and of a dun color; the hair hard, curly, and black; the strength considerable; the mind slow, disposed to gravity, caution, and timidity, but tenacious and steady.

Some writers recognize a *nervous* temperament, in which the predominating characteristic is a great excitability of the nervous system, and an undue predominance of the emotional impulses. This temperament is always associated with the sanguineous or the melancholic. In both sexes, the characteristics of the temperaments are far less manifest in old age than in earlier life. If it be admitted, as Dr. Todd believes, that a constant connection exists between color and temperament, it obviously follows that the nature of the temperament is determined by certain peculiarities in the physical condition of the organism. The different temperaments often merge so gradually into one another that it is in many cases difficult to decide positively to which variety any special case belongs.

TEMPERAMENT, in Music, a system of compromise in keyed instruments for the avoidance of the necessity presupposed by the strict relation of musical intervals of having a separate row of keys corresponding to each tonic. Taking C as keynote, the ratios of the notes of the diatonic scale, as derived from the number of vibrations in a given time of a string sounding that note (see MUSIC) are :

C	D	E	F	G	A	B	C
24	27	30	32	36	40	45	48

The intervals between these notes are by no means equal, and may be thus expressed in numbers by logarithms :

C	D	E	F	G	A	B	C
	51	46	28	51	46	51	28

We have here three species of intervals, of which those represented by 51 are called major tones; those by 46, minor tones; and the smaller intervals represented by 28, semitones. These intervals will evidently only serve with C as keynote. If, for example, we start from D instead of C, we find E a tolerable, though not quite correct, second to D; but the third and seventh of the scale are entirely wrong.

Were the major and minor tones equal, and each semitone exactly half a tone, the insertion of a note in the middle of each tone dividing the seven intervals would make it immaterial where the scale began; any one of the twelve notes becoming alike available as a keynote; and though such equality is contrary to the immutable principles of harmony, an arrangement based on it is found practically to give but little offence to the ear. In what is called the *equal temperament*, the twelve intervals are all of the same length, and no advantage is given to one key over the rest. This is, in theory at least, the temperament adopted in the pianoforte. Another system, known in this country as *Smith's* or the *vulgar temperament*, in which some keys were favored at the expense of others, has been much used in organs. While the keys of B♭, F, C, G, D, and A are more perfect than on equally tempered instruments, E♭, A♭, D♭, and F♯ contain some very harsh intervals. The bad fifths and thirds which exist in these keys are designated by musicians by the name of *Wolf* intervals. This mode of tuning the organ is being more and more abandoned for the equal temperament, or an approximation to it. The different characters of the various keys often observed on the pianoforte, as well as the organ, could have no existence were the temperament absolutely equal, and arise out of the circumstance that this strict equality is not altogether adhered to in practice.

TE'MPERANCE. *History of the Movement.*—The origin of the temperance movement dates from the beginning of the present century; and the merit of having taken the first steps in the matter belongs to America, where the vice of drunkenness appears to have reached an alarming height about that time. In the month of April 1808, a society was established at Moreau, county of Saratoga, in the state of New York, consisting of 43 members; one of whose rules was as follows : 'Art. 4. No member shall drink rum, gin, whisky, wine, or any distilled spirits, or compositions of the same, or any of them, except by the advice of a physician, or in case of actual disease (*also excepting at public dinners*), under the penalty of 25 cents, provided that this article shall not infringe on any religious rite.'

This society had other rules prohibiting members (under penalties) from offering any of the above liquors, or from being intoxicated; but though it continued to exist for 14 years, it does not seem to have accomplished much good. Gradually, however, the attention of the clergy and of philanthropical laymen was called to the subject; and after a series of sermons had been preached and published against a vice whose rapid progress was threatening (according to Dr. B. J. Clarke) to make the Americans 'a community of drunkards,' a society was started at Boston (February 1826), called *The American Temperance Society*, 'to restrain and prevent the intemperate use of intoxicating liquors.' In 1829, *The New York State Temperance Society* was formed; and before the close of the year, 1000 local societies, with 100,000 members, were in existence, and a periodical, entitled *The Journal of Humanity*, established to promote the new movement. Rumors of the progress of temperance societies soon reached the Old World, and in August 1829, a society was started at New Ross, in the county of Wexford, Ireland, under the auspices of the Rev. George Whitmore Carr, the members of which pledged themselves 'to abstain from the use of distilled spirits, except as a medicine in the case of bodily ailment;' and further, 'neither to allow the use of them in their families, nor to provide them for the entertainment of friends.' Simultaneously, a movement in favor of temperance was begun in Belfast and the north of Ireland, by the Rev. Dr. Edgar, Rev. Dr. Cooke, and Rev. Mr. Morgan, and before 12 months were over, 60 societies had been constituted, numbering about 3500 members, both Catholics and Protestants. Meanwhile, Scotland had not been uninfluenced. As early as October 1829, Mr. John Dunlop of Greenock, a justice of peace for Renfrewshire, after lecturing on the subject of temperance in Glasgow, Stirling, and elsewhere, succeeded in forming a society at Greenock, the first in Scotland, and the precursor of *The Glasgow and West of Scotland Temperance Society*, formed in the ensuing November. Mr. Dunlop is thus entitled to be considered 'the Father of temperance societies in Great Britain.' In his early labors, he was greatly assisted by Mr. William Collins of Glasgow, who became the editor and publisher of the *Temperance Record* (1830—1835).

The rules of *The Glasgow and West of Scotland Temperance Society* were substantially the same as those of the American and Irish societies—the members voluntarily agreeing 'to relinquish entirely the use of ardent spirits, except for medicinal purposes,' although 'the moderate use of other liquors is not excluded.' The zeal and activity of this society were remarkable. According to the Report read at the first annual meeting (December 30, 1830), it had circulated in the course of the year 425,300 tracts and 20,200 pamphlets, and numbered in Glasglow alone 5072 adherents; while it was stated that throughout Scotland at large there were 130 societies, and 25,478 members. It is not necessary to follow further in detail the course of the temperance movement, *strictly so called*, in Scotland, except to remark, that members of the clergy now began to interest themselves in it, and at the close of 1831 there were 187 ministers of various denominations in Scotland connected with the cause; but we must now notice the introduction of a new and more stringent application of the temperance principle. On the 21st September 1830, Mr. John Davie, and several other members of the Temperance Society of Dunfermline, pledged themselves to 'total abstinence from all intoxicating liquors—small-beer excepted, and wine on sacramental occasions;' and in the course of the next two years, 'Total Abstinence Societies' were started in Glasgow, Paisley, and other places. In 1830, the temperance movement extended to England. Mr. Henry Forbes, a merchant of Bradford in Yorkshire, happening to be in Glasgow on business, had attended one of the meetings of the Glasgow Society, became deeply interested, and on his return home took steps to organize a Bradford Society (February 2, 1830). Another society was formed at Warrington (April 4, 1830); a third at Manchester (May 12, 1830); and by the close of the year, about 30 temperance societies were in existence, numbering in all 10,000 members.

In June 1831, *The British and Foreign Temperance Society* was organized in London, mainly through the persevering efforts of Mr. William Collins of Glasgow. This was for many years the leading society of the party, its patron being the Bishop of London, and its vice-presidents including several other prelates, distinguished officials both civil and military, and a few members of parliament. The pledge taken by its members was simple : 'We agree to abstain from distilled spirits, except for medicinal purposes, and to discountenance the causes and practice of intemperance.' We have not space to narrate its history and progress in detail, but we may notice that it was instrumental in awakening an interest in the temperance movement both in the army and navy, and that, in the course of a single year (1831—1832), it could boast of having induced 400 old Greenwich pensioners to give up their grog!

Gradually, however, the more fervid friends of temperance in England arrived at the same conclusion as the Dunfermline 'reformers' viz., that a crusade against gin and other 'alcoholic'

liquors was not enough; that 'beer' was the great cause of drunkenness in their country, and that nothing but total abstinence from all intoxicating drinks would cure the evil. The movement in this direction first took shape at Preston in Lancashire, in September 1832, when Mr. Joseph Livesey, and some other members of the Temperance Society there, pledged themselves 'to abstain from all liquors of an intoxicating quality, whether ale, porter, wine, or ardent spirits, except as medicines.' An active propagandism in all the principal towns of Lancashire followed, and a considerable number of adherents were gained to the new cause. In September 1833, according to the commonly received story (see Burne's *Teetotaller's Companion*, p. 333), the notable word *Teetotal* was first used. A certain Richard Turner, or, as he was more generally called, 'Dicky Turner,' a plasterer's laborer or *lime-larry*, who was much given to holding forth in the Lancashire dialect at the meetings of the new sect, happened in the course of a philippic against temperance to say: 'I'll hev nowt to do wi' this moderation—*botheration*—pledge; I'll be reet down tee-tee-total for ever and ever.' 'Well done, Dicky!' said Mr. Livesey: 'that shall be the name of our new pledge.'

This origin of the word, which appears to make it but a stuttering pronunciation of *total*, has, however, been disputed; and it is affirmed that the term is simply a Lancashire phrase for final, thorough, or complete; thus, when a man is discharged merely for want of work, he is said to be *sacked*, but when discharged from inability to work, *teetotally sacked*. Whatever may have been the origin of the term, the new sect was resolved to be 'thorough.' In April 1834, a *Youths' Temperance Society*, on strictly teetotal principles, was formed at Preston, and before a year had passed, it reckoned nearly 1000 members. By dint of zeal, respectable teetotal societies were also established at Manchester (August 1834), Lancaster (November 1834), Colne (December 1834), Isle of Man (December 1835), and numerous other places. Meanwhile (September 1835), a conference of Lancashire and Yorkshire delegates was held at Manchester, and a new general society formed under the title of *The British Association for the Promotion of Temperance on the Principle of Total Abstinence from all Intoxicating Liquors*. This title clearly indicated the ambitious views of the new sect. It wished, and it hoped ere long, to speak in the name of the whole temperance party; and as early as 1836, one of the Yorkshire district societies, that of Wilsden, ventured to memorialize *The British and Foreign Temperance Society* of London on the subject of the total abstinence pledge. The answer that it received showed that a disruption was not far off. In Scotland and Ireland, the progress of teetotalism, as distinct from temperance, was not at first very marked; but its votaries were resolute, and held vehement discussions, public and private, with the advocates of the rival system, in which they were generally considered victorious by the crowds before whom they disputed. During 1834—1835, teetotalism was struggling hard for recognition in London—the influential leaders of the old Temperance Society being dead against it. At length, however, owing to the persevering efforts of Mr. Livesey of Preston and other enthusiasts, the teetotallers got a footing, and, in September 1835, established *The British Teetotal Temperance Society*, which, in August 1836, was merged into *The New British and Foreign Society for the Suppression of Intemperance*. Teetotalism now in turn began to get the upper hand, and in the course of the next two or three years, the 'moderate' party almost disappeared; the majority of its members doubtless passing over to the ranks of the total abstainers. But these now fell out among themselves.

Up to 1839, *The New British and Foreign Society* had two pledges, the long and the short; the former including the 'neither give nor offer' clause; and the latter omiting it. The more rigorous teetotallers made strenuous efforts to get the 'short' pledge abolished, which were as strenuously opposed, and in a very brief period the whole teetotal world was up in wild commotion on the subject. Various meetings of 'delegates' from the different societies in England, Scotland, and Ireland were held in London in May 1839, under the presidency of Earl Stanhope, and scenes of the utmost disorder ensued. The result was a temporary disruption, and the formation of two societies. Still the cause prospered in spite of fierce distractions. Strong provincial associations were formed in Yorkshire, Leicestershire, Lancashire, Norfolk, and Cornwall and Wales, almost always on the 'long pledge' principle. In Scotland, the 'long pledge' took deep root; indeed, after 1837—1838, the 'short pledge' was scarcely ever thought of. But it was in Ireland that the most brilliant successes attended the movement. In 1838, Father Mathew (q. v.) commenced his extraordinary career, and in less than two years, 1,800,000 men and women were enrolled in *Ireland's Great National Total Abstinence Society*.

The subsequent history of the movement must be briefly sketched. In November 1842, the disruption, above mentioned, of *The British and Foreign Temperance Society* was healed, and the two societies which that disruption had called into existence were amalgamated in *The National Temperance Society*. The work of proselytizing then went on vigorously. Innumerable tracts were circulated, and all Britain echoed with the noise of infinite speech. Excursions, processions, Exeter Hall demonstrations, incessant tea-parties, &c. were got up with enthusiasm, which speaks volumes for the energy and sincerity of the teetotal agents. But in a less showy though more noble way, the missionaries of the new faith pursued their benevolent work in the lanes and alleys of large cities, the haunts of profligacy and dissipation, where they sought out the homes of drunkards, and tried (not without success) to rescue them from the power of the horrible vice that was dragging them to destruction. Action of this sort—whatever one may think of the movement as a whole—is to be spoken of only with reverence. In August 1846, *The World's Temperance Convention* met in London, on which occasion 302 delegates were present, representing different societies in the United Kingdom and the United States. Since then, the temperance cause has steadily, if not rapidly, progressed. It has recently been estimated that there are not fewer than 4,000,000 total abstainers (inclusive of juveniles) in Great Britain and Ireland, and a much greater number in the United States of America. Of late years, total abstainers have devoted themselves mainly or largely to advocating the necessity or propriety of imperial legislation on the subject of intoxicating liquor.

A very extensive development of the temperance movement is that known as *Good Templarism*. It originated in New York in 1851, and rapidly spread through the United States. In 1868, the order established itself in England, in 1869 in Scotland, and in 1870 in Ireland. Its progress has been singularly rapid. In England alone, exclusive of Scotland, Ireland, and Wales, there were in 1875 no fewer than 3570 'lodges,' having 168,425 members, estimated in 1880 to have increased to more than 200,000 persons. These of course do not represent absolutely new adherents to the temperance cause. They are in many cases members drawn from the older temperance societies, though it is also an undoubted fact that the order has been very successful in making fresh converts to the cause of total abstinence. The name is derived from the famous *Knights Templars*, and originated in a fanciful analogy between the functions of the ancient order of military monks, and the modern disciples of temperance. As the former were enrolled to defend the Holy Sepulchre and the interests of religion, so the latter are banded together to protect Christianity against a worse foe than the Saracens, viz., 'the drinking institutions of the land.' It is professedly a *religious* movement, and its ritual is evangelical. Its platform is absolute prohibition of the manufacture, importation, sale, or use of all intoxicating liquors as beverages; but it owes its great popularity to certain peculiarities in its constitution, its picturesque or showy ceremonial, and its aim to combine social and festive amusements with missionary zeal. —See *Good Templarism*, by the Rev. George Gladstone (Glasgow, 1872); as also the several magazines of the order. A more recent abstinence movement is the *Blue Ribbon Army*, which counts its supporters by thousands. The *Salvation Army* is also a temperance organization, in so far as those joining it must be abstainers.

Pleas and Counter-pleas.—The question of abstinence from intoxicating liquors is capable of being argued on three distinct grounds, *scriptural*, *physiological*, and *social*.

The Scriptural argument in favor of abstinence from intoxicating liquor may be briefly stated. The only 'strong drink' mentioned in the Bible is wine. It is both praised and blamed. The question raised by teetotallers is: Are the sacred writers referring in both cases to the same kind of wine? This they deny, and endeavor to make good their denial, by an appeal to the original Hebrew. On examination, it is found that ten or twelve different designations for wine are used, but the two by far the most frequent are *yayin* and *tîrôsh*. The first of these is the generic term for wine, and therefore (say the advocates of total abstinence), as it *must* embrace fermented liquor, it is the word used when wine is denounced. Thus, it is *yayin* that is 'a mocker' (Prov. xx. 1), that is not to be looked upon (Prov. xxiii. 31, 32), &c. On the other hand, when wine is praised, *tîrôsh* is the word used, and *tîrôsh* (it is asserted) means the wine in clusters, that is, the actual grape itself, or the unfermented juice thereof, then, as now, liberally drunk as a beverage by the inhabitants of Syria and elsewhere. The application of this view to the New Testament is obvious. If there was a wine that might be used, as well as a wine that was condemned—which, ask the teetotallers, would Christ and his apostles be most likely to sanction? The wine that 'maketh red the eyes,' that 'biteth like a serpent, and stingeth like an adder,' that 'deceiveth,' that 'maketh drunken' and 'mad;' or the wine that 'maketh glad the heart,' that is 'good,' a 'blessing,' &c.;—in a word, *yayin* in any of its dangerous forms (*sôbe*, from the root to 'soak;' *chemer*, the 'foaming or bubbling:' and *mesec*, *mezeg*, *mimsac*, the mixed wines), or the innocent *tîrôsh*, that cheers, but not inebriates? It is conceived that there can be but one answer to this question, and that every candid and reverent Christian must be forced to the conclusion, that the wine which Jesus made at the marriage-feast at Cana of

Galilee, and used in his last supper with his disciples, and which Paul advised Timothy to drink for his stomach's sake, was the unfermented, innocuous, and popular *tîrôsh*.

To this it is replied that the distinction made between *yayin* and *tîrôsh* does not exist. Both parties are agreed that the former term is the generic one (corresponding with the Greek *oinos*, the Latin *vinum*, and the English *wine*, with all of which it is believed to be etymologically connected); but it is denied by the scriptural opponents of total abstinence that *yayin* means fermented, and *tîrôsh*, unfermented wines, exclusively. Not to trench upon the chemistry of the question, which, it is affirmed, wholly disproves the possibility of the 'juice of the grape' being kept for any length of time without undergoing a process of fermentation, and thereby acquiring to a certain degree intoxicating properties, it is alleged that the etymology of *tîrôsh* does not favor the teetotal view. According to Gesenius, it is derived from the root *yârash*, 'to get possession of;' that is, of the brain. Dr. Lees, indeed, quotes Bythner as suggesting that it may have been so named because the vine was a 'possession' in the eyes of the Hebrews; but this is extremely improbable, and in the absence of other explanations, that of Gesenius is certainly to be preferred. Again, *tîrôsh* is not exclusively used to denote the 'fruit' (strictly so called) of the vine; the dreaded *yayin* performs the same harmless function—e. g., in Jer. xl. 10, 12, where it is connected with a verb significant of 'gathering,' and in Ps. civ. 14, 15, with another expressive of growth. It is even denied that *tîrôsh* is ordinarily to be so understood, for although, being mostly found in connection with 'corn,' the verb applied to the consumption of that article of food is by *zeugma* made to apply to the 'wine' also, yet in the only passage where the act of consuming *tîrôsh* alone is mentioned (Is. lxii. 8, 9), the verb is *shâthâh*, which invariably signifies the act of drinking. Lastly, it cannot be shown that *tîrôsh*, when it does mean wine, means innocuous wine. No doubt, *yayin* is the one generally employed when wine is denounced, and *tîrôsh* when it is praised, but this is not uniformly the case, for in Hos. iv. 11, 'whoredom and wine (*yayin*) and new wine (*tîrôsh*) take away the heart,' *tîrôsh* actually forms (as has been remarked) 'the climax' of intoxicating influences. The conclusion, therefore, to be drawn from a consideration of Scripture is, that the distinction insisted on by total abstainers between the two terms —viz., that the one (*yayin*) means fermented, and the other (*tîrôsh*) unfermented wines, is one that cannot be maintained. Both must be held as referring to fermented intoxicating wine; and the praise of *tîrôsh* is simply to be considered a recommendation of the moderate use of ordinary wine, as the condemnation of *yayin* is to be regarded as a solemn prohibition of excess in the same.

The physiological argument in favor of total abstinence necessarily takes various shapes; for it is concerned with physiological questions which are yet, to a great extent, matter of opinion—of speculation and conjecture, not of science. A question arises upon three distinct points: 1st, the effects of alcoholic liquors in quantities sufficient to produce intoxication; 2d, their effects when habitually used in moderate quantities; 3d, the effect of abstaining from them altogether.

Upon the first point, teetotalers usually maintain that insanity, idiocy, almost every form of organic disease, many chronic, not a few acute disorders, are frequent results of habitual intoxication; that the children of drunkards are often idiotic, and have transmitted to them various diseases, which are produced by excessive drinking—which, therefore, tends to the deterioration of the race; that drunkards are always the first victims of epidemics; and that it can be shown from tables of mortality that drinking has a marked effect in shortening life. It is not disputed that many of these effects can be connected with the habitual use of liquors in excess; but as to some of the most striking of them, it is denied that they are physiological effects of such excess—being not direct results of hard drinking, but due to the bad conditions under which poor people who drink hard usually live. The question between teetotalers and those who differ from them, at this point, however, is only a matter of degree. The latter admit that alcohol, in narcotic or intoxicating quantities, produces only injurious results. In such quantities, it has a deteriorating, a devitalizing influence upon the brain and nervous tissue, and habitual excess in its use is attended by a progressive impairment of nervous structure, indicated at length by such results as epilepsy or delirium. See INTOXICATION. But the results of excess differ greatly, it is said, in the case of different persons, so that, not unfrequently, many years of hard drinking do not affect the system of the drinker in a marked degree.

It is upon the second point—the habitual use of alcoholic drinks in moderation—that the opinion of teetotallers serious conflicts with that of many physiologists. The teetotal argument—leaving out minor points such as an alleged effect of alcohol in impairing the digestion—may be stated thus: 1. Alcohol can never have been intended by nature for the food of men. It is never produced spontaneously in nature. The vegetable world yields in abundance the principles which form the flesh, and those which keep up the heat of the body, but the healthy plant never produces alcohol. In the body, too, in health, food is never converted into alcohol. And the body does not merely not produce alcohol; it treats it as a foreign element, and gets rid of it as fast as possible. 2. Alcohol in the body, by taking up the oxygen supplied through the lungs, checks the burning of tissue, upon which life and the production of energy, muscular or mental, depend; and similarly it impedes the efforts of the body to get rid of the waste matters which are the products of the burning. It thus lowers vitality, vitiates the blood, and prevents the production of healthy fibre. Toddy or beer taken at bedtime, instead of being favorable to health, has just the same effect, according to Dr. Carpenter, with sleeping in a four post bed with the curtains carefully tucked under the bed-clothes. In either case, that is, there is a diminution of the supply of oxygen required for vital processes, especially for burning the waste of the body. 3. The stimulation produced by alcohol is succeeded by a recoil or reaction; and to produce a certain effect of stimulation, the quantity taken must constantly be increased. From this cause—to say nothing of social influences connected with drinking calculated to produce the same result—moderate drinking tends to pass into excessive drinking, about the evil consequences of which there is no dispute.

The physiological opinion opposed to those arguments is, that while alcohol, like other similar substances, has, in large quantities, a narcotic, a devitalizing effect, it has in small quantities a stimulating effect, between which and narcotism there is a difference, not of degree, but of kind. The stimulating effect is precisely the same with that of highly-nutritious and easily digested food; as regards the vital functions, it differs from the effect of ordinary food only in rapidity of production. It does not substitute an abnormal for the normal action of the bodily organs; it restores their natural functions; and it is capable of rectifying either deficient or redundant functional action. The only positive difference of effect between ordinary food and alcoholic stimulation is, that the latter does not, to any great extent, add to the bulk of the body. Their is no recoil or reaction after it, except that, as in the case of ordinary food, the effect is exhausted after a time. There is nothing to support the belief in a reaction, except the depression involved in the gradual recovery from the narcotic effect of a large quantity of alcohol; but between the narcotic effect of a large, and the stimulating effect of a small, quantity, there is, as already said, a difference of kind—their connection is merely accidental. And the experience of mankind—the fact that moderate drinking does not usually pass into excessive drinking—sufficiently shows that it is not found necessary to increase the quantity used for stimulation. Since stimulation restores the natural functions, it, of course, is capable of removing the consequences of functions being perverted. Thus, it is maintained that, among other things, it gives relief from pain and muscular spasms, reduces the circulation when too rapid, produces healthy sleep, and removes general debility, as well as the fatigue of special organs. Whether it, to an important extent, affects the waste of tissue, or keeps waste matters in the blood, is at present undetermined; however this may be, there is no justification for holding that life is to be measured by the aggregation of tissue, or the rapidity of bodily changes. The notion that alcohol checks the burning of tissue by taking up the oxygen received by the lungs originated when it was believed, upon the authority of Liebig (it was so believed until a few years ago, but the contrary is generally held now), that alcohol was altogether decomposed in the body. If these views are correct, it follows that alcohol taken cautiously and in small quantities—the quantities varying with the circumstances and with the constitution of the individual—may be used not only with safety but with advantage.

Under the third head, teetotallers, of course, maintain that total abstinence is highly favorable to health. They adduce their personal experience; the mortality statistics of one or two regiments and of ships' crews mainly, or entirely, made up of abstainers; the evidence of arctic voyagers on the one hand, and of travelers in tropical regions on the other, to prove that in every climate health can be maintained, and is most likely to be maintained, when no use is made of alcoholic drinks. On the other side, the fact that men of all races use alcoholic beverages, is held to show that men, living as men must usually do, find those beverages useful, if not necessary. It is not disputed that many persons live in health without them—that persons having an abundance of wholesome food, not overworked, living in well-constructed houses, and in wholesome air, can usually dispense with them. But when some, or all, of those conditions are wanting—which in towns, at any rate, happens in all but exceptional cases—it is alleged that a nearer approach to health is made when a moderate use is made of alcohol.

The social arguments in favor of total abstinence, though very weighty and earnestly insisted upon, can be indicated in a few sentences. It is affirmed that the use of alcoholic drinks is at the

root of all the misfortunes of the poorest and most numerous class; that it is the chief cause of pauperism, the chief cause of crime, a frequent occasion of immorality; that it lowers the health and shortens the life of the great mass of artisans and laborers, makes their homes wretched, and exposes them and their families to the evils and temptations of chronic destitution. Then, such are the seductive influences of drink and good-fellowship, that moderate drinkers are in danger of becoming drunkards; thus the use of liquors effects the ruin of a considerable percentage of the middle and upper classes.

Total abstinence is demanded as a measure of personal precaution, because no one who drinks at all is safe against falling into drunkenness; as a patriotic duty, incumbent upon those who desire the improvement of the poorer classes; as a duty of example which every man owes to his neighbor, and which, involving self-denial, must have a favorable reflex influence upon character. On the other side, it is not denied that drinking is closely connected with, or that it exasperates, the misery undergone by the poor; but it is denied that it is the cause of the misery. It is maintained that drinking must be regarded as an effect of the bad conditions inherited by the poor, and under which they live. Persons born in close alleys, and brought up in foul air, living always from hand to mouth, often upon insufficient or unwholesome food, feel (it is said) a need of stimulants to support vitality. It is affirmed that the fluctuations of crime (properly so called) do not depend upon the amount of drinking, but—so far as they can be traced to one circumstance—upon variations in wages; that it is destitution, not drunkenness, that contributes most largely to the production of crime. The drunkenness, the crime, the pauperism, it is maintained, cannot be permanently reduced except through a material and moral improvement being effected among the poor. Then it is denied that moderate drinkers, in general, are in any danger of becoming drunkards; it is persons wanting in prudence, and of intemperate constitution, who are exposed to that danger.

Of late years, total abstainers—in unison with others who, though not themselves abstainers, are anxious to promote public sobriety—have exerted themselves to obtain, in one shape or another, a legislative prohibition of the trade in drink. This movement was set on foot in Great Britain in 1853, by an organization called 'The United Kingdom Alliance,' on account of the success which had crowned the exertions of teetotalers in Maine and many other of the United States of America. In Maine, the liquor-traffic was suppressed in 1846; the law was made more stringent by a provision for confiscating all alcoholic drinks in 1851; and though, in 1856, the existing laws were repealed, and it became lawful to distil spirits, to sell spirits, and to have spirits in possession, drinking-houses continued to be prohibited. (Kansas had in 1881 the strictest prohibitory liquor-law.) The 'Alliance' finding it impossible to carry a Maine liquor-law here, first asked for a Permissive Bill, enabling the ratepayers of a parish, if a majority of two-thirds of them should think fit, to suppress all public-houses within the parish. Subsequently, they have demanded LOCAL OPTION (q. v.). They support this claim by a variety of arguments. Alcohol, they say, being a poison, its sale ought to be subject to the same restrictions as that of other poisons. The legislature has admitted the exceptional and dangerous nature of the liquor-trade, by putting it under strict regulation; in consistency, it should suppress it as a trade altogether. They allege that the amount of drinking in a place always varies directly with the number of public-houses; and then that the amount of crime and of pauperism varies directly with the amount of drinking.

In 1857, Dr. Lees calculated the expense of the use of liquors to this country at 120 millions a year—the cost of the liquor being put at 60 millions, and the remainder of the amount made up by allowing for the crime and pauperism caused by drinking, the loss of time in drinking, and, through disease induced by drinking, the waste of life consequent upon it and many minor items. This money, it is said, if not spent upon drink, would have a marvelous effect in improving the condition of the poor. On the other side, it is maintained, *in limine*, that the subject matter of this bill is so important, and so full of difficulty, that parliament should not delegate its functions in respect of it to the ratepayers; also, that to do so would be to plant, in every parish in the country, the seeds of perpetual strife. Upon the merits, it is said that a prohibitory law could not be carried out—at any rate in large towns, where the worst evils connected with drinking are found; and that systematic attempts at evasion would be made, which would demoralize the people, and put them in chronic antagonism to the law. Besides the arguments already stated upon this side, it is urged that—excepting the case of poisonous substances—it is no part of the duty of a governing body to say to its people: You shall not spend your money upon this or that; that it is unreasonable, in a fiscal point of view, to speak of the national resources being wasted upon liquors, any more than upon tea or beef, or other substances which perish with the using; and that the power of procuring articles which are desired is what men work for—the great motive of industry. It is also maintained that compulsory abstinence from drink would not produce the same results as voluntary abstinence; that men would seek indemnifications, resorting, it might be, to other and more injurious narcotics than alcohol, and to vices which might be even more injurious than drinking. It is said that abstinence, to be valuable, must be a sign of a moral improvement; and that it is safest we should leave the poor to face the temptations of their situation, trying to fortify them against these temptations by education, by giving them just moral and religious views—at the same time, holding before them the spectacle of temperance and its results in the case of the more comfortable classes.

The following are the leading organizations in Great Britain, that, with various modifications of creed, carry on the temperance agitation. They can claim as directors and advocates men of acknowleged position and ability; and the aggregate sum of money spent annually is very great. The National Temperance League, London (organ, the *Weekly Record*); the United Kingdom Alliance, Manchester, with numerous branches (organ, the *Alliance News*); the Church of England and Ireland Temperance Society, London (organ, the *Church of England Temperance Magazine*); the Scottish Temperance League, Glasgow (organ, the *League Journal*); the National Band of Hope Union, London (organ, *Band of Hope Review*). The Roman Catholic and Methodist branches of the Temperance Society form distinct organizations. The *Good Templars* have been named above.

TEMPERATURE. See TERRESTRIAL TEMPERATURE.

TE'MPERATURE OF THE BODY. It is admitted, as a result of the observations of numerous physiologists, amongst whom our countryman, Dr. John Davy, stands pre-eminent, that although the range of temperature varies in different parts of the human body, the normal temperature at completely sheltered parts of the surface amounts to 98°·4, or a few tenths more or less in temperate climates; and that if there is a persistent elevation above 99°·5, or a depression below 97°·3, some form of disease is certainly indicated. (In warm-blooded animals, generally, the temperature is one degree lower at completely sheltered parts of the surface than in the back of the mouth, or other accessible internal parts.)

Some of the circumstances which cause a deviation from the normal temperature are mentioned in the article on ANIMAL HEAT. It may be further noticed, that exposure to cold without exercise, and sustained mental exertion, reduce the temperature, and that the amount of heat is at first reduced after a full meal, although, as stated in the above-named article, it subsequently rises. Moreover, in the tropics, the average temperature is nearly 1° higher than in temperate regions.

When the temperature rises in cases of disease, the following relation to its augmentation and that of the pulse has been established: *an increase of temperature of* 1° *above* 98° *corresponds with an increase of ten beats of the pulse in the minute.* Thus, if the pulse is 60 at 98°, it is 70 at 99°, 80 at 100°, and so on. It is now established beyond all doubt, by the observations of Wunderlich, Virchow, and many other foreign physicians, and by Parkes, Jenner, Aitken, and Ringer in this country, that the preternatural heat which in certain cases can be detected by the themometer, and may exist to the extent of 4°, 6°, or even 8° above the healthy average, and which varies in amount in different diseases, in different persons, and at different times of the same day, is the essential symptom of fever. Dr. Davy in his *Physiological and Anatomical Researches*, vol. i. p. 206, describes the case of a lunatic soldier, in whom the accidental discovery that his temperature was 6° above the normal standard, led to the detection of tubercular disease of the lungs and intestines. Wunderlich, whose experience embraces at least half-a-million exact thermometric observations, bears unqualified testimony to the value of this mode of investigation in the early detection of disease, and as often furnishing an important guide to treatment. Some of these instances are quoted by Dr. Aitken in his *Science and Practice of Medicine*, 3 ed. vol. i. pp. 44—46.

We give in a condensed form a few of the more important of these observations. In *ague*, the temperature of the body begins to rise several hours before the beginning of the paroxysm; and after the disease *seems* to have disappeared, a periodic increase of the temperature may still be detected, and as long as this continues, the patient is not really cured. In *typhoid fever*, the rise of temperature, or its abnormal fall, will indicate what is about to happen three or even four days before any change in the pulse or other sign of mischief has been observed. A sudden fall of temperature has thus denoted intestinal hæmorrhage several days before it appeared in the stools. A fall as low as 93° was noticed by Parkes in a case of this kind. When a person, who yesterday was healthy, exhibits this morning a temperature above 104°, it is almost certain that an attack of ephemeral fever or ague is coming

on, and should the temperature rise up to or beyond 106°·3, the case will certainly turn out one of ague or of some other form of malarious fever. If during the first day of illness, the temperature rises to 106°, it is certain that the patient does not suffer from typhus or typhoid fever; and if the temperature of a patient, who exhibits the general signs of pneumonia, never reaches 101°·7, it is certain that there is no soft infiltration in the lungs. 'In typhoid fever, a temperature which does not exceed on any evening 103°·5, indicates a probably mild course of fever. A temperature of 105° in the evening, or 104° in the morning, shows that the attack is a severe one, and forebodes danger during the third week. On the other hand, a temperature of 101°·7, and below, in the morning, indicates a very mild attack, or the commencement of convalescence. In pneumonia, a temperature of 104° and upwards indicates a severe attack.

'In acute rheumatism, a temperature of 104° is always an alarming symptom. In a case of jaundice otherwise mild, an increase of temperature indicates a pernicious turn. In tuberculosis, an increase of temperature shows that the disease is advancing and that untoward complications are setting in. In short, a fever temperature of 104° to 105° in any disease indicates that its progress is not checked, and that complications may still occur.' —*Op. cit.*, p. 21. We may further observe that, from the observations of Dr. Sidney Ringer, a persistent elevation of temperature exists as an invariable precursor of the growth of tubercle in any organ. As a general rule, when the temperature rises continuously to 106°·2, the prognosis is unfavorable; and when it rises to 110°, a fatal issue is almost certain. The diseases in which the highest temperatures have been observed are scarlatina, in which it has been noted at 112°, and tetanus, in which, at the period of death, it was 112°·5, and an hour afterwards was 113°·8. In Dr. Aitken's work, the reader will find a series of diagrams illustrating the range of temperature in ague, erysipelas, measles, pneumonia, simple continued fever, scarlatina, small-pox, typhoid and typhus fevers, &c.; together with a full description of the instruments to be used, the method of using them, and practical rules for recording observations.

TEMPERING METALS. A peculiar effect is produced upon some metals by heating them to redness, and then suddenly cooling them. By this means extreme hardness is obtained, especially in steel, which is so susceptible to this process, called tempering, that almost any degree of hardness and brittleness can be obtained. If, for instance, we make a piece of steel red hot, and then plunge it into cold water, it becomes hard and brittle when cold, and is actually, though slightly, increased in bulk. But if we reheat the metal, and allow it to cool slowly, it again becomes soft and malleable as before. Moreover, if we again reheat it, but not to redness, and cool it suddenly, it is still further softened. If, before reheating, the surface has been polished, a beautiful shade of color is produced by the heat, which is varied according to the temperature employed; and so exactly is this the case, that the experienced manipulator is entirely guided by the color produced, instead of by nice regulations of the heat applied. For ordinary operations, the metal is cooled by plunging it in cold water; but oil, mercury, and saline solutions are used for special purposes. An exact series of experiments has proved that the following colors are produced at the temperatures given: Very pale yellowish, by 430° Fahr.; pale straw, 450°; yellow, 470°; brown, 490°; mottled brown. 510°; purple, 530°; bright blue, 550°; blue, 560°; dark blue, 600°.

TE'MPLARS, KNIGHTS, a celebrated religious and military order, founded at Jerusalem in the beginning of the 12th c., by Hugues de Paganes, Geoffroy de St. Omer, and seven other French knights, for the protection of the Holy Sepulchre, and of pilgrims resorting thither. Baldwin II., king of Jerusalem, bestowed on this order their first place of residence; and an additional building was acquired from the abbot and canons of the church and convent of the Temple, whence the order obtained the name of the 'Poor Soldiers of the Temple of Solomon,' afterwards abbreviated into Templars. The knights were bound by their rule to hear the holy office every day, or if prevented by their military duties, to say a certain number of paternosters instead; they were to abstain from flesh four days in the week, and from eggs and milk on Fridays. They might have three horses and an esquire each, but were forbidden to hunt or fowl. In the earlier period of their history, the Templars made a great show of poverty, contrasting much with their later condition. After the conquest of Jerusalem by the Saracens, they spread over Europe; their valor became everywhere celebrated; immense donations in money and land were showered on them; and members of the most distinguished families thought themselves honored by enrolment in the order. In every country where they existed, they had their governor, called the Master of the Temple or of the Militia of the Temple. The Templars had settlements in England from an early period. The first was in London, on the site of Southampton Buildings, Holborn; but from 1185, their principal seat was in Fleet Street, still known as the Temple. The round church which bears their name was dedicated by Heraclius, Patriarch of the Church of the Resurrection in Jerusalem, in 1185, and the chancel was consecrated in 1240.

The Templars were at first all laymen and of noble birth. Pope Alexander III., however, in 1162, authorized the admission of spiritual persons not bound by previous vows, as chaplains to the order, who were not required to adopt the military vows. A third class was afterwards introduced, consisting of laymen not of noble birth, who entered as serving brothers, some of them being attendants on the knights, and others exercising trades in the houses or lands of the order. Eventually, many persons became affiliated members without taking the vows, for the sake of the protection afforded them. As the power and prosperity of the Templars increased, so did their luxury, arrogance, and other vices, which gave the French kings a pretext for endeavoring to suppress them, and lay hold of their possessions. Accusations, many of which were absurd and incredible, were brought against them by two members of their own body. Their principal enemy was Philippe IV. of France, who induced Pope Clement V. to accede to a scheme by which the whole members of the order were seized and imprisoned, their lands confiscated, and many of them tried, convicted, and executed for capital crimes. The English Templars were arrested by command of Edward II.; and a council held in London in 1309 having convicted them of various crimes, most of which were probably imaginary, the king seized their possessions. In 1312, the whole order throughout Europe was suppressed by the Council of Vienne, and its property bestowed on the Knights of St. John, to which latter order their English possessions were formally transferred by a statute of Edward II. in 1323.

The habit of the Templars was white, with a red cross of eight points of the Maltese form worn on the left shoulder. Their war-cry was 'Beau séant;' and their banner, which bore the same name, was parted per fess sable and argent. They also displayed above their lances a white banner charged with the cross of the order. Their badges were the *Agnus Dei*, and a representation of two knights mounted on one horse—indicative of the original poverty of the order.—See Addison's *History of the Knights Templars, the Temple Church, and the Temple* (Lond. 1842); A. O. Haye's *Persecution of the Knights Templars* (Edin. 1865).

TE'MPLATE, a mould in wood or metal, showing the outline or profile of mouldings, and from which the workmen execute the moulding.

TEMPLE (so called because the Knights Templars had one of their branches in that part of London), in its connection with the law of England, is a part of the city occupied exclusively by barristers or attorneys, with few exceptions. It is the joint-property of the two Inns of Court (q. v.), called the Societies of the Inner Temple and Middle Temple, each of which has the right of calling persons to the degree of barrister—a privilege shared by the two other Inns of Court, Gray's Inn (q. v.) and Lincoln's Inn (q. v.). The Temple consists of buildings occupied by barristers, who rent the same from the above two societies, who are the private proprietors, and issue their own regulations as to the management of the property.

TEMPLE, SIR WILLIAM, an eminent diplomatist and popular writer, was the eldest son of Sir John Temple, Master of the Rolls in Ireland. He was born in London in 1628, studied for two years at Emmanuel College, Cambridge (where he had the celebrated Dr. Ralph Cudworth for tutor), and at the age of 19, went abroad on his travels. He acquired the French and Spanish languages, and also cultivated his taste for English composition. He entered on public life in 1661, as member for the county of Carlow, in the Irish parliament. In 1665, he was selected to proceed to Westphalia, on a secret mission to the Bishop of Münster; and on his return, he was created a baronet, and appointed resident at the court of Brussels. He was, as Sir James Mackintosh has remarked, the model of a negotiator, 'uniting politeness and address to honesty;' while as a domestic politician, 'in an age of extremes, he was attached to liberty, and yet averse from endangering the public peace.' In fact, the chief aim and desire of this accomplished statesman was to enjoy lettered ease and leisure, apart from all exciting public care and responsibility. His most important diplomatic success was the famous treaty of 1668, known as the Triple Alliance, by which England, Holland, and Sweden bound themselves to unite in curbing the ambition of France. This negotiation was accomplished in five days, in conjunction with the great Dutch statesman, De Witt. At the congress of Aix-la-Chapelle, and at the subsequent treaty of Nimeguen, T. was also a negotiator. He was long ambassador at the Hague, and assisted in bringing about the marriage of the Prince of Orange with the Princess Mary. Charles II. in vain endeavored to prevail upon him to accept the appointment of Secretary of State; but though shunning such arduous duty, he attempted to reform the government, by establishing, with consent of the king, a privy council of thirty persons, by whose deliberations his

majesty promised to be guided in all public affairs. As might have been foreseen, so numerous a council, under such a sovereign as Charles, and in times of such fierce rivalry and faction, proved an utter failure. T. then finally abandoned politics, and retired to the country.

When the Revolution placed William III. on the throne, T. was again solicited to become Secretary of State; but he again refused. The remaining ten years of his life were mostly spent at his favorite seat of Moor Park, in Surrey, where he carried out his schemes of planting and landscape gardening, and realized his early wish for studious retirement. During this period, he had, as secretary and humble companion, the immortal Jonathan Swift, who regarded his stately self-complacent patron with more fear and distrust than affection, but who ultimately became his literary executor. T. died at Moor Park, in January 1699. His collected works form four volumes (Lond. 1814).

As an author, T. is now known chiefly by his historical *Memoirs* and his *Miscellanea*, the latter being a collection of essays on various subjects—as government, trade, ancient and modern learning, gardening, heroic virtue, and poetry. He has been considered one of the reformers of our style; 'the first writer,' says Johnson, 'who gave cadence to English prose.' His style has quite a modern air, and is smooth, copious, and agreeable. He is too pretentious as respects scholarship and learning, and has no weight as a political writer; but he expatiates very pleasantly on foreign travel and country life, on flowers and fruits, on parterres, terrace-walks, and fountains. His epicurean temperament is happily and characteristically displayed in the last words of his last essay. 'When all is done,' he says, 'human life is at the greatest and best but like a froward child, that must be played with and humored a little to keep it quiet till it falls asleep, and then the care is over.' This is taking the battle of life very easily, but it is not in such manner that great men or true patriots are formed.

TEMPLEMO'RE, a market-town of the county of Tipperary, province of Munster, Ireland, is supposed to take its name from a commandery of the Knight's Templars, and is situated on the right bank of the river Suir, 9 miles north of Thurles. Although without manufactures of any note, T. has some considerable share of inland traffic. It is a station on the Great Southern and Western Railway, 79 miles distant from Dublin. The public buildings, one of which is an extensive barrack, are substantial, but without any noteworthy architectural character. The pop. in 1881 was 2800, of whom upwards of 2000 were Roman Catholics.

TE'MPO (Ital. time), the degree of rapidity with which a piece of music is to be executed. The rythmical proportions of notes, as indicated by their form, give them only a relative value, and have no reference to the absolute speed with which the composition should be played. Some compositions require, from their character, a quick lively movement; for others, a slower movement is more suitable; and different terms are used to indicate different gradations of movement. Of these, the principal, beginning with the slowest, are: *Largo*, broad; *larghetto*, somewhat broad; *lento*, dragging; *grave*, heavy, solemn; *adagio*, slow; *andantino*, moving a little; *andante*, moving; *allegretto*, somewhat lively; *moderato*, moderately quick; *allegro*, lively; *vivace*, with vivacity; *presto*, rapidly; *prestissimo*, with great rapidity. These terms are not always used with the precision that might be wished, and sometimes apply more to the character than to the absolute speed of performance. They are often modified by other qualifying words, as *allegro con brio*, lively and with briskness; *allegro appassionnato*, passionately excited. The *tempo* is indicated with more exactness by a reference to the beat of the Metronome (q. v.).

Thus, M.M. ♩ = 120, signifies that 120 beats of the metronome, each representing a crotchet, are to fill up the space of a minute; M.M. ♪ = 60, that 60 quavers are to be performed in a minute.

While the general rule is, that the time of a movement is to be steady and unvarying, cases often occur where a certain part of a composition has to be taken quicker or slower than the rest; this is indicated by such terms as *più vivo*, more lively; or *ritenuto*, kept back; while a return to the original time is expressed by the words *a tempo*. The performer may be required to proceed from one degree of movement to another, not abruptly, but gradually; the terms used to express this are: *rilasciando*, slackening; *ritardando*, retarding; *calando*, calming down; *stringendo*, pressing on; *accelerando*, gradually increasing speed; with some others.

TEMPO RUBATO (stolen time) is the name given to a mode of performance in which a restless character is imparted by protracting one note beyond its proper duration, and curtailing another, so that the aggregate duration of each measure remains unchanged.

TE'MPORAL POWER (OF THE POPE) is a phrase susceptible of two meanings, which are very distinct from each other, and the confusion of which has led to frequent and serious misunderstanding.

I. In one of these senses, it means the sovereign power which the pope possessed as ruler of the so-called PAPAL STATES (q. v.), and which, especially of late years, has been the subject of much controversy. The power which the pope exercised within his own states, although modified in its exercise by his spiritual character, was in substance the same as that of any arbitrary sovereign. The history of its origin and progress, and of the variation of the limits within which it has been acknowledged, is briefly detailed under the head PAPAL STATES. The question as to the necessity or utility of such a power vested in the hands of a spiritual ruler, and even of its lawfulness and its compatibility with his spiritual duties, has been very warmly debated; nor is this controversy of entirely recent origin. Many of the medieval sectaries put forward the principle of the incompatibility of the spiritual with the temporal power in the same person, not only in relation to the pope, but also as to the baron-bishops or other ecclesiastical seigneurs of that age. Such were the doctrines of the Vaudois, of Pierre de Bruis, and above all, of Arnold of Brescia. The last-named of these rendered himself specially obnoxious by the activity and even turbulence with which he propagated this view, and the sentence of death under which he suffered was the penalty of rebellion quite as much as of heresy.

Through the centuries which followed, the anti-papal controversies turned so entirely upon doctrine, that there was little room for the discussion of this question, and it is a mistake to suppose, as has not unfrequently been done, that it entered in any way into the conflict of Gallican and Ultramontane principles. Even the great Gallican champion, Bossuet, not only admitted the lawfulness of the pope's temporal sovereignty, but contended that it was in some sense necessary to the free exercise of his spiritual power, and to the independence of his ecclesiastical government. It was not until the aggression of the French Republic upon Rome, and the annexation of the Papal provinces called the Legations, to the Cisalpine Republic, and afterwards to the kingdom of Italy, by Bonaparte, that the controversy assumed any practical interest. During the later conflict between Pius VII. and Napoleon I., the design which the latter entertained of a still further annexation of Papal territory was one of the main causes of dispute, and still more recently, after the re-annexation of nearly the same portions of the Papal States to the kingdom of Italy, the question once more agitated the entire Catholic world. No formal and authoritative judgment of the Roman Church was pronounced regarding it; but a strong and almost unanimous expression of opinion was tendered to the present pope, Pius IX., in the form of letters and addresses from bishops and others in every part of Catholic Christendom. The tenor of all these is nearly the same. They profess that the possession of temporal sovereignty is no essential part of the privileges of the successor of St. Peter; but they also regard the possession of a sovereignty independent of any particular sovereign, as the means providentially established for the protection of the spiritual independence of the pope, and of the free exercise of his functions as spiritual ruler of the church. The contrary opinion held by some distinguished members of the Roman Church, although regarded with great disfavor, was not formally condemned by a doctrinal decision, nor was any action taken on it in the Vatican Council. The recent annexation of the city of Rome itself to the kingdom of Italy elicited a still stronger expression. The event is noticed in the article PAPAL STATES (q. v.).

II. By the second signification of the phrase 'Temporal Power of the Pope' is understood what would more properly be called the claim of the pope, in virtue of his office, to a power over the temporalities of other kings and states.

This power may be of two kinds, *directive* and *coercive*. In the first sense, it is a claim which no Catholic, consistently with his belief of the spiritual supremacy of the pontiff, can be supposed to deny, as it imports nothing more than that the pope, as supreme moral teacher, has power to instruct all members of his church, whether subjects or sovereigns, in the moral duties of their several states.

If the power be regarded as coercive, it is necessary to distinguish the nature of the coercion which may be employed. That coercion may either consist in the threat or infliction of *purely spiritual censures;* or it may involve temporal consequences, such as suspension or deprivation of office, forfeiture of the allegiance of subjects, and even liability to the punishment of death. Considered in the former sense, the claim must be regarded as a natural consequence of the spiritual headship of the church, which is acknowledged by all Catholics; nor can it be denied that the power to compel sovereigns, by purely spiritual censures, to the fulfilment of the moral duties which their state imposes, is a natural concomitant of the spiritual primacy.

But the papal claim to authority over the temporalities of kings has gone far beyond these limits. From the 10th c. downwards, popes have claimed and have repeatedly exercised a power of coercing kings, and punishing them when refractory by suspension, by deprivation, and by the transfer of the allegiance of their

subjects to another sovereign. This well-known claim has been a subject of controversy in the Roman Catholic Church between the Gallican (q. v.) and Ultramontane (q. v.) schools; and in the Ultramontane school, two different theories have been devised for its explanation. The first and most extreme (which holds the power to be a direct one) supposes that this power was given directly by God to St. Peter and his successors, that the two powers are foreshown by the 'two swords' mentioned in Luke xxii. 38, and that the temporal power is a privilege of the primacy by divine law, equally with the spiritual sovereignty itself. According to the second, or *indirect* theory, the temporal power is not directly of divine institution, but is an indirect though necessary consequence of the spiritual supremacy; and is only given as a means of completing, and, in a corrupt and disorganized state, rendering more efficacious, the work which the spiritual supremacy is directly instituted to accomplish. It was in this latter form that the theory of the temporal power was defended by the great champion of Ultramontanism, Cardinal Bellarmine, and the celebrated Declaration of the Gallican Clergy (*Declaratio Cleri Gallicani*) in 1682 (see GALLICAN CHURCH) was directed against it.

A third view of the temporal power, and one which has found many modern defenders, was propounded by the celebrated Fenelon (q. v.). According to Fenelon's theory, which is generally described as the Historical Theory of the temporal power, the pope does not possess, whether by direct divine appointment, or in virtue of the necessities of his spiritual office, any temporal power whatsoever. But he possesses the plenitude of that spiritual power which is required for the government of the church, and he is empowered to enforce it by spiritual penalties, and especially by excommunication or deprivation of membership of the church. Now, although excommunication and such other penalties, of their own nature, are purely spiritual, yet the religious sentiment of the medieval period, and the awe with which it regarded the authority of the church, invested these penalties with certain temporal effects. See EXCOMMUNICATION.

The penalty of forfeiture of certain civil rights was attached by the law of England, in the case of private persons, to the spiritual censure of excommunication (q. v.). The same penalty was applied by the laws of other countries to the sovereigns themselves; by the law of Spain in the sixth council of Toledo in 638; that of France, as confessed by Charles the Bald in 859; the law of England, under Edward the Confessor, and the so-called Saxon and Swabian codes of Germany. The last-named codes recognize in the pope, in certain specified cases, the right to excommunicate the Emperor himself; and ordain that in case the Emperor should remain for twelve months without being absolved from the excommunication, he shall be deposed. In the appeal of the Saxon nobles to the pope against Henry IV., this law is expressly referred to. The contemporary historians, Paul of Bernried, Lambert of Aschaffenburg, Nicholas Roselli, and others, describe it as the ground of the Emperor's deposition; and even Henry himself, without denying the force of the law, sought his defence solely in a denial of the charge of heresy which was imputed to him. The same spirit of the age is exhibited in the form of oath taken at the coronation of the sovereign in many countries, especially (although not exclusively) in those whose kings—as Roger of Sicily, Peter III. of Aragon, Guiscard of Naples, Godfrey of Jerusalem, and John of England—had made their kingdoms feudatory to the see of Rome; by which the monarch swore to be the protector and defender of the sovereign pontiff and the Holy Roman Church in all their necessities and utilities, and to guard and maintain their possessions, honors, and rights.

From these and similar indications of the public feeling of the medieval time, the advocates of this theory of the Temporal Power infer that orthodoxy and obedience to the pope, in all essential matters of faith and discipline, were by the consent, express or tacit, of sovereigns and of peoples accepted as a condition of the tenure of supreme civil authority—a condition similar in its character and objects to that which forms the basis of the limitation settlement of the succession to the English crown, to the heirs of the Princess Sophia of Hanover, 'being Protestant.' Hence they conclude that the function really exercised by the popes in relation to heterodox or scandalously immoral sovereigns, or oppressors of the church and church liberties, was in itself a spiritual one, and that the civil consequences which it entailed of deprivation or deposition arose, not from the church law, but from the expressed or understood international civil law of the age. This notion of the origin and nature of the pope's power over sovereigns and states may be regarded as the view now commonly received, and it may help to a better understanding of some points of the controversy regarding the celebrated Syllabus. It may be added, that this view is not confined to Catholic writers, but is held by Leibnitz, Pfeffel, Eichhorn, Voigt, Frederick Hurter (while still a Protestant), and others.

On the other hand, it is difficult, if not impossible, to reconcile this theory with the language used by the popes themselves in enforcing their claim to temporal authority, and with the arguments upon which they rest that claim. Nor can it be denied that whatever is said of the cases of the exercise of such a power which occurred in the 12th and 13th centuries, the power continued to be claimed and to be exercised down to and even after the reformation, when it would be idle to suppose that any such such public understanding, if it had existed in the middle ages, had not been revoked, if not by all, at least by those nations which had revolted from the Roman Church.

The history of most of the principal instances of the exercise of this power by the popes, will be found detailed under the separate articles which refer to the particular popes or sovereigns who engaged in the contest of church and state.—See Gosselin's *Pouvoir du Pape au Moyen Age.*

TENA'CITY (Lat. *tenacitas*, power of holding) is that property of material bodies by which their parts resist a force employed to attempt to separate them. It is the result of the attractive forces exerted by the particles of matter upon one another through the infinitesimally small spaces which are supposed to exist between them; hence it differs in different materials, and even in the same material at different degrees of temperature. The practical bearings of the tenacity of solids (especially of wood and iron) are discussed in the article STRENGTH OF MATERIALS; and we shall therefore here only state a few of the conclusions at which Muschenbroek and other experimentalists have arrived regarding the modifications which the tenacity of metals undergoes in consequence of various processes. Forging and wire-drawing increase the tenacity of metals in the longitudinal direction. Copper and iron have this property more than doubled, while gold and silver have it more than trebled by these metals being drawn into wire. Mixed metals have usually a greater tenacity than simple ones. See ALLOY.

TENAILLE, in Fortification (q. v.), a work in low relief, constructed immediately in front of the curtain. It may either have two faces, in a line with the faces of the adjoining bastions, and meeting at the center in a re-entering angle; or three faces, of which two are prolongations of the bastion faces, and one parallel to the curtain. The tenaille must be low enough for the defenders to be safe from the musketry-fire on one bastion defending a breach in the other bastion. This work is of great use in protecting the ditch, covering the postern from the enemy's view, &c.

TE'NANCY AT WILL, in point of Law, means an occupation by a person in the character of a tenant, but for no fixed term other than the will or caprice of the landlord or proprietor. In general, courts are averse to assume a tenant to be a tenant at will, if there are materials to satisfy the description of a yearly tenant. Rent is payable, under a tenancy at will, according to the time of occupation, and the tenancy can be determined by either party at any time. But the tenant is not to be prejudiced by the sudden determination of the tenancy, so that if he has sown the lands, he is entitled afterwards to re-enter the lands, to reap the crops; and, in like manner, he has a reasonable time to remove his furniture.

TENANCY IN COMMON, in point of Law, means a right to hold or occupy lands, or possess chattels, along with another or other persons. In such a case, each has an equal interest; but in the event of the death of either, his share does not go to the survivors, as is the case in Joint Tenancy (q. v.), but to his heirs or executors. Tenancy in common applies to ownership as well as leasehold interests. Though each tenant has as much right to the whole property as the others, yet neither has a definite share set apart to himself exclusively. If one wastes or deals with the property to a greater extent than his share, the others can bring an action against him. Each can at any time compel a severance of the property so that thereafter he may have his own share severally.

TENANCY ON SUFFERANCE differs from a tenancy at will in this, that a tenant at will enters on a good title, whereas a tenant on sufferance has no title, and wrongfully continues. Thus, when the term has ended, and the tenant has got notice to quit, but does not, he continues a tenant on sufferance, and may be ejected at any time, unless the landlord elect to treat him as a tenant in continuation of the former lease.

TENANT FOR LIFE, in English Law, means one who has not the absolute property, but an interest in the property, which ceases with his own life, or the life of another. An estate for life in lands is classed with freehold estates. Where the estate for life depends on the life of a third person, as it is the interest of the tenant that such third person should live as long as possible, frauds are often committed on the reversioner by misrepresenting the fact of such person being alive; hence, to prevent fraud, the reversioner may insist on the third person being produced, failing which he will be taken to be dead. An estate for life is usually created by deed, but there are two legal estates for life—namely, the widow's estate in dower, and the husband's estate by courtesy on his wife's death. As a general rule, a tenant for life of real

estate is entitled to take wood to repair and burn in the mansion of the estate; but he cannot for other purposes fell the trees, nor open mines or pits, though, if these have been already opened, he may carry them on. Sometimes a tenant for life is declared by the deed or will to be tenant without impeachment of waste, in which case he can exercise most of the rights of an absolute owner, except cutting down ornamental timber, or defacing the family mansion. Tenants for life may now apply to the Court of Chancery for leave to raise money to drain the lands and make improvements. When a tenant for life dies between the usual terms for drawing rent, the rent is apportioned between his executors and the party next entitled. A tenant for life is called, in the law of Scotland, a Liferenter (q. v.).

TENANT IN FEE SIMPLE, in English Law, is the old feudal description of one who is absolute owner, the fiction being that all were originally tenants of the crown. A tenant in fee simple has a freehold estate of inheritance, which is the highest degree of property known to the law. There is practically no feudal connection with the crown, and he can alienate or devise the property without the leave or sanction of the crown. A tenant in fee simple has an absolute right to the soil and the mines down to the the center of the earth, and has a right to build as high as he pleases. If he dies, the estate goes to his heirs—i. e., his heirs general; but he has power to devise it to whom he pleases, subject to certain restrictions, in cases where the donee is a charitable corporation or trustee for charitable purposes. See MORTMAIN. A tenant in fee simple is called in the law of Scotland, a Fiar (q. v.).

TENANT IN TAIL. See TAIL, ESTATE.

TENANT-RIGHT. This term is used by tenants to denote the various claims of right which they may maintain against their landlords, such as the right of occupancy not subject to removal; and the right to occupy at a rent not subject to increase on the ground of improvements; it being said to be inequitable to make them pay rent for what they have themselves produced. It is in Ireland that the claims have always had most importance. In Ulster, and in the north of Ireland generally, the equity of them has long been recognized and acted upon. In the south of Ireland, on the other hand, tenant-right was never conceded by the proprietors; while the right of occupancy not subject to removal, has, *de facto*, been enjoyed by the tenants. The non-settlement of the question was long the cause of bitter controversy, and undoubtedly its evil condition was the root of much of the national misery. Owing to the old tenure of land as tribal or clan property, the people of the south of Ireland never received into their minds the notion of 'contracting' with any one as the 'owner' of land. They had the traditional feeling of being themselves the owners; and so much was this feeling a source of agrarian disturbances, that few Irish 'landed proprietors' have ever ventured fully to exercise their rights of property. And in the south, the land was often occupied by the same families from time immemorial, without lease or contract of any kind.

By the Land Act of 1870, the Ulster tenant-right and all corresponding customs received the force of law, and when there was no definite custom, the outgoing tenant became entitled to compensation from the landlord to an amount varying from one to seven years' rent. The act also gave compensation for improvements. The Land Act (Ireland) of 1881 makes most beneficial changes in the position of Irish tenant-farmers. A Land Commission or Court (with sub-courts throughout the country) was established, to which every tenant may have recourse in order to have a 'judicial' rent fixed for a period of fifteen years, at the end of which time the tenant may again apply to the court. During the fifteen years, the tenant cannot be evicted save for the breach of certain conditions, or non-payment of rent, and the rent cannot of course be raised. The tenant's right to sell his tenancy to one person at the best price he can get was recognized; and provision was made for advancing money to tenants willing to purchase their holdings absolutely.

The Irish claim of tenant-right very much resembles that made by the Indian ryots against their zemindars. In India, as in Ireland, until what may be called recent times, land belonged to families or communities, which held themselves to be composed of kindred; but by acts passed by our government, a class of mere tax-collectors have been converted into land-owners, in order to facilitate the collection of the revenue. Hence, there has been in India an agitation very much resembling that which prevailed in the south of Ireland. The ryot claim of tenant-right was made the subject of a suit before the supreme courts of India, when a majority of the judges favored the equitable claim of the ryots. In countries where the people have been trained in notions derived from the Roman or feudal laws, there has been little heard of this species of claim of right, and land has been recognized by the people as being, like other things, a fair subject for contract.

In Scotland and in the north of England, farms are almost always let on long leases, and at such rents as are supposed to repay the tenant the capital which he may lay out in improvements; and the common case is, that the landlord binds himself to pay the tenant a stipulated sum as the value of his improvements, provided that these are found at the end of the lease to be of a certain stipulated value. Over England generally, on the other hand, tenancy can be ended by six months' notice on either side, and the evils incidental to this precarious tenure have been obviated or mitigated solely by the honorable conduct of the English proprietors. It is quite common in England to find that the son has succeeded the father as tenant at will for many generations, often for centuries.

Since the admission of the claim to tenant-right in Ireland, it has been more frequently heard of in the other parts of the United Kingdom, especially in the form of a claim to compensation for permanent or unexhausted improvements made by the tenant. Of the equity of this claim there can be no doubt, and the law might easily be altered so as to admit of effect being given to it. As matters at present stand, there is little inducement for a tenant to improve the land. The law by which the ownership of improvement follows the ownership of land, is in the present condition of things in the highest degree unjust and inexpedient. The tenant's interest in all his improvements ending with his tenancy, he is very unlikely, at least towards the end of his term, to spend anything on the land which will be of benefit to it; and where he is a tenant at will, he is entirely without interest to improve it.

TENA'SSERIM, acquired by Britain after the war in 1825, is the third or southernmost division of British Burmah* (q. v.)—the other two divisions comprising the ancient kingdoms of Pegu and Arracan. On the 31st January 1862, these three maritime provinces were united under one local administration, bearing the name of British Burmah.

T. is a narrow line of coast about 500 miles in length, with a varying breadth of from 40 miles at its southern extremity to 80 miles; the latter distance being measured from the sea-shore at the mouth of the Salwen to the range of mountains on the east that separates T. from Siam. It extends lengthwise from the southern border of Pegu in 17° 50′ N. lat. to near the tenth parallel of N. lat., and from 97° 30′ to 99° 36′ E. long., and has a total area of 46,730 sq. m. T. is divided into six administrative districts besides the town of Moulmein: Toungu, area 6354 sq. m.; Schwe-gyen, 5567 sq. m.; Salwen, 4646 sq. m.; Amherst, 15,193 sq. m.; the town of Moulmein, 10 sq. m.; Tavoy, 7200 sq. m.; and Mergui, 7760. The principal town is Moulmein; the next in importance being Toungu and Mergui.

Physical Features.—The general aspect of the country is bold and picturesque. The numerous wooded ranges of hills take generally a course from north to south. The northern part of the country is the most level; the southern portion is little else than a wilderness of thickly-wooded hills, enclosing long and narrow leys. The soil of the plains is very fertile, and suited to the growth of rice, indigo, cotton, sugar, and vegetables. Tobacco grows chiefly on the banks of rivers in the hills. Only about $\frac{1}{18}$th of the country is under cultivation, and the forests occupy two-thirds of the entire area. The chief rivers are the Salween, Gyne, Attaran, Yé, Tavoy, and Tenasserim. The Tenasserim, from which the country derives its name, is the most considerable river of the province. The principal ports of T. are Maulmain (q. v.), Amherst, Tavoy, and Mergui, of which Maulmain is the best. Amherst harbor, at the mouth of the Salween, affords good anchorage for ships of any draught of water, but is difficult of approach. The Mergui Archipelago, lying off the southern coast of T., consists of almost innumerable islets, some of which are said to be rich in iron ore; and they are famous for their edible birds' nests. Numerous anchorages are found amongst the islands. The country possesses vast stores of mineral wealth, which now lie absolutely neglected. Gold-washing has been pursued with success at the head of the Tavoy River. At Kahan, on Mergui Island, are rich and accessible tin-mines; and thousands of tons of good clean ore, yielding 75 per cent. of the pure metal, could be raised not far from the surface of the ground. A very productive iron ore is obtained from Iron Island, between Tavoy and Tiger Island. Mergui province furnishes a valuable lead ore, and has extensive fields of coal. Manganese has been found on the Tenasserim River, where it is believed to be very plentiful.

Botany.—The botanical productions of T. may vie with those of any part of the world. There are more than one hundred different kinds of timber-trees, of which the teak is the most important. The celebrated *Amherstia nobilis* is the most splendid of the many flowering and ornamental trees for which T. is famous. The palm tribe are in great variety, and Dr. Griffith collected 1700 different species of plants in about 14 months.

The *climate* of T. is regulated by the monsoons; and the wet

* The provinces of British Burmah extend along the eastern shore of the Bay of Bengal from the Naf Estuary, in about 20° 50′ N. lat. to the Pak-chan River in about 10° 15′, with a coast line of 900 English miles. Their area and population, according to the latest returns (1872), are as follows: Arracan, area 14,526 sq. m., pop. 481,363; Pegu, area 27,300 sq. m., pop. 1,662,058; Tennasserim, area 46,730, pop. 600,727.

and dry seasons divide the year into two nearly equal parts. The average yearly fall of rain is about 194·28 inches, and this descends during the six rainy months from May to October. The greatest amount of rain ever recorded as having fallen in one day (27th May 1857) is 12·75 inches; and the gauge for the week registered 40·27 inches (Dr. Walter). While the rains last, the temperature is very uniform, the thermometer ranging between 76° and 82°. The cool season lasts from the cessation of the rains in October, when the north-east monsoon begins, to the middle of February. During that time, the thermometer seldom reaches 90° in the shade, and occasionally falls as low as 56°, and now occurs the greatest thermometric range, which is sometimes as much as 30° in one day. The sun then gradually regains its power, and the heat increases daily till the south-west monsoon again brings clouds and rain. In the hot period, the thermometer at mid-day is not often below 92° in the shade, and not unfrequently stands at 95°.

Commerce.—The principal exports from T. are teak, timber, and rice. The trade of the province is, however, not on the increase. The first two articles of export mentioned are not continuous from year to year; and we accordingly find that the decrease in the value of trade is owing to the diminished demand for teak timber. Indeed the defective continuity of supply is to some extent a fact also as regards timber. Rice is the most reliable article of commerce.

Inhabitants.—In 1872 the pop. of the T. districts was as follows: Toungu, 86,166; Schwe-gyen, 129,485; Salween, 26,117; Amherst, 193,468; Moulmein (town), 46,472; Tavoy, 71,827; Mergui, 47,192; total pop. of T., 600,727. Most are Burmans proper, but there are other races, as Talaings, or descendants of the ancient Peguans; Karens, a dispersed people, inhabiting secluded mountain districts —among whom Christianity has made some progress, through the labors of American missionaries; Toungthoos, Khyengs, Shans, Europeans and their descendants, Chinese, and Indians. Throughout T. and British Burmah generally, inheritance and marriage are regulated by Buddhist law, while at the seaports the English mercantile law and law of contracts are in force, and regulate the decisions of the courts.—*The Natural Productions of Burmah and the Tenasserim Provinces*, by the Rev. F. Mason, A.M. (Maulmein, 1850); *Six Months in British Burmah*, by Christ. T. Winter (Lond. 1858); *The Tenasserim and Martaban Directory* (Maulmain, 1857); *Reports of the Administration of the Province of British Burmah, for* 1861, 1862, *and* 1863, by Lieut.-colonel A. P. Phayre, C.B., Chief Commissioner and agent to the Governor-general (Rangoon, 1862, 1863).

TE'NBY, a small parliamentary and municipal borough, and thriving watering-place, of South Wales, in the county of Pembroke, and 10 miles east of the town of that name. Its charming situation on a peninsula, overlooking the Bay of Caermarthen, its salubrity of climate, and the facilities for bathing which the extensive sands in the vicinity afford, have made it one of the best and most fashionable watering-places in Wales. A considerable part of the ancient embattled walls of the town still remains. There are also a handsome church and picturesque ruins of a castle. The season lasts from June till October, and the number of permanent winter residents is annually increasing. Fishing is extensively carried on. Pop. (1881) 4783; but during the season the number is greatly increased.

TENCH (*Tinca*), a genus of fishes of the family *Cyprinidæ*, of a thick form, with small scales, and a barbel at each side of the mouth, the teeth on the pharynx compressed and club-shaped. The COMMON T. (*T. vulgaris*) is an inhabitant of ponds and other

Tench (*Tinca vulgaris*).

stagnant waters in Europe and the north of Asia. It passes the winter in a torpid state, concealed in the mud. It is of a deep yellowish-brown color, more rarely golden or greenish. Instances have occurred of its attaining a length of three feet, but a T. of half that length is unusually large. It is very tenacious of life, and, like the carp, can be conveyed to a distance alive in wet moss. It spawns in May and June, depositing its spawn among aquatic plants. The ova are very small and very numerous. The flesh of the T. is soft and insipid, except when it is very well fed, when it becomes delicate and pleasant. It is commonly placed in ponds along with carp; a much smaller number of T. than of carp, however, being deemed sufficient to stock a pond. In Britain, the T. is found only in England, and there sparingly in some of the slow and muddy rivers. It is not improbable that it may have been originally introduced as a pond-fish, although it has long been naturalized. Angling for T. resembles angling for carp. The same kinds of bait are used.

TE'NDA, COL. DE, a pass over the Maritime Alps. See ALPS.

TENDER, as a Legal term, means the formal offer to perform some obligation incumbent on the person tendering. It is more frequently used in reference to the payment of money which is due. Whenever a tender of the debt is properly made, the legal consequence is this, that if the money is refused, the creditor will have to pay the costs of any action he may bring to recover it, and cannot claim interest afterwards. In case such an action is brought, the debtor has nothing to do but to plead that he duly tendered the money, and if he then pay into court the sum which he had formerly tendered, the other party must stop the action, or continue it at his own risk. In order, however, that a tender should have the above effect, it must have been duly made—that is to say, it must have been made without imposing any conditions on the creditor, and at the proper time and place. The tender must be in money, and not by bill of exchange; but Bank of England notes are a good tender for all sums above £5. If the debt is beyond 40*s*., it ought to be in gold, so far as it goes. Though other bank-notes than Bank of England notes are often tendered, the creditor is not bound to accept them; but if he take them without any specific objection, then it will be a sufficient discharge. A tender of a larger sum than is due is good, but must not require change to be given, which the creditor is not obliged to find. Nor must any consideration be annexed to the tender, not even the condition of giving a stamped receipt, though on other grounds, by statute, a person receiving payment is bound to fill up a stamped receipt on its being tendered to him, and to pay the stamp; and his refusal to fill up the receipt subjects him to a penalty of £10. A tender of payment must, in general, be made to the creditor at the place he has indicated, and it is the duty of the debtor to find out and pay the creditor. With regard to payment of rent, however, it is enough that the tenant be ready to pay the rent on the premises at the time it is due, it being the landlord's duty to send or call for it, for the land is the proper debtor, and that is the place to apply to in the first instance.

TENDER, in Naval language, a small vessel appointed for the service of a larger one. Steam gunboats are most commonly employed as tenders.

TEN'DON is the term employed in Anatomy to designate the white fibrous tissue reaching from the end of a muscle to bone or some other structure which is to serve as a fixed attachment for it, or which it is intended to move. In accordance with their form, tendons have been divided into the three following varieties: (1) *Funicular*, or rope-like, as the long tendon of the biceps muscle of the arm; (2) *Fascicular*, as the short tendon of that muscle, and as the great majority of tendons generally; and (3) *Aponeurotic* or tendinous expansions, sometimes of considerable extent, and serviceable in strengthening the walls of cavities, as, for example, the tendons of the abdominal muscles.

The tendons commence by separate fascicles from the end of each muscular fibre, and they similarly terminate by separate fascicles in distinct depressions in the bones, besides being closely incorporated with the periosteum. In some birds, whose tendons are black, the periosteum is black also, from this incorporation. If a tendon is ruptured by an accident, or divided by the surgeon, the two ends, if not too far separated, unite with extreme readiness, by the formation of intervening plastic material, which soon acquires great firmness. So rapidly is this process of repair carried on, that, according to Mr. Paget, a specimen, six days after division, could bear the weight of 25 lbs.; while in another specimen, the new material, at the end of 21 days, bore a weight of 56 lbs. When the interval between the two ends of a tendon exceeds a certain limit, there will be only an imperfect bond of union, and either a partial or total loss of the use of the muscle will result. For details regarding this process of repair, which has an intimate bearing on the treatment of ruptured tendons, the reader is referred to Mr. Paget's admirable *Lectures on Surgical Pathology*.

Amongst the diseases of tendons, *inflammation* requires especial notice. 'Tendons,' says Mr. Tatum, in his article upon *Affections of the Muscular System*, 'together with their sheaths, are not unfrequently inflamed. Independently of gout and rheumatism, the most frequent cause is a sprain or wrench in the neighborhood of a joint. These injuries are occasionally productive of long-continued wearing pains, assuming much of a rheumatic character, and yield often slowly and unwillingly to the remedies, both local and general, employed in rheumatism.'—Holmes's *System of Surgery*, vol. iii. p. 544. In one of the forms of Whitlow (q. v.), known as *Paronychia gravis* or *tendinous whitlow*, 'the tendons and

their sheaths in the finger and hand are the seat of a severe and often most destructive inflammation, which, though often confined to one finger, not unfrequently extends to the hand and arm, attacking not only the tendons and softer parts, but exposing the bones, and disorganizing the joints.'—*Op. cit.*, p. 544. It arises from slight punctures or wounds, with or without the inoculation of irritant or poisonous matter, and often without any apparent cause, except a derangement of the general health. It begins with severe and throbbing pain in the palmar surface of a finger, which extends upwards along the arm. There is extreme tenderness, and a certain amount of redness and swelling, with great tenseness of the parts. If the inflammation is not checked, suppuration soon ensues, accompanied by much constitutional disturbance. The matter frequently extends amongst the muscles, and in bad cases, occurring in unhealthy persons, the bones and joints become affected in the way already mentioned. In the early stage, free leeching, followed by hot fomentations, may be useful. The hand should be kept elevated, and an active purgative, with low diet, prescribed. If, as is often the case, these measures are unsuccessful, a free incision must be made along the center of the palmar aspect of the finger—an operation which gives extreme relief, by removing the tension, and allowing the escape of blood, even if little or no pus is discharged. A generous diet, stimulants, and tonics, are now advisable; and under this treatment the disease generally yields; although cases occasionally present themselves in which the suppuration produces such results as to render amputation of the arm necessary, or even to cause death. A permanently bent finger, from adhesion of the tendon to its sheath, is a common result in severe cases of whitlow of this kind.

Tendons are not very unfrequently the seat of syphilitic enlargements or tumors. Malignant tumors scarcely ever spring from tendons, but fibrous tumors and small cartilaginous enlargements are often found in tendons.

Rupture of the tendons is an accident which is frequently caused by violent muscular action, especially if, from illness or other causes, the muscles have been for some time in a state of inactivity. The long tendon of the biceps cubiti is very obnoxious to this injury, which, in this case, is more often due to the disorganization caused by chronic rheumatic gout than to mere mechanical violence. The other tendons most frequently ruptured are the tendo Achillis, and the tendons of the rectus femoris and the triceps humeri. When a tendon is ruptured or divided by a surgical operation (tenotomy), 'the part which is attached to the muscle is drawn away from the opposite end for about an inch. Blood is poured out between the ends, but much less than in rupture of muscles. The pain is said not to be very great; a considerable shock, however, is felt, as from a blow received on the part, accompanied by cramp of the muscle, and a perfect inability to use the limb; and in rupture of the tendo Achillis, a feeling is described as if the heel were sinking into a hole in the floor.'—Holmes's *System of Surgery*, vol. iii. p. 541. The essential point in the treatment of ruptured tendon is to keep the injured part in a state of constant rest and muscular relaxation, so that the separated ends may be approximated as much as possible, and to prevent any violent extension till firm union, by the process of reparation, has been established. The special methods of treating individual cases (as rupture of the tendons of the rectus femoris and the triceps, and of the tendo Achillis) are discussed in Holmes's *System of Surgery*, and other standard works on surgery.

TENE'BRIO. See MEAL-WORM.

TE'NEDOS (Turk. *Bogdsha-Adassi*), an island belonging to Turkey in the north-east of the Ægean Sea, off the coast of the Troad, and about 17 miles south of the western entrance to the Strait of the Dardanelles. It is about five miles long by two broad, rocky, but not unproductive, with a pop. of more than 6000, who are partly Greeks and partly Turks. The chief town, also called Tenedos, or *Bogdsha*, has a trade in wine. Opposite T., on the coast of Asia Minor, is the bay of Besika, whither the English fleet was sent in 1877.

TENERI'FE, the largest of the Canaries (q. v.).

TENERIFE, PEAK OF, or PICO DE TEYDE, a famous dormant volcano, the highest summit in the Canary Islands, stands in the south-west of the island of its own name, and is 12,182 feet above sea-level. The lower slopes of the mountain are covered with forests, or laid out in extensive meadows, yielding rich grass; but the upper ridges, and the Peak, properly so called, are wild, barren, and rugged in appearance. The Peak and its two inferior neighbors, the *Montana Blanco* and *Chajorra*, rise from a rugged circular plain of lava debris and pumice, 7000 feet above sea-level, about 8 miles in diameter, and fenced in on all sides by an almost perpendicular wall of rock. From the crevices of these mountains sulphurous vapors are constantly exhaling. The Peak can be seen from a distance of upwards of 100 miles; but the view from it is generally destroyed by the dense masses of cloud which hang over the surrounding sea at an average elevation of 4000—5000 feet, the sky above being almost uniformly clear and bright. Mr. Piazzi Smyth, in the summer and autumn of 1856, made here a series of experiments for the purpose of ascertaining how far astronomical observation could be improved by eliminating the lower third part of the atmosphere, and with this object observed for two months, first on Guajara (an elevated peak of the rocky wall, 8903 feet high), and afterwards on Alta-Vista (on the side of the Peak, 10,702 feet high). See *Tenerife*, by C. Piazzi Smyth (London, 1858).

TENÈS, a rising seaport of Algeria, 100 miles west of the city of Algiers. It is happily situated for commerce, is the entrepôt for Orleansville, and the depot for the supply of the army with provisions. It is at once fortunate in the agricultural resources of its territory, in its mineral wealth, and its position in respect to transit-trade. Pop. (of commune in 1871) 8000.

TENE'SMUS (from the Gr. *teinein*, to strain) is the term employed in Medicine to designate a straining and painful effort to relieve the bowels when no fæcal matter is present in the rectum; the effort being excited by some adjacent source of irritation. All that is got rid of by the straining, which usually occasions more or less descent of the gut, is mucus, frequently stained with blood. Tenesmus is a common symptom in dysentery, irritation of the bladder, stricture of the urethra, &c.

TENIERS, DAVID, the Elder, a Flemish artist of note, was born at Antwerp in 1582. For some years, he was a pupil of Rubens; afterwards he visited Italy, where he studied under Adam Elzheimer, and on his return, settled in his native city, where he died in 1649. The subjects of T.'s pencil are in general very homely, and often low—the interiors and exteriors of public-houses, smoking-rooms, rustic games, weddings, &c.; but they are executed in the most vividly realistic manner, with such charm of color, and happy ease of composition, that they never fail to excite in the beholder a lively sense of pleasure. T. was almost constantly employed during his career as an artist.

TENIERS, DAVID, the Younger, son of the preceding, was born at Antwerp in 1610. He received his first lessons in art from his father, who, it is said, subsequently placed him in the studio of Adrian Brauwer; but this statement can scarcely be true, for Brauwer (q. v.) was only two years older than himself. It is probable that he derived most, if not all his professional instruction from his father, to whose genius his own bore a peculiarly filial resemblance. In fact, the elder T. may be considered the founder of a school of which the younger is the most brilliant and prolific member. The latter, like his parent, rapidly rose into distinguished consideration, enjoying in the course of his life the favor and friendship of the Archduke Leopold, Queen Christina of Sweden, Don John of Austria, the Prince of Orange, the Bishop of Ghent, and other dignitaries. T. lived for the most part in a villa on the outskirts of Malines, where he had abundant opportunities of studying closely that humble rustic life which he has so charmingly depicted in all its aspects; but he died at Brussels, 11th February 1685. He was twice married: first to a daughter of the painter Breughel (q. v.), *Velvet* Breughel as he was called; and again to the daughter of a councillor at the court of Brabant. The number of his pictures is something marvelous. Smith, in his *Catalogue Raisonné* has carefully described 685. England is peculiarly rich in specimens, but they are also liberally scattered over the galleries and private collections of the continent, and, in spite of their number, bring great prices. They possess, but in a superlative degree, the beauties of the elder T.'s pieces. In the coloring of his skies, the sketching of his trees, the animation and grouping of his figures, we see everywhere the presence of a richer, finer, more observant and more imaginative genius.

TENNANT, WILLIAM, still to be remembered as the author of *Anster Fair*, was born at Anstruther, in Fife, in the year 1785. A cripple almost from his birth, and doomed to propel himself through life on crutches, he betook himself naturally to study, as requiring no exertion of the limbs. In 1799, he went to the neighboring university of St. Andrews, where, however, he only remained two years, leaving it to join his brother, a corn-agent in business. In this, his success was indifferent; and in 1813, he was fain to accept the situation of parish schoolmaster at Dennino, a small hamlet about four miles from St. Andrews, with a salary of £40 a year. The year before, he had published his *Anster Fair*, a poem of much sprightliness and humor, notable as the first attempt to naturalize in our language the gay *ottava rima* of the Italians; by Byron, soon after adopted with such splendid success in his *Beppo* and *Don Juan*. The piece gradually made its way, and in 1814, a highly laudatory notice of it appeared in the *Edinburgh Review*, from the pen of the then omnipotent Jeffrey. In 1816, Mr. T. became teacher of a school at Lasswade, near Edinburgh, whence, three years afterwards, he transferred his services to the Academy of Dollar, in Clackmannanshire. His attainments as a linguist were extraordinary; and in 1835 he was ap-

pointed Professor of Oriental Languages in the university of St. Andrews—a post for which, perhaps, not many men then living had similar qualifications. In connection with his new duties, he published, in 1840, grammars of the Syriac and Chaldee languages. He died, on 15th February 1848, at his residence near Dollar, where his summers were usually spent. He was one of the most genial and amiable of men. Besides other miscellanies in verse, he gave to the world, in 1822, *The Thane of Fife, a Poem;* in 1823, *Cardinal Beaton, a Tragedy;* and in 1825, *John Baliol, a Drama.* None of these later productions had much success, or did anything to increase the literary reputation which his first work had won for him.

TENNESSEE′, a southern state of the American Union, the third admitted under the federal constitution, extends in lat. 35° —36° 30′ N., and long. 81° 37′—90° 28′ W., and is bounded on the N. by Kentucky and Virginia; and on the S. by Georgia, Alabama, and Mississippi. Area, 45,600 square miles. The chief towns are Nashville, (the capital), Memphis, Knoxville, Chattanooga, Murfreesborough, and Jackson. The principal rivers are—the Mississippi, forming the boundary on the west; the Cumberland (q. v.); the Tennessee River, which twice crosses the state; the Obion, Hatchee, and numerous branches of the larger rivers, which give navigation and water-power to the entire state. Eastern T. is crossed by several ridges of the Alleghany Mountains, some of which have elevations of 2000 feet; the middle region between the Cumberland and Tennessee rivers is hilly, and the west level. The western portion of the state, between the Mississippi and the Tennessee, is of the alluvial and cretaceous formation of the shores of the Atlantic and Gulf of Mexico. Extensive iron mines lie between the Tennessee and Cumberland rivers. In the limestone regions are numerous caves, mostly unexplored. Several in the Cumberland Mountains are 100 feet deep, and miles in extent. A considerable river has been discovered in one at a depth of 400 feet; another opening perpendicularly in a mountain has never been fathomed. In some of these caves are large deposits of fossil bones of extinct animals. In the Enchanted Mountain are seen impressions of the feet of men and animals in limestone. Tracts of several acres have sunk into caverns a hundred feet deep. In many places are interesting remains of ancient mounds and fortifications.

The climate of T. is temperate, and, except in some of the river-bottoms, salubrious. The soil of the whole state, except the eastern mountainous regions, is extremely fertile, producing cotton, tobacco, Indian corn, wheat, figs, peaches, grapes, and all the fruits and productions of the southern temperate regions. The state is richly wooded with pine, oak, hickory, sugar-maple, cedar, black walnut; and the woods abound in game, as bears, deer, opossums, raccoons, foxes, &c.; and the country is rich in horses, cattle, sheep, and swine—the last running in large herds in the woods, and fattening on nuts. The state debt at the end of 1880 was near $27,000,000; the state receipts are about $650,000 yearly. In 1879, the crops of T. included 50,897,500 bushels Indian corn, 11,852,000 bushels wheat, 44,160,000 lbs. tobacco, and 204,457,000 lbs. of cotton. In 1870 there were 21,465,452 lbs. tobacco, and 181.842 bales cotton. The commerce of the state, by its rivers and 23 lines of railway, is chiefly with New Orleans, St. Louis, and Cincinnatti. There are state asylums for deaf and dumb at Knoxville, and for the insane and blind at Nashville. There are 51 colleges; a common school-fund of $2,500,000; 2842 churches, chiefly Methodist, Baptist, and Presbyterian; 9 daily, 110 weekly papers. The value of property in 1879 was above $222.000.000.

In 1756, a settlement was formed near Knoxville, then a part of North Carolina. Nashville was settled near the close of the Revolution; in 1790, T. was organized as a territory with Kentucky; and admitted, in 1796, into the Union as a separate state. In January 1861, a proposal to secede from the Union was defeated; but in June, carried by a majority of 57,667. In ten months, the state raised 50 regiments for the Confederacy; while 5 or 6 were also recruited for the Union. The state was the scene, at Knoxville and Chattanooga, of some of the most important operations of the war. T. sends 8 representatives to congress, in addition to the 2 senators allowed to each state. For some years after the civil war, portions of T. continued in a very disturbed condition, numerous outrages being committed by bands of disguised marauders. Population (1800) 105.602; (1820) 422,813; (1840) 829,210; (1860) 1.109,847; (1870) 1,258,373; (1880) 1,542,461; (1,139,-129 whites. 403,343 colored).

TENNESSEE, a river of the United States, the largest tributary of the Ohio, has its origin in the union of the Clinch and Holston, which rise in the Alleghany Mountains of South-western Virginia, and flowing south-west in two parallel valleys, unite at Kingston in the west of Tennessee state. The river flows still south-west, in the Alleghany valley, entering Alabama close by the north-west corner of Georgia, whence it flows 60 miles further in the same course, then turning to the west-north-west, re-enters Tennessee at the north-east corner of Mississippi, flows northwardly across the state, then north-west across Kentucky to its confluence with the Ohio at Paduca; length 800 miles, or from the source of the Holston, 1100. Its chief branches are the Sesquatchie, Paint Rock, Flint, Duck, North Branch, Hiawassee, Big Sandy, and Clark's. It is navigable 259 miles to Mussel Shoals—a series of broad shallow rapids—and 500 miles above. Chief towns, Florence and Decatur, in Alabama; and Chattanooga, Tennessee.

TE′NNEY, in Heraldry, orange color, one of the tinctures enumerated by heralds, but not of frequent occurrence in coat-armor. It is indicated in engravings by lines in bend sinister, crossed by others barways.

TE′NNIS, a game of great antiquity, belongs to the class of ball-games, and finds its analogies in the *sphairisis* of the Greeks, and the *pila* of the Romans. Under the name of *paume*, a name given to it from the ball being at that time struck with the palm of the hand, it is noticed in the Arthurian romances, and in the earlier records of the dark ages. In the 15th c. it was in great vogue in France among all classes, from the monarch to the meanest of his subjects; and about this time the use of a heavy glove to protect the hand in striking the ball was introduced, and a further improvement was subsequently effected by the adoption of the *racket*. The game in England kept pace with its progress in France, and during the 16th, 17th, and 18th centuries, was generally practised under the name of *tennis*. Many modifications have been introduced, but the legitimate descendant of the paume and tennis of former days is the present game of rackets. (See LAWN TENNIS.) 'Rackets' is played in a court 96 or 97 feet long, by 33 or 34 feet wide, and surrounded by walls sufficiently high to prevent the ball from being lost. The players are either two in number, or four divided into two parties. The player or party 'in' *serves* the ball against the head-wall of the court, so as to rebound over a line drawn at a certain distance; it is returned by means of the racket by the player or party 'out,' who must make it rebound from the wall to the other side of the line; and the game is thus carried on till one player fails to strike the ball or cause it to rebound properly. If the player 'in' fails, he changes places with the player 'out;' if the latter fails, the former scores a point. The part of the court on which the player or party in is placed is called the 'service' side; the other, the 'hazard' side.' A similar game played without the racket is called *fives*, *hand-tennis*, or *hand-ball*.

TENNYSON, ALFRED, was born in the year 1809 at Somersby, in Lincolnshire, of which parish his father was rector. He was the third of a large family, several other members of which shared with him in some measure the genius which has won for him undisputed rank as the first English poet of his time. Very early, the bent of nature became obvious; and in 1827, T., along with his brother Charles, issued a small volume, entitled *Poems by Two Brothers*, of which almost nothing has been preserved. Having gone to complete his education at Trinity College Cambridge, he gained in 1829 the Chancellor's Medal by a poem in blank verse, entitled *Timbuctoo*, in which there is plainly to be traced some impress of his peculiar genius. His literary career, however, may properly be said to date from 1830, in which year a volume appeared of *Poems, chiefly Lyrical*, by Alfred Tennyson. It was not received with great favor by the public; but amid much that was weak and immature, it contained pieces which in no indistinct manner announced the advent of a true poet. In a notice of the book by Professor Wilson, in *Blackwood's Magazine*, the promise of the young writer was recognized in sufficiently express terms. The praise was, however, not unmixed with censure, which, though it seemed on the whole judicious, did not commend itself as such to the poet, who retaliated on 'crusty Christopher' in his next volume, published in 1833. This consisted of a selection of poems from the previous one, carefully retouched by the writer, with the addition of pieces produced in the interval, many of which have scarcely been surpassed in beauty by anything he has since produced. Onward from this time, the reputation of the writer slowly but surely extended itself; and the publication, in 1842, of *Poems, by Alfred Tennyson*, in two volumes, raised him to the position of absolute supremacy which he has ever since continued to occupy by almost universal consent. In 1847 appeared *The Princess, a Medley;* and in 1850, the series of elegies entitled *In Memoriam, A. H.*, a tribute of affection to the memory of Arthur Hallam, a son of the eminent historian, and the chosen friend of the poet in his earlier years at Cambridge.

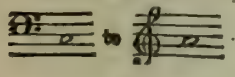
On the death of Wordsworth, in 1850, T. succeeded him as poet-laureate, in which capacity he issued, in 1852, his *Ode on the Death of the Duke of Wellington*. In 1855 appeared *Maud, and other poems*. The immediate reception of this little volume was not enthusiastic. While many of its lyrics instantly caught the public ear, *Maud*, as a whole, at first rather puzzled the critics, and was little better than 'caviare to the general;' and though it has since risen in estimation, the subtle and recondite art exhibited in the structure of the poem is probably even now appreciated by only a few of

its admirers. But for any little falling off in T.'s popularity on this occasion, a noble *amende* was made him on his next appearance. *The Idylls of the King*, published in 1859, were everywhere received with enthusiasm. With scarce a whisper of dissent, this work at once took rank as one of the noblest poems in our language. It was followed in 1864 by a volume, containing *Enoch Arden*, one of his most finished and successful works; *Aylmer's Field;* a short piece, *Tithonus*, consummate in its beauty and finish; and a few other poems of a somewhat less elaborate character; one of which, however, *The Northern Farmer*, written in the Lincolnshire dialect, is singularly striking. Since then, T. has given us several new *Idylls*, which may be considered to complete his handling of the Arthurian romance: *The Holy Grail* and *Pelleas* and *Ettarre* (1869); and *Gareth and Lynette*, and *The Tournament* (1872). *The Window* appeared in 1870; the *Lover's Tale*, in 1879; and *Ballads*, &c. in 1880. In 1875 he published his first drama, *Queen Mary*, followed by *Harold* in 1876; *The Falcon* was acted in 1879; *The Cup*, in 1881; and *The Promise of May*, in 1882. Recent collected editions arrange the various *Idylls of the King* in the order, not of their publication, but of their proper sequence in the legend of Arthur, and enable the reader to appreciate the full beauty and significance of the ideal story. T.'s biography, even more than that of most authors, is given, so far as the public is concerned with it, in the simple enumeration of his works. He has lived for the most part a retired life in the Isle of Wight, or at Haslemere in Surrey.

It is not an easy matter to criticise the poetry of T. dispassionately, so deeply is one apt to become enamored of its beauties. His verse is the most faultless in our language, both as regards the music of its flow and the art displayed in the choice of words. Nowhere in literature is the *callida junctura verborum* so wondrously seen. As a painter, no modern poet has equalled him. But it is neither to his color nor to his music alone that he owes his great popularity. His *virtue* as a poet doubtless lies in these things; but the pleasure which his poetry gives springs largely from the cordial interest he displays in the life and pursuits of men, in his capacity for apprehending their higher and more beautiful aspirations, and in a certain pervasive purity and strength of spiritual feeling.

TE'NON, in Carpentry, the square end of a timber, reduced about ⅓d its thickness, to fit the mortise or socket in another timber, so as to join the two.

TENOR, in Music, one of the four classes into which voices are divided in respect of their compass. It is the higher description of adult male voice, and generally extends from

 Music for tenor voices is most properly written on the tenor or C clef, in which its principal tones come within the staff; but the treble clef is occasionally used, with the notes written an octave above their true pitch.

TENO'TOMY, or the Division of Tendons, is a comparatively recent surgical operation, whose object is to relieve some variety of deformity by severing a permanently contracted muscle at its tendinous portion. The invention of subcutaneous tenotomy is due to Stromeyer (1831), and a lucid account of the history of this operation is given by Dr. Little in his *Treatise on Club-foot and Analogous Deformities* (Lond. 1839). The various kinds of knives that have been devised for severing tendons are termed *tenotomes*. The affections in which tenotomy is advantageously employed are club-foot, contractions of the upper extremity from spasm and paralysis, deformity from diseases of the palmar fascia, torticollis or wry-neck, anchylosis of the knee and other articulations, and squinting.—For further details, the reader is referred to the above-mentioned work by Dr. Little, and to the same author's treatise *On the Deformities of the Human Frame* (Lond. 1853).

TE'NREC or TANREC (*Centetes*), a genus of Mammalia, nearly

Tenrec (*Centetes ecaudatus*).

allied to moles and hedgehogs, usually ranked in the family *Erinaceidæ*. The tenrecs are incapable of rolling themselves up like hedgehogs. They are nocturnal animals, natives of Madagascar and the Mascarene Isles. Three species are known. They are remarkable for spending the hottest part of the year in a dormant state, as some animals in arctic regions spend the winter. Their flesh has a very peculiar flavor, but is acceptable to the natives of Madagascar.

TENSE (Fr. *temps*, from Lat. *tempus*, time), in Grammar, designates a set of changes which verbs undergo in order to mark the time of the action. See CONJUGATION.

TENT (Lat. *tentorium*, from *tentus*, stretched). Without speculating on the relative priority of tents and other forms of human dwellings, it is safe to assume, that among nomadic tribes, some shelter easily framed and portable, must have been felt to be a

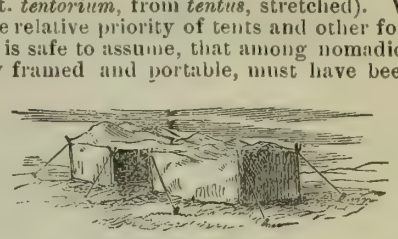


Fig. 1.—Arab Tent.

primary necessity. The skins of animals, or the larger kinds of foliage, would form the earliest coverings, for which textile fabrics would be substituted as civilization advanced. In the book of Genesis, the patriarchs, Noah, Abraham, Lot, Isaac, Jacob, are represented as dwelling in tents, probably much the same as the modern Arab tents, which are large structures, very rude in form, covering a considerable space of ground, but of small height. Among the Nineveh sculptures is a representation of the tent of King Sennacherib, which, like modern tents, was supported by ropes: numerous tents of the officers and common people are likewise shown.

The early Greek, and afterwards the Macedonian tents were small coverings of skins, under each of which two soldiers slept. Alexander the Great is said to have had a pavilion of extraordinary magnificence. Its roof, one mass of gilded embroidery, was sustained by eight pillars covered with gold. In the center, was the royal throne; and 100 beds could be made up within the temporary edifice.

The Roman soldiers seem to have used two sorts of tents—one, a tent proper, of canvas or some analogous material, and con-

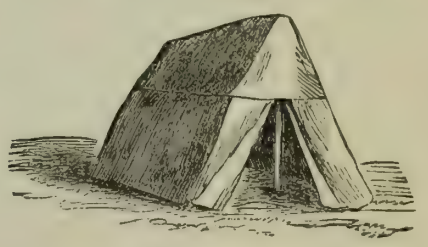


Fig. 2.—Roman Tent.

structed with two solid upright poles, and a roof-piece between them; the other, more resembling a light hut, of a wooden skeleton, covered by bark, hides, mud, straw, or any material which afforded warmth. Of these tents, the poles of the first would have been too cumbrous for carriage, and were probably cut afresh at each halting place; the latter was evidently unsuited to removal, and was most likely only erected for winter-quarters or a long sojourn. The Roman tent held 10 soldiers, with their *decanus*, or corporal.

In Persia, there are many tribes who pass their whole time in tents, which, naturally, they have brought to considerable perfection. They make them nearly hemispherical, with a wooden frame-work, and covered with felt, while worked hangings close the aperture. This felt admits of the exhibition of much taste in its decoration.

The Chinese lower orders live much in tents. They are ordi-

Fig. 3.—Chinese Tent.

narily of matting. These people are clever in their construction, and make them of great size, and with considerable comfort.

Modern military tents are all made of linen or cotton canvas, supported by one or more poles according to shape, and held extended by pegs driven into the ground. British tents comprise

Fig. 4.—Bell-tent.

the hospital-marquee, a large oblong tent with high side-walls; and the round-tent, or bell-tent, for troops. The latter is 12 feet 6 inches in diameter, 10 feet 4 inches high, weighing, with all its appurtenances, 68 lbs., and giving sleeping accommodation to 16 men; the appurtenances comprise 2 mallets, 50 pins, 20 ropes, 20 loops, and 2 long ropes, for use in storms in giving additional firmness round the central pole. In modern tents, there is a low side-wall of canvass, to give greater room inside. These tents are said to be comfortable and moderately healthy, if floored with tarpaulin, vulcanized india-rubber, or other waterproof material. The great drawback is the tendency to blow over. To obviate this, and the inconvenience arising from the conical shape, Major Rhodes, a British officer, invented some years ago a new tent,

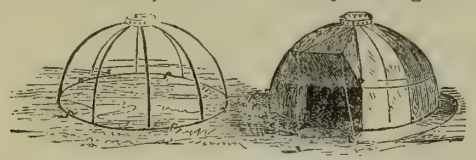


Fig. 5.—Major Rhodes's Tent.

which has found much favor both in this and in other countries. He does away with the central pole, and has a circular frame, hingeing in the center like the ribs of an umbrella, over which the canvas is stretched. It is claimed for this tent, that it is more roomy than the regulation tent, in proportion to its weight, is better ventilated, and possesses far greater stability.

TENTA'CULITES, a genus of obscure annulated tapering shells, found abundantly in some strata of Silurian age. They are generally referred to annelids, but the structure of the shell seems to exhibit greater affinities to recent pteropodous molluscs.

TE'NTERDEN, a municipal borough and market-town in the Weald of Kent, 18 miles south-south-east of Maidstone. The church, which contains portions of Early English, is surmounted by a massive and lofty perpendicular tower. Tradition asserts, that a quantity of stones, which had been got together for the purpose of strengthening the sea-wall of the Goodwin Sands, were employed in the building of this tower, and that when the next storm came, the district of Goodwin Sands, which had formerly belonged to the mainland, was submerged. Thus arose the popular saying, that 'Tenterden steeple was the cause of the Goodwin Sands. Pop. (1871) 3669; (1881) 3620.

TENTERDEN, CHARLES ABBOTT, LORD, a distinguished English lawyer, was born at Canterbury, on the 7th October 1762. He was the son of a hairdresser. Being admitted on the foundation of the King's School connected with the cathedral, he distinguished himself by perseverance and extreme accuracy. A small exhibition in the gift of the chapter enabled him to proceed to Oxford, where, in 1781, he was elected scholar of Corpus Christi College; and a few years later, he obtained what were then the chief distinctions at the university, the Chancellor's two gold medals, one being for English, the other for Latin composition. In due time, he became a Fellow of his college. After being a student of the Inner Temple, in 1795, he was called to the bar. He joined the Oxford circuit; and in spite of a husky voice, a leaden and unmeaning countenance, and painfully timid manners, his great activity of mind, good taste, scholarship, scientific and legal knowledge, were soon appreciated, so that he rapidly acquired a large business. He published, in 1802, his treatise *On Merchant Ships and Seamen*, in all respects the best written book which had till then appeared on one department of English law. It had the effect of increasing his employment in the more lucrative mercantile causes; and in 1807, it appears from his income-tax return that his fees amounted to upwards of £8000. In 1816, he accepted a puisne judgeship in the Court of Common Pleas; and in 1818 he was knighted, and chosen to succeed Lord Ellenborough as Chief-justice of the King's Bench. As a judge, his most marked characteristic was his evident impartiality and freedom from bias. The comparative leisure he enjoyed on the bench he spent in reading the classics and in the study of botany. He was, in 1827, raised to the peerage. In the House of Lords he was the most influential speaker against the Catholic Relief Bill; and in his last speech, he made a vow that if the Reform Bill, that 'appalling bill,' passed, he would never again take his seat as a peer. The success of the measure, it is believed, affected his health. He was seized with a violent attack of inflammation in November 1832, when presiding at the trial of the mayor of Bristol for misconduct during the riots, and he died there on the 4th of that month.

TENUIRO'STRÉS, a tribe or sub-order of birds, of the order *Insessores*, characterized by a lengthened slender bill, which is sometimes straight, sometimes curved. Some of them feed on insects, some chiefly on the honey of flowers. To this tribe belong the Creepers (*Certhiadæ*), Sun-birds (*Cinnyridæ*), Humming-birds (*Trochilidæ*), and Hoopoes (*Upupidæ*).

TENURE OF LAND, in England, was an accompaniment or immediate consequence of the Feudal System (q. v.) established during the middle ages throughout the greater part of Europe. Feuds were introduced by the barbarous tribes who poured themselves into the Roman Empire during the 4th, 5th, and 6th centuries. The chief feature of feuds was, that the lands of the conquered country were parceled out to the leaders, on the condition of bearing arms whenever the sovereign required them. The relation thus created between sovereign and vassal was called a feud. The grantee held his lands at first for life only, but gradually it was developed into a hereditary character, and also into one which admitted of subinfeudation, i. e., the parcelling out of the feudal land among vassals of the head vassal, who was the lord of his own vassals. This kind of relation between lord and vassal gradually was extended to all kinds of land, for the owners of allodial land voluntarily surrendered their land to some lord, so as to have the same advantages. The vassal did homage to the lord, and took the oath of fealty. Besides these characteristics, the holding came to be attended with the following incidents. 1. An aid, which was a payment granted to help the lord in his necessities. 2. A relief was a tribute paid by a new tenant on succeeding to his predecessor. 3. A fine was paid by a tenant to the lord on alienating the lands to a purchaser. 4. An escheat or forfeiture was the reverting of the estate to the lord when there was a failure of heirs or some violation of duty on the part of the vassal.

The feudal system was extended to England by the Norman barons soon after the Conquest, with the concurrence of William I., much to the dislike of the Saxons, whose grievances grew until they found vent in Magna Charta, which was in fact an attempt to restore their earlier constitution. The chief fiction, however, of a relation between the crown and the holders of land was not got rid of. The crown was nominally the lord paramount, and there were intermediate lords called mesne lords, of whom the tenants held. Gradually, the kinds of tenure were classed under free and base services—the former being those which a freeman might perform, as serving in war, or paying a sum of money; the latter, such as a peasant might perform, such as ploughing the lord's land, &c. These were afterwards further distinguished according to the certainty or uncertainty of the extended services to be performed. Ultimately, the tenures were classed as three. 1. *Knight-service*, or chivalry, i. e., holding on condition of serving in the war, and taking the oath of fealty. This was accompanied by the incidents of descent, wardship (or guardianship of the knight's heir by the lord), marriage (i. e., the lord's right to give the knight's infant in marriage), aids, reliefs, primer seisin (i. e., one year's profits from an heir on his succession), fine, escheat, and forfeiture. These incidents gradually grew irksome. JAMES I. proposed to commute knight-service into an annual fee-farm rent; but this not being done, the statute of 12 Ch. II. c. 24 swept the whole away, and converted it into free socage. 2. *Free socage* was a tenure by some certain and determinate service, as by paying a small fixed rent, or ploughing the lord's lands for a fixed number of days. The incidents were rather less burdensome than those of knight-service, being descent, wardship, marriage, and reliefs, primer seisin, fines, escheat, and forfeiture. These incidents were all abolished by the above statute of 12 Ch. II. c. 24, and the tenure of free socage is now generally known as freehold. 3. *Villenage service*, or Copyhold Tenure (q. v.), which still exists nearly in its original state. The result is, that in England at the present day the two tenures are freehold and copyhold.

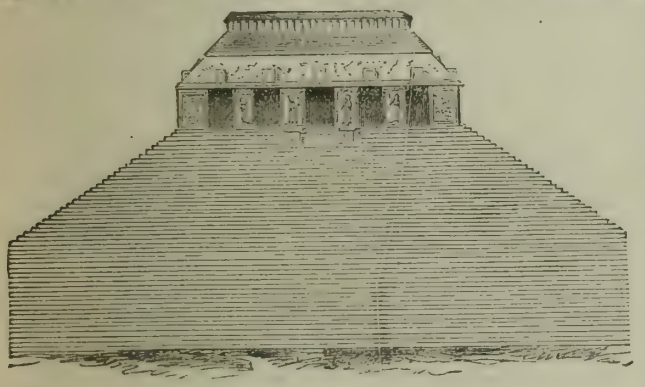
The leading characteristic of freehold is, that practically the feudal relation between the crown and the holder is cut off, and the holder is entirely his own lord and master, can sell the estate, devise it by will, give it away, and do what he likes with it free from any interference or payment to the crown. As to copyhold, the feudal relation is kept up to a certain extent between the lord and the copyhold tenants, who must in form pay rents more or less nominal, and fines and Heriots (q. v.) to the lord on alienating the lands or succeeding thereto. Yet, practically, the copyholder

does not materially differ from a freeholder except that he is liable to these petty and harassing acknowledgments towards a stranger; and by recent statutes, he can compel the lord of the manor to commute these fines and incidents, and convert the tenure into freehold.

In Ireland, the tenure of land is almost identical with that in England; but see TENANT RIGHT.

As to Scotland, there is a marked difference between the tenure of lands there and the tenure in England. At the present day, the feudal system prevails to a great extent, resembling in many respects the English copyhold tenure. Every piece of land there has generally its lord or superior and its vassal, that is to say, the vassal has the *dominium utile*, or actual enjoyment, while the superior has a kind of superior interest, or *dominium directum*, which consists in his drawing a rent called a feu-duty, which the vassal is bound to pay, or to forfeit the land. On each alienation or death of the vassal, there must be certain forms superadded, implying a consent or recognition by the superior, and certain casualties or additional payments must be made on such occasions. Recent statutes have tended to extinguish several of these superfluous forms, and make the vassal more independent. But a great many remain unaltered. And not only is there this feudal relation between the crown and its vassals, but these may subdivide the property and create intermediate estates without limit, each vassal being in turn the superior to his subvassal; and this endless chain of relationships complicates the conveyancing still more. See CONVEYANCING; FEU.

TEOCA'LLI (House of God), the name given to the temples of the aboriginees of Mexico, of which many still remain in a more or less perfect state. They were built in the form of four-sided pyramids, and consisted for the most part of two, three, or more stories or terraces, with the temple, properly so-called, placed on a platform on the summit. The largest and most celebrated is the pyramid of Cholula, measuring 1440 feet each way, and 177 in height; it is much defaced, and the temple on its summit has



Teocalli at Palenque.

been removed. The teocallis in Yucatan are in far better preservation; they are not generally built in terraces, but rise at an angle of 45° to the level of the platform, with an unbroken series of steps from base to summit. The temples on their summit are sometimes ornamented with bas-reliefs in stucco and hieroglyphic tablets, and the roof is formed by courses of stone approaching each other, and furnished with projections like dormer windows. The preceding woodcut gives the elevation of a large teocalli of this kind at Palenque, on a scale of 50 feet to the inch. Not unlike the tocallis are the palaces of the Aztec kings or chiefs, which differ from them in having the pyramids smaller, less prominent, and oblong in plan, while the building, larger and more elaborate, consists for the most part of a stone basement, with square doorways, but without windows, surmounted by a structure which appears to be directly copied from wood-work. On some of these façades, we have also rude pillars and grotesque carvings, and there are often a number of chambers in the interior. A palace and temple are sometimes found attached together; and in a few cases, the most remarkable of which is the Casa de las Monjas, at Uxmal, the buildings are arranged round a courtyard. See MEXICO.

TEPI'C, a town of Mexico, in the state of Jalisco, on a height 400 miles north-west of the city of Mexico. T. is the residence, during the rainy season, of many of the inhabitants of the port of San Blas, about 25 miles distant. Pop. 10,000.

TERA'MO (anc. *Interamna*), a town of southern Italy, in the province of the same name, at the junction of the Tordina and Vezzola, 28 miles north-east of Aquila. It is well built, with long and rather wide streets, has a cathedral, a public library, a foundling-hospital, and a botanic garden, carries on an active trade in corn, wine, and olives, and has a pop. of (1881) 8634.

Ancient *Interamna* (of which the name T. is an Italianized form) was a city of Picenum, in the territory of the Prætutii. In the middle ages, it also bore the name of Abrutium or Aprutium (supposed to be a corruption of Prætutii), whence the modern name of the district, Abruzzo. Vestiges of the ancient city—the amphitheater, temples, baths, aqueducts, &c.—are traceable, and many statues, altars, and inscriptions have also been discovered. In the plain below T. took place, July 27, 1460, between the army of John, Duke of Anjou, and the Milanese allies of Ferdinand I. of Aragon, one of the most sanguinary battles ever fought in Italy. After the contest at Castelfidardo (1860), T. was the first Neapolitan city that opened its gates and gave joyful welcome to King Victor Emmanuel.—Pop. of province, (1881) 254,986.

TE'RAPHIM (Heb. plur.) a word of uncertain derivation (connected by some with Serapis), denoting certain images, idols, or household gods occurring in the Old Testament, which were consulted as oracles, and probably even worshiped to a certain extent. The gods which Rachel stole are called Teraphim, and Saul was reproached by Samuel for stubbornness which is like Teraphim; his daughter placed a Teraph into David's bed to conceal his flight, &c. There is no proof that this veneration for Teraphim was not held perfectly compatible with the worship of Jehovah, spite of some reformatory attempts to sweep them away. Many and curious have been the explanations given of the nature of the Teraphim by different scholars in and out of the synagogue. A vague but generally prevailing notion is that of their having been a kind of astrological automata, which somehow or other could be made to move, and to utter certain sounds. All that is certain, however, is only the fact, that the real meaning and character of this strange idol had been forgotten already at a very early period.

TERATO'LOGY (Gr. *terata*, wonders, or monsters) is a term used in Physiology as synonymous with 'The History of Monstrosities or Anomalous Formations.' See MONSTROSITY.

TE'RBIUM, a very rare metal, whose oxide, *Terbia*, is found in association with the rare earth Yttria, the oxide of Yttrium (q. v.).

TERBURGH, GERHARD, a Dutch painter, belonging to an old and respectable family of Zwoll, was born in 1608, studied first under his father, who was also an artist of note, and afterwards visited Germany, Italy, Spain, England, and France. On his return to his native country, he settled at Deventer, of which town he became burgomaster, and died in 1681. The elegant ostentatious life of his time, with its superfine courtly manners, and splendid costume, found in T. an admirable painter. The central figure in many of his pictures is a young lady with fair hair, and dressed in white satin. His most famous piece, however, is a picture containing portraits of the 69 plenipotentiaries who drew up the Treary of Westphalia. In Dr. Waagen's opinion, T. is the real founder of the art of painting conversation-pieces, and at the same time the most eminent master in this style. 'In delicacy of execution, he is inferior to none; and in a certain tender fusing of the colors, he excels all others; but none can be compared with him in the enchanting harmony and silvery tone, and the observance of the aërial perspective. His figures, which are well drawn, have an uncommon ease of refinement, and are frequently very graceful.' T.'s works are to be found in various English collections, particularly those of Sir Robert Peel, the Duke of Sutherland, Lord Ashburton, Mr. Hope, the Marquis of Bute, and Her Majesty; as also in the galleries of Dresden, Munich, Vienna, the Louvre, Amsterdam, and Berlin.

TERCE (Lat. *tertia*—i. e., *hora*, the third hour), one of the 'Lesser Hours' of the Roman Breviary, so called from the time of the day for which it is fixed. See CANONICAL HOURS.

TERCE, in the Law of Scotland, is the interest or estate which a widow has in the land of her deceased husband at common law. This amounts to a liferent of one-third of such estates. In estimating the estate of the husband, all real burdens must be first deducted, and certain other things—as the mansion-house, if there is only one, superiorities, and patronage, leases, and feu-duties. The mode by which a widow completes her title to the terce is by a process called *Kenning to the Terce* (q. v.), the object of which is to separate her portion from the rest, which goes to the heir, so that each may possess independently his and her portion respectively. She is then in the position of an ordinary proprietor for life. Though terce is a legal right, yet this right of the widow may be modified by an antenuptial contract, under which she is otherwise provided for.—In England and Ireland, a widow has a similar right, called Dower (q. v.).

TERCEI'RA, one of the Azores Islands (q. v.), and the second in size of that group, forms one of the central cluster, and lies eastward from San Jorge. Area, 220 sq. m.; pop. between 40,000 and 50,000. Steep rocks of lava almost everywhere line the coast; the island is accessible only at few places, and these are defended against invasion by fortifications. The soil is fertile; the plateaux of the mountains afford excellent pastures, and cattle-breeding is

an important branch of industry; the principal articles of export are wine, timber, and orchil. Chief town of the island, Angra, the capital (pop. 18,000), in the fort of which reside the governor and the bishop of the Azores.

TEREBINTA'CEÆ. See ANACARDIACEÆ.

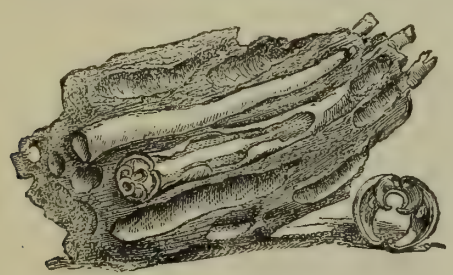
TEREBRA'NTIA, a section of the insect order *Hymenoptera*, distinguished by the females having an ovipositor. To this section belong Saw-flies (*Tenthredinidæ*), Ichneumons, Gall-insects, &c.

TEREBRA'TULA, a genus of deep-sea brachiopodous molluscs. The animal is attached to the shell by a pedicle, and the brachial disc is three-lobed, the center lobe being elongated and

Terebratula:
a, valve with the spiral arms; *b*, valve with arms removed.

spirally convoluted. The shell is smooth, with a truncated perforated beak, the foramen being circular. The shelly loop is very short and simple. The shell of this genus, and some of its allies, is covered with minute quincuncial perforations, sometimes visible to the naked eye, but usually requiring a lens of a low power to distinguish them. The generic title is now restricted to shells with a short internal loop. The species with long loops are grouped together under the name *Waldheimia*. Of the restricted genus, there is only a single living species (*T. vitrea*); but the fossil species are more than a hundred in number, and are found in all periods of the earth's history, from the Devonian age upwards.

TERE'DO, a genus of lamellibranchiate molluscs of the family *Pholadidæ;* very much elongated, and worm-shaped; the mouth very delicate, open in front and at its lower part, for the passage of the short foot; the shell rather thick, equivalve, destitute of hinge, gaping at both ends. The species are rather numerous,



Common Shipworm (*Teredo navalis*).

and are generally known by the name of SHIPWORM or PILEWORM, because they perforate and live in timber. Their perforations are made in the direction of the grain of the timber, except when a knot is met with, or the shell of another *Teredo*, when they accommodate themselves to circumstances by bending. The cavity is lined with a calcareous incrustation.

The aperture by which the T. enters is small, and it grows within the cavity which it makes. Two small valves form the true bivalve shell; the calcareous tube encloses the worm-shaped body of the animal. Its growth is very rapid, and its ravages are often terrible. A piece of deal has been found riddled by shipworms after forty days' immersion. Ships, piles, and all submarine woodwork are destroyed by it. Copper-sheathing is employed to protect ships from the ship-worm, or the timber is driven full of short, broad-headed nails, the rusting of which forms a coating which it does not penetrate. The dykes of Holland have been threatened with destruction by its ravages. The COMMON SHIPWORM (*T. navalis*) is said to have been introduced into Europe from warmer climates. It is now, however, extremely abundant in European seas. In the East Indies, a very large species (*T. gigantea*) is found, generally in shallow water among mangrove trees; it is sometimes more than five feet in length, and at the thickest part three inches in diameter.

TERE'K, one of the most considerable streams of the Caucasus, rises near the lofty Mount Kasbec (about 17,000 feet high), flows north-west through the defiles of the mountains, crossing the district of the Kabarda, and reaches the border of the government of Stavropol, where it curves eastward, forming the south boundary of that government, until, reaching Kisliar, it divides into numerous branches, which form a delta 70 miles broad, and 50 miles long from apex to base, and falls into the Caspian Sea. It is not navigable. Total length estimated at from 300 to 390 miles.

TERE'NTIUS A'FER, PUBLIUS, the comic poet, was born at Carthage, 195 B.C. By birth or purchase, he became the slave of the Roman senator P. Terentius Lucanus, who, out of regard to his handsome person and unusual talents, educated him highly, and finally manumitted him. On his manumission, he assumed, of course, his patron's *nomen*, Terentius. His first play was the *Andria*, written in his 27th year, but not acted till 166 B.C. Its success was immediate, and introduced its author to the most refined society of Rome, where his engaging address and accomplishments made him a particular favorite. His chief patrons were Lælius and the younger Scipio, after living with whom in great intimacy for some years in Rome, he went to Greece, where he translated 108 of Menander's comedies. He never returned; and the accounts of how he came by his death are conflicting. He is supposed to have died in his 36th or 37th year, leaving one daughter. Six comedies are extant under the name of T., which are perhaps all he produced—viz., *Andria*, *Hecyra*, *Heauton-timoroumenos*, *Eunuchus*, *Phormio*, and *Adelphi*. In conjunction with Plautus, T., on the revival of letters, was studied as the model by the most accomplished play-writers. His language is pure almost to being immaculate, and though inferior to Plautus in comic power, he is more than his match in consistency of plot and character, in tenderness, in wit, and in metrical skill. His plays have an educational value, as dividing, with the works of Cicero and Cæsar, the honor of being written in the purest Latin. They have been translated into most of the European languages. The best editions of his works are those of Bentley (Cambridge, 1726), and of Parry (1857).

TERESA, ST., one of the most remarkable of the female saints of the modern Roman calendar, and the most admired of the modern mystic writers of that communion, born at Avila, in Old Castile, March 28, 1515, was the daughter of Alfonso, of the noble House of Sanchez de Ceyeda. Even as a child, T. was remarkable for piety of a most enthusiastic kind; and when she was but seven years old, she and her little brother, Rodrigo, fled from her father's house, with the design of offering themselves for the crown of martyrdom among the Moors, but were overtaken, and restored to their parents. Her mother died while she was still young, and she was educated in a convent at Avila, from which, however, she was compelled by illness to return home when she was in her 16th year. During her illness, she resolved, notwithstanding the very earnest opposition of her father, to become a nun, and having in her 18th year entered a convent of the Carmelite order in her native city, she made her solemn vow on the 3d November 1534. In this convent she continued to reside for nearly thirty years, but it was not till about the year 1539, that her constitution became strong enough to permit her to follow, even in an imperfect way, the observances of conventual life. Her own account of her mental and spiritual condition during this period, which extended to the year 1555, is extremely interesting, and, like the confession of St. Augustine and other saints, has furnished endless materials to the spiritualists of more recent times. The change of heart and of purpose came in 1555—1556, and was as complete and decisive as her former condition had been purposeless or fluctuating. After a time, her religious exercises reached a most extraordinary degree of asceticism. Her prayers were almost continual, and she was reported to be favored with visions, ecstasies, and other supernatural visitations, of which many curious details are related by her biographers, and in her own letters and papers. The fame of her sanctity spread not only throughout Spain, but into almost every part of the church. By some, the reality of the reported supernatural favors which were ascribed to her was called into question; and there were even some who threatened to invoke the rigorous investigation of the Holy Office; but the popular voice was freely accorded to her, and the authority of St. Francis Borgia, St. Peter of Alcantara, and other high names, eventually disarmed the opposition.

The most notable and permanent fruit of the enthusiastic spirituality of T. is the reform of the Carmelite order, of which she became the instrument. She commenced this work in concert with a few zealous members of her own sisterhood in the convent at Avila, where she had resided from the date of her profession; but after a time, she obtained permission from the Holy See, under the direction of Peter of Alcantara, to remove with her little community to St. Joseph's, a small and very humble convent in the same city, where she established in its full rigor the ancient Carmelite rule, as approved by Innocent IV. in 1247, with some additional observances introduced by T. herself. This new convent was established in 1562, and in the end of that year, or the beginning of 1563, T. took up her abode therein; and in 1565, she obtained from the pope, Pius IV., a formal approval for the rule as modified by her. For two years, T. lived in great privacy and

quiet in her convent of St. Joseph; but in 1567, the general of the Carmelite order, F. Rubeo, was so struck during his visitation of the convents at Avila, with the condition of that over which T. presided, that he urged upon her the duty of extending throughout the order the reforms thus successfully initiated. T. entered upon the work with great energy, and although she met with much opposition, nevertheless succeeding in carrying out her reforms. In 1579, the Carmelites of the stricter observance established by T. were released from the jurisdiction of the old superiors, and united into a distinct association, with a separate head and a distinct organization, which was approved in 1580 by Pope Gregory XIII.

Under this new constitution, the association flourished and extended; and within the lifetime of T., no fewer than 17 convents of women and 16 of men accepted the reforms which she had originated. T. died at Alba, October 4, 1582, in her 68th year. She was canonized by Gregory XV. in 1621, her feast being fixed on the 15th October. She left a number of works, which have at all times maintained a high reputation among the spiritualists of her own church, and whose merits, in many respects, are acknowledged by non-Catholic writers. They consist of ascetical and mystical treatises, instructions in the conventual life, meditations, &c., besides a large number of letters, which possess remarkable literary merit, quite independent of their doctrinal character. Her works in the original Spanish fill two folio volumes, and they have been in the whole or in part translated into almost every European language. Her life occupies nearly an entire volume of the new continuation of the *Acta Sanctorum;* and several more popular biographies have been written in Spanish, French, Italian, German—the best known English one being that by the Rev. Canon Dalton. See *Leben der heil. Theresia*, von Dr. Fr. Pösl (Regensburg, 1847).

TERLI'ZZI, a flourishing, well-built town of Italy, in the province of Bari, 20 miles south-east of Barletta, and 8 miles from the Adriatic. It contains a cathedral, a parish church, and three convents. The almond tree is extensively cultivated in the vicinity. Pop. (1881) 20,442.

TERM, in Legal phrase, has several meanings, but that best known is when it denotes certain days of the year for calculating rent between landlord and tenant, and which have been adopted by immemorial usage, owing to the convenience of thus terminating the contract between the parties. In England and Ireland, the year is for this purpose divided into four quarters or terms. These are—Lady-day, March 25; Midsummer-day, June 24; Michaelmas-day, September 25; and Christmas-day, December 25. In Scotland, the terms as between landlord and tenant are divided into legal and conventional terms. There are two terms recognized by common law—viz., Whitsunday, May 15; and Martinmas, November 11; while other two conventional terms subdivide these—viz., Candlemas, February 2; and Lammas, August 1.—There is also a subdivision of the year into Law-terms (q. v.), adopted and sanctioned by statute for the purpose of the sittings of the law-courts. These are Hilary, Easter, Trinity, and Michaelmas terms.—There is a third and technical meaning of the word 'term,' when it means an estate for years in land.

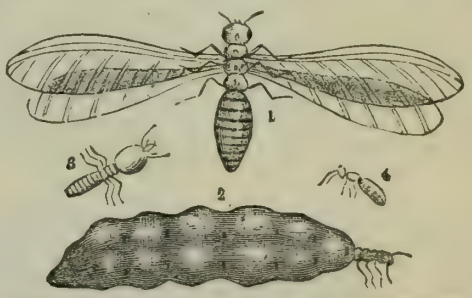
TE'RMINI (anc. *Thermæ Himæræenses*), a seaport town on the north coast of Sicily, 21 miles east-south-east of Palermo, at the mouth of the river Termini. It is built partly on a plateau (the summit of which is crowned by a castle—now a prison—of mediæval construction), and partly on the slope and in the hollow beneath. T., with its noble background of towering hills, and its magnificent view of the Mediterranean, well deserves the title of *La Splendidissima*, bestowed on it by the Emperor Frederick II. Many of the inhabitants are engaged in fishing for tunny and anchovies. Pop. about 20,000.

The ancient *Thermæ* (of which T. is an Italian corruption) was founded 408 B.C., after the destruction of the Greek city of Himæra, and whence its name Himærenses. Whether it owed its origin to the Carthaginians themselves, or to the surviving citizens of Himæra, is doubtful; but it soon passed under the authority of the former, who here defeated the Romans with heavy loss (260 B.C.) during the first Punic war. After Sicily became a Roman province, Thermæ was treated with peculiar consideration by its new masters, and became a flourishing place. Relics of the ancient city, as the baths (which are still used), fragments of a theater, and aqueduct, are still visible; and numerous inscriptions, statues, &c., are preserved in public and private collections.—See B. Romano's *Antichità Termitane* (Palermo, 1838).

TE'RMINUS, a Roman divinity, supposed to preside over public and private boundaries. Originally, he appears to have been the same as Jupiter himself, but gradually he was recognized as a separate and distinct god. Hardly any religious conception is more thoroughly characteristic of the Romans, that land-loving, law-reverencing people, than the conception of T., whose worship was practised down to a late period.

TE'RMITE, or WHITE ANT (*Termites*), a genus of insects of the order *Neuroptera*, and of the family *Termitidæ*, or *Termitinæ*. They live in great communities, chiefly in tropical countries, and are almost omnivorous, in the larva, and pupa, as well as in the perfect state. In their communities, there are five classes —males, females, workers, neuters, and soldiers. The workers, neuters, and soldiers seem all to be imperfectly developed females. The males and perfect females have four wings, which are long and nearly equal, and which are often suddenly cast off before the termination of their life; but the greater part of the community consists of workers, which are wingless. The 'soldiers' are larger than the neuters, and have very large mandibles, which they are always ready to use upon any assault. The antennæ of the genus *Termes* are long and thread-shaped, with about 20 joints; the eyes are small and prominent, and there are three *ocelli;* the abdomen has a pair of minute caudal appendages.

Most of the white ants make their nests on the ground, but some of them among branches of trees, decayed or dry wood forming a principal article of their food. The species which make their nests on the ground make them conical, or turret-shaped, often 12 feet, and sometimes even 30 feet high, in groups, like a little village. The soil where the white ants have labored is particularly good, and the South Africans take advantage of its excellent quality. The nest is divided internally into numerous chambers and galleries; there are generally two or three roofs within the dome-shaped interior, and the thick walls are perforated by passages leading to the nurseries and magazines of food. If a breach is made in the building, the soldiers appear, ready for defence. White ants are very useful in consuming every kind of decaying animal or vegetable matter. They even eat grass, and



1, Perfect male Termite: 2, Female, distended with eggs; 3, Soldier; 4, Worker.

the snapping of multitudinous mandibles has been likened to the sound of a gentle wind among trees. They sometimes attack the wood-work of houses, and soon reduce the thickest timbers to a mere shell. Extraordinary and incredible stories are told of their attacking and devouring large animals, but it seems probable that they do so only when the animals are helpless from age or sickness. They come in vast hosts to any place where food is to be found, and are not easily driven off; multitudes pressing on, although previous multitudes have been destroyed. They gather great stores of corn into their nests, of which the natives of Africa often avail themselves. They are themselves also used as food in Africa, and are said to be delicate and pleasant. The abdomen of the pregnant female T. becomes dilated to an extraordinary degree, so as to exceed the rest of her body 1500 to 2000 times, and she is then about 1000 times heavier than the male insect. Her fecundity is prodigious; she is supposed to lay more than 31,000,000 of eggs in a year.

The Termites which live in trees construct nests of great size, like sugar-casks, of particles of gnawed wood, cemented by a kind of gluten, and so strongly attached to the branches as not to be shaken down even by violent storms. These species sometimes take up their abode in the roofs of houses, where they are very destructive to the wood-work.

Termes mordax and *T. atrox* are among the African ground-building species. *T. lucifugus* is found in the south of Europe, and has proved very destructive in the navy-yard of Rochefort, and elsewhere in the south of France. Sulphurous gases and chlorine are forced into its galleries, without completely effecting its extirpation. *T. flavicollis* is very injurious to olive trees in Spain. *T. frontalis* extends as far north in the United States as Massachusetts, and does mischief in vineries, not only attacking dead wood, but the roots of living vines. No true species of *Termes* is found in Britain, but some of the *Termitidæ* are British insects. One of them is *Psocus pulsatorius*, one of the insects which emit a sound like the ticking of a watch in houses. The species of the genus *Psocus* are very small, active insects, living beneath the bark of trees, in wood, straw, &c. Some of them are often found among books and in collections of natural history.

In books of travels, the termites are often called ants, their habits being similar, although they belong to a different order of insects.

TERN (*Sterna*), a genus of birds of the Gull family (*Laridæ*), by some made the type of a distinct family (*Sternidæ*); having the bill as long as the head, or longer, nearly straight, compressed, slender, tapering; the wings long and pointed; the tail long and forked. The plumage is very full. From their forked tail, manner of flight, and small size, the terns are often called sea-swallows. They are incessantly on the wing, skimming the surface of the water, and catching small fishes and other small animals from it. The species are numerous, and are found in almost all parts of the world. Some of them are of very wide geographic distribution. Many are birds of passage. Thus, all which occur on the British coasts, and in other northern parts of the world, are mere summer visitants. The COMMON T. (*S. hirundo*) is abundant on the more southern shores of Britain, but rarer in the north. It is found also on the coasts of Europe, Asia, and Africa, from the Arctic Circle to the farthest south; but there is some doubt if its range extends to America, where a very similar species, WILSON'S T. (*S. Wilsoni*), was long mistaken for it.

TERNA'TE. See MOLUCCAS.

TE'RNI (anc. *Interamna*), a town of Central Italy, on the right bank of the Nera (anc. *Nar*), a little below its confluence with the Velino, 49 miles north-north-east of Rome. It is encircled by a wall, with towers and five gates, is well-built, gives name to an archbishopric, and possesses a cathedral, several fine palaces and churches, a hospital, theater, and various monuments of antiquity, as the ruins of an amphitheater, temples, and baths—none of which, however, are of much importance. T. manufactures silk and woollen fabrics. Pop. about 14,000. About two miles from the town is the famous cataract of Velino, 500 feet high, celebrated by Byron in his *Childe Harold*.

Ancient *Interamna*, according to classic tradition, was founded only 80 years after Rome, but we have no knowledge of its history until it ceased to be an Umbrian, and became a Roman city. About the time of Marius and Sulla, it was (according to Florus) one of the *florentissima Italiæ municipia*, but at no period did it occupy a very prominent position. Its chief claim to notice arises from its being regarded (by some) as the birthplace of the historian Tacitus, and of his descendant, the emperor of the same name.

TERNSTRŒMIA'CEÆ, a natural order of exogenous plants, allied to *Guttiferæ*, and consisting of trees and shrubs, natives of warm and temperate countries. About 150 species are known. They are most abundant in South America; a few are found in North America; some in India, China, and other parts of the East; only one African species is known; and Europe produces none. The leaves are alternate, leathery, in many species evergreen, generally undivided, sometimes dotted. The flowers are on axillary or terminal stalks, generally white, sometimes pink or red; with 5—7 concave, leathery, deciduous sepals, and 5—9 petals, which are often combined at the base; many hypogynous stamens, which are either free or variously combined; 2—7 filiform styles, more or less combined; the fruit a 2—7-celled capsule, either opening by valves, or leathery and indehiscent, the seeds large, few, and attached to the axis, the cotyledons very large, and often containing much oil. This order is very important as containing the Tea-shrubs. It is also interesting because of the great beauty both of the foliage and flowers of many of the species, of which the genus *Camellia* affords the best-known examples. See TEA, CAMELLIA, and GORDONIA.

TERPSI'CHORÉ (Gr., delighting in the dance), one of the nine Muses (q. v), presided over choral song and dancing.

Statue of Terpsichore.

TERRACI'NA (anc. *Tarracina*), a town of Central Italy, in what was formerly the Papal States, is situated on the coast at the south-east extremity of the Pontine Marshes, near the mouths of the Ufente and Amaseno. It is the seat of a bishop, possesses a cathedral (built on the ruins of a heathen temple), a square with a handsome fountain, a palace of Pius VI., and on the summit of a precipice overlooking the town, the ruins of a palace of Theodoric, king of the Goths. The harbor, a naval station of the Romans, is now filled up. Pop. 7600.

Tarracina was originally a Volscian town, and was called by the Volscians *Anxur*, a name which is often applied to it by the Latin poets. It fell into the hands of the Romans 400 B.C., became the seat of a Roman colony 329 B.C., and as long as the Republic and Empire lasted, was a flourishing and important city. So closely do the mountains here approach the sea, that there was scarcely room for the celebrated 'Appian Way;' hence the importance of T. as a military position. Numerous ruins of the ancient town are extant.

TERRA-CO'TTA, an Italian term signifying *baked-clay*. It is applied chiefly, if not altogether, to manufactures of brick-earth used for ornamental purposes, especially those used architecturally. Formerly, it was not uncommon in Britain, particularly about the beginning of the 18th c.; but after the reign of Queen Anne, it was discontinued, and was scarcely ever used until within the last ten years. A complete revival has now taken place, and this material has been applied with admirable effect in some of the buildings lately erected, especially the South Kensington Museum, and the Charing Cross Railway Station Hotel.

TE'RRA DEL FUE'GO, more correctly, Tierra del Fuego (q. v.).

TE'RRA DI LAVO'RO (*Campania Felix*), now CASERTA, a maritime province of Southern Italy, bounded on the N.-W. by what was formerly the Papal States. Area, 2326 square miles; pop. (1881) 714,487. This is the famous *Campania Felix* of the ancients. Pliny extols its beauty and its fine situation. Florus calls it the finest country in the world. In ancient times, it was inhabited by the Ausonii, the Osci, and later by the Campani. The finest part of Campania has been separated from it, and is that fertile tract of country which surrounds the Gulf of Naples like an amphitheater; another part has been added to the province of Molise. T. di L. is watered by two rivers, the Liris or Garigliano and the Volturno. Towards the east, it is broken up by the Apennines, and its beautiful ranges of hills are clothed with vine and olive yards, and studded with country-seats. It produces corn, strong wines, oil, fruits, and silk. Its seaport towns are populous and busy, although here and there the sea-board is interrupted by marshes. The climate is very mild in winter, and extremely hot in summer.

TE'RRA DI SIE'NNA. See BURNT SIENNA.

TERRA-FI'RMA, a term frequently employed to denote continental land as distinguished from islands. But it was at one time more specially applied—1st, to all the mainland of Italy which acknowledged the supremacy of Venice—viz., to the duchy of Venice, Venetian Lombardy, the March of Treviso, the duchy of Friuli and Istria; 2d, to that extensive tract of South America, bounded by the Pacific Ocean, Peru, the silvas of the Amazon, the Atlantic Ocean, and the Isthmus of Panama, which mostly belonged to the Spaniards during the last century. In a still more restricted sense, the term was applied by the Spaniards to the Isthmus of Panama itself. Colloquially, the phrase *terra-firma* is applied (but erroneously) to land as distinguished from water.

TERRA JAPO'NICA. See CATECHU.

TERRANO'VA, a seaport town on the south coast of Sicily, province of Caltanisetta, on the right bank of the Omonimo, 18 miles E. from Alicata. Pop. (1881) 17,173. There is no regular port, but the town carries on a good trade in fruit, corn, pulse, sulphur, soda, and above all, in cotton, large quantities of which are grown in the vicinity. A kind of coarse cloth is manufactured for home consumption. T. is believed to occupy the site of the ancient Gela (q. v.). The town now standing was built by Frederick II. in the 12th century. In its neighborhood is the village of Mazarino, from which the famous cardinal took his name.

TE'RRAPIN, the popular name of many species of fresh-water tortoises, of the family *Emydæ* (see EMYS), natives of tropical and the warmer temporate countries. The neck can be wholly retracted within the shell; the head is flat, and the jaws prolonged into a beak. They feed partly on vegetable food, but also devour fish, reptiles, and other aquatic animals. They swim very well, and even on land move with much greater swiftness than land-tortoises. Their flesh is generally much esteemed.—Several species are natives of North America.

TERRE HAUTE, a city of Indiana, U. S., on the east bank of the river Wabash, 78 miles west-south-west of Indianapolis; a handsome town, regularly built, on an elevated plateau, in a rich agricultural country, with three railways, the Wabash and Erie Canal, machine-shops and manufactories. It has 3 banks, 4 public-school edifices, Roman Catholic convent and schools, free college, 13 churches, 3 daily and 3 weekly papers, 2 public libraries, and abundant supplies of bituminous coal. Pop. (1870) 16,103; (1880) 26,040.

TERRE-PLEIN, in Fortification, is the flat surface of the rampart, on the front portion of which the parapet and banquette are formed, and of which the rear slopes down to the general level of the enclosure.

TERRE'STRIAL MAGNETISM. In the article MAGNETISM, it is shown that the earth itself is to be considered as a great magnet; and in the present article it is proposed to exhibit the chief results of observation on the earth's magnetism as seen in its action on artificial magnets. That action is simply *directive;* that is, it determines the way in which the magnet shall point, but has no tendency to translate or move it bodily. Terrestrial magnetism

acts differently at different places; what are called the *magnetic elements* of a place, are the direction of the needle in regard to the points of the horizon (*variation* or *declination*), its direction in regard to the verticle (*inclination* or *dip*), and the force that keeps it in these positions (*intensity*). For the first two elements see DECLINATION-NEEDLE and DIPPING-NEEDLE. The element of intensity is more difficult to determine. The relative horizontal intensity is measured by the number of oscillations that a needle, of unit size and strength, when disturbed makes in a given time, the intensities of two places being as the squares of the oscillations. The total intensity is got by dividing the horizontal intensity by the cosine of the angle of dip. Gauss has succeeded in reducing this measurement from a relative to an absolute standard.

Magnetic Charts.—The magnetic elements have been ascertained with great care at different portions of the earth's surface. The knowledge thus obtained has been embodied in magnetic charts, in which the points at which the declination is the same are joined by lines, and similarly those where the dip and intensity are alike. The lines of equal declination are called isogonic lines; those of equal dip, isoclinic; and those of equal intensity, isodynamic lines. As the magnetism of the earth is subject to a slow secular variation, such charts are only true for the time of observation. The chart, fig. 1, was drawn up by Colonel Sabine for the year 1840, and gives an approximate view of the lines of equal declination for that year. The change since 1840 has been small, so that an isogonic chart for the present time would differ but slightly from it. The chart sufficiently explains itself. Attention may, however, be given to one or two points. The declination is marked on each line. Thus, the line passing through England, for instance, is marked 25°, and that passing north-west of the British Islands, 30°. At places under those lines, the needle points to a north 25° and 30° west of the true north.

On the space intervening between these lines, including Scotland and Ireland, a correction, varying from 0° to 5°, must be made according as the station lies more towards the one line than the other. The westerly line of no declination passing northward cuts off the eastern corner of South America, proceeds to North America, which it enters at North Carolina, traverses the continent by Lakes Erie and Huron and the west of Hudson's Bay, and ends in the north of the continent at Boothia. The easterly line of no declination passing southward enters Europe in the north of Russia, crosses the White Sea, the east of Russia, of the Caspian Sea, of Persia, and the Arabian Sea; then turns eastward, and cutting off the west of Australia, passes southward. The space included between those two lines, and which in the chart is left untinted, constitutes, so to speak, the hemisphere of westerly declination. It includes the east of the two Americas, the Atlantic Ocean, the whole of Europe and Africa, and the west of Asia and Australia. The rest of the earth, which in the chart is tinted, has an easterly declination. There is an elliptic space in Eastern Asia, which is left white, having a westerly variation, and forms an exceptional region in the eastern magnetic hemisphere.

It will be seen that the lines converge in the north of North America, and in the south of Australia. So far as experience goes, and so far as the most matter-of-fact theory (Gauss's) teaches, the convergence in both cases is to a point. The point in North America is the *north magnetic pole*, and that south of Australia is the *south magnetic pole*. At these points, then, all isogonic lines converge, and a compass-needle lies indifferently in any position.

The isogonic lines, as seen from the chart, form a somewhat complicated system. This arises from the fact, that we refer the indications of the needle to the geographical poles, which are, so far as we know, arbitrary or extraneous as regards terrestrial magnetism. Duperrey, by drawing what he calls *magnetic meridians and parallels*, draws a system of lines which have much the same conformation with regard to the magnetic poles that the meridians and parallels of latitude have to the geographical poles. A magnetic meridian, according to Duperrey, is the line that would be described by a person setting out, say from the south magnetic pole, and traveling always in the direction of the magnetic north till he reached the north magnetic pole. The magnetic parallels are lines drawn at right angles to the magnetic meridians.

In fig. 2, the isoclinic lines, by the same author and for the same epoch, are given. In the upper part of the chart, which is left white, the north end of the needle dips; and in the lower part, which is tinted, the south end of the needle dips. The amount of dip is marked on each line. Thus, the line passing through the center of England is marked 70°. A dipping-needle, at any place cut by the line, is inclined 70° to the horizon. The line 75° passes to the north of the British Isles. In Ireland and Scotland, therefore, the dipping-needle has an inclination greater than 70°, and less than 75°. The line marked 0° is the line of no dip; at any station on it the dipping-needle is horizontal. This line is called the *magnetic equator*. It will be seen that it is not coincident with the geographical equator; it is not even a great circle of the earth, but is an irregular curve cutting the equator in two points, one near the west coast of Africa, and the other in the middle of the Pacific Ocean. The points on the earth's surface where the dipping-needle stands vertical, and where, in consequence, as before mentioned, the compass-needle lies in any direction, are called the magnetic poles.

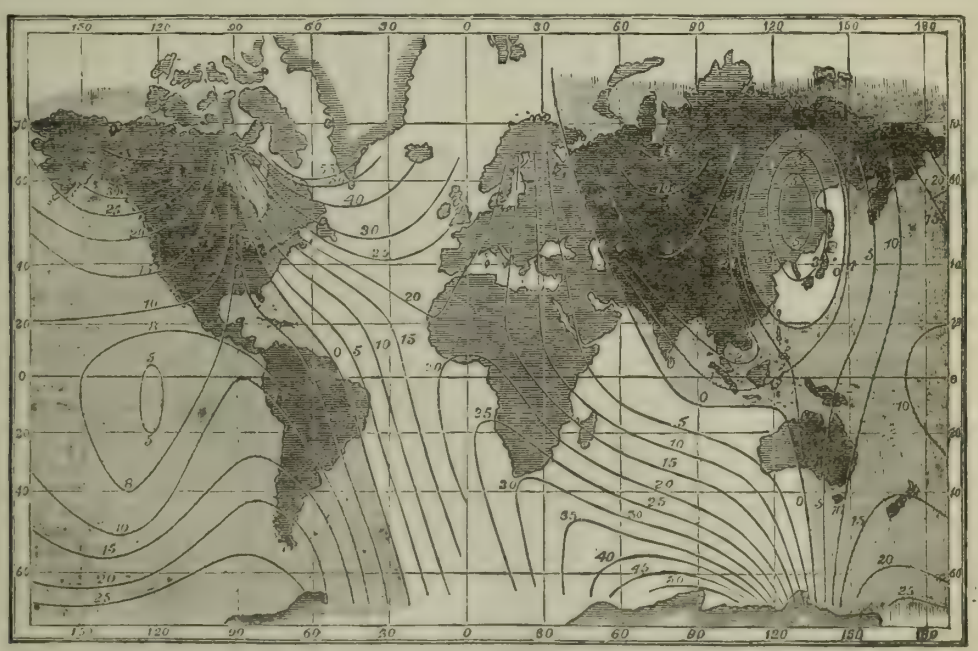


Fig. 1.

The north magnetic pole was found in Boothia Felix by Captain Ross at 70° 5′ N. lat., and 263° 14′ E. long. According to Gauss's calculation, it should have been at the time (1831) some 3° north of this point. From observations made at Hobart Town, the nearest station to it, the south magnetic pole should lie 66° S. lat. and 146° E. long. These points are not diametrically opposite each other, as the geographical poles. If the lines of equal dip were drawn on a globe, they would form round the magnetic poles a system of irregular circles, somewhat resembling that of the parallels of latitude round the poles of the earth.

We do not add an isodynamic chart, as it would take up too much space. Colonel Sabine's Dynamical Chart, along with the isogonic and isoclinic charts, will be found fully engraved and explained in Johnston's *Physical Atlas* (new edition). From this

chart we learn that the magnetic intensity is least in the vicinity of the magnetic equator, and increases as we approach the magnetic poles. The lines of equal intensity, though running much in the same direction as the lines of equal dip, are neither coincident nor parallel with them. The line of least intensity, itself not an isodynamic line, runs nearly parallel to the magnetic equator, but lies, except in the western half of the Pacific, a few degrees to the south of it. We thus learn that the changes in direction and intensity do not march together. We should fancy that at that point or points on the earth's surface where the dipping-needle stood erect, we should be nearest to the center of free magnetic energy, and that there the force would be greatest; but this is not the case. The point in North America where the intensity is greatest, is situated to the west of Hudson's Bay, some 18° south of the north magnetic pole. But this is not the only point of maximum force in the north magnetic hemisphere. There is another, which was found by Hansteen in 1828, in Northern Siberia, about the longitude 120°. This maximum point is weaker than the American, in the proportion of 100 to 107 (Sabine).

According to Gauss, there can only be one maximum point in the southern hemisphere, which is stronger than either of the other two. It lies north-east of the south magnetic pole, and its intensity is 137 (Gauss) compared with 107, that of the principal northern center. At none of those points does the dipping-needle stand erect. This want of coincidence of the points of vertical dip and of maximum intensity has led to some confusion in the use of the term magnetic pole; some writers meaning by it a point of vertical dip, and others a point of maximum intensity. In adopting the former definition, we are only adhering to the popular meaning of the word, and to the opinion of Gauss, perhaps the greatest authority on the subject. Some of the best English authorities, however, attach to it the latter meaning.

Although the total intensity increases as we go northward or southward from the line of least intensity, the horizontal intensity diminishes. This arises from the fact, that the greater the dip the less the horizontal intensity. Hence the compass-needle,

Year.	Declination.
1576	11° 15′ easterly.
1657—1662	0° 0′ no declination.
1760	19° 30′ westerly.
1815	24° 27′ 18″ westerly.
	Maximum.
1850	22° 29′ 30″ westerly.
1865	21° 6′ "
1875	19° 33′ "
1882	18° 20′ "

Year.	Inclination.
1720	74° 42′
1780	72° 8′
1800	70° 35′
1830	69° 38′
1850	68° 48′
1865	68° 9′
1875	67° 47′
1882	67° 32′

At present, the annual decrease of declination at Kew is 8′. At this rate it would take rather more than 84 years for the compass-needle to shift through a whole point. From the observations of the dip, we find that it has been gradually decreasing for the last 150 years. The annual decrease of dip is at present about 2′·6. The time during which observations have been taken of the declination and dip is far from comprehending a cycle of change in either, and it is a mere matter of speculation how long that may take. The magnetic history of London does not apply to other places; each place, so far as has been ascertained, having a magnetic history of its own. Thus, in Paris, the time of no declination was 1669; and of maximum declination, 1814; the latter amounting to 22° 34′ W. Every place, according to Barlow, appears to have its own magnetic pole and equator. Magnetic intensity has been observed for so short a time, that little as yet is known of its secular variation. At present, the horizontal intensity is increasing in Europe, but that may arise partly from decrease of dip.

The magnetic elements are also subject to changes, which have a yearly and a daily period. In describing these shortly, we shall limit ourselves to the changes affecting declination, as these are of most general interest. The following are the chief particulars of the *annual variation* of declination given by Cassini: From April to July, or from the vernal equinox to the summer solstice, the western declination decreases. From the summer solstice to the

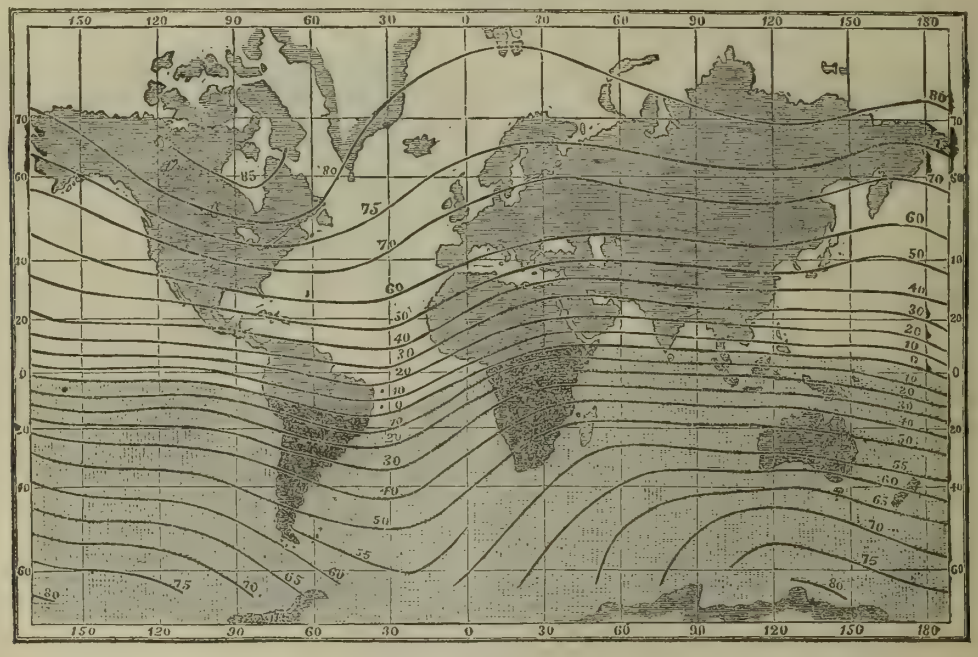


Fig. 2.

which is affected alone by the horizontal intensity, oscillates more sluggishly as we leave the line of least intensity. A dipping-needle, for instance, oscillates faster at London than at Calcutta, because the total intensity which affects it is greater at London than at Calcutta; but with a compass-needle it is the reverse, from the horizontal intensity being greater at the latter than at the former station.

Variations of the Needle.—The magnetic elements do not remain constant in the same place, but are subject to continual though small variations. These are regular and irregular. Under regular variations are included *secular*, *annual*, and *diurnal* variations. The secular variations take centuries for their completion. The following list of the declination and dip at London in different years will give an idea of the secular variations for these elements

vernal equinox, that is, during the other nine months of the year, the declination increases, the needle turning to the west. Its position in May and in October is nearly the same; so that in the winter months, from October to April, the westerly motion is slow The range of the annual variation at Kew is 58′·85.

The mean *diurnal variation* for Kew is shown in fig. 3. The irregular line indicates the course of the north end of the needle. A rise of this line indicates a change of the north end to the east; a fall, a change to the west. The interval between two horizontal lines corresponds to a deflection of the needle 1′ to the east, and a fall 1′ to the west. The line marked *o* is the magnetic meridian, or the mean daily position of the needle. The interval between two upright lines corresponds to an hour. The course begins at twelve at night, and ends at twelve the following night. At twelve at night, the magnet is 1¼′ east of the mean position,

and continues nearly in the same position, with only a slight westerly deviation, till 15 hours (three in the morning), when it veers eastward. At 20 hours (eight in the morning), it reaches its furthest east point. From eight in the morning till one in the afternoon, it makes a sweep of 10′ towards the west, and then stands about 6′ to the west of the mean. After one, it goes west-

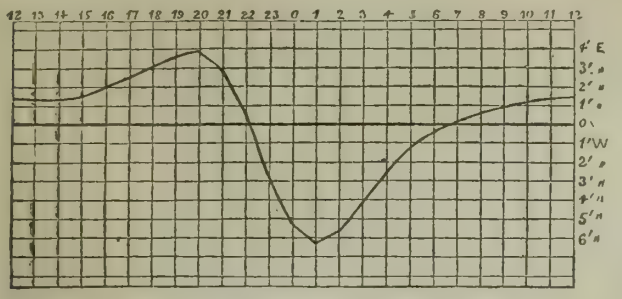


Fig. 3.

ward till midnight, when it again begins the same course. The needle stands in its mean position a little after ten in the morning, and a little before seven in the evening. The course here described is the course for the year. But the diurnal range is different in different months. In May, for instance, the average range between the extreme points is 12′, which is the maximum range for the year; and in December, when it is a minimum, it is only 5′ 28″. The diurnal changes here described for Kew are much the same all over the north magnetic hemisphere. The amount, however, is different. Near the magnetic equator the diurnal variation is little or nothing, and it increases as we go northward. Captain Duperrey states that at or near the magnetic equator, the north point of the needle in the morning shifts slightly east or west of the mean, according as the sun passes south or north of the station. In the southern magnetic hemisphere, the daily motions of the needle take place much in the same way as in the northern hemisphere, only the south pole takes the place of the north pole, and the direction of the deflections is reversed. The correspondence, and at the same time opposition, of the southern hemisphere is also shown from the time of maximum and minimum range. When the sun is in the northern signs of the zodiac, the range is a maximum in the northern, and a minimum in the southern hemisphere; and when the sun is in the southern signs, the reverse takes place. The diurnal variation is so small, that the ordinary compass-needle is not delicate enough to show it.

The *irregular variations* are those which break in upon the regular march of the diurnal variation, without in the main altering it. Instead, for instance, of the needle steadily going westward from 8 A.M. to 1 P.M., as shown in fig. 3, it makes, when affected by irregular variation, deflections eastward as well as westward, although it in the main moves westward; so that the line between these hours, instead of being comparatively straight, would be an irregular zigzag. These disturbances of the mean course are sometimes considerable, amounting even to one or two degrees in extreme cases. On some days, the mean diurnal course is much disturbed, on others, very little; but it is never quite free from them. It has been found that places of the same longitude have similar disturbances at the same time; that those on opposite sides of the globe, or differing by 180° of longitude, have disturbances equal in amount, but opposite in direction; and that those situated 90° west or east of the disturbed regions, have little or no disturbance. The appearance of auroras is invariably accompanied by magnetic irregularities, and their effect extends far beyond the regions where they are visible. Earthquakes and volcanic eruptions have also a marked effect in this way. Humboldt gave the name of *Magnetic Storms* to these irregular disturbances. The frequency of these storms, and the amount of the diurnal variation, are found to be greatest when sun-spots are most numerous. See SUN.

1. *Theories of Terrestrial Magnetism.*—The earliest theory was that suggested by Gilbert, in which it is supposed that a magnet in the middle of the earth extends from one magnetic pole to the other. On this supposition, the general phenomena of terrestrial magnetism may be accounted for—a needle both by declination and dip, must point to the poles. This must always remain, from its simplicity, the popular theory on the subject. In consistency with his theory, Gilbert considered the north pole of the magnet to be a south pole, as he took the north pole of the earth for his standard north pole. If this theory were correct, the magnetic equator would be a great circle of the earth, and the magnetic poles would be 90° from it, which is far from the case. It is only a rough approximation to a just theory.

Halley endeavored to supplement Gilbert's theory, by supposing two magnets of unequal strength crossing each other at the earth's center to be the cause of terrestrial magnetism. The theory of the two magnets or four poles was ably defended by Hansteen.

Barlow considered that the earth acted on the needle as if currents of electricity traversed it from east to west. He imitated its action by wrapping a wire in parallel coils round a wooden globe, and causing a galvanic current to pass through it. Each turn of the wire represented a magnetic parallel, and the two ends of the coil the magnetic poles; and to complete the analogy, the globe was movable on an axis, which stood in the same relation to the ends of the coil as the astronomical to the magnetic poles of the earth. When a small needle was placed on the globe, its declination and dip bore a striking resemblance to those of a needle similarly situated on the earth's surface. The objection to this theory is the difficulty of accounting for the origin of such currents in the earth. To meet this, some suppose the earth to be a huge thermo-electric pile; as the heat of the sun falls on one side of it, currents are there generated which travel round the globe. But how, again, it may be asked, are the conditions of thermo-electricity implemented by the materials of the earth? This question still remains to be answered.

The close connection between temperature and magnetism is shown by the diurnal variation of declination, the epochs of which closely correspond with those of the daily temperature, and by the fact, that the isodynamic and isothermal lines manifest a marked correspondence. Sir David Brewster has also shown that there are two centers of maximum cold in the northern hemisphere, which are situated near to the two intensity poles.

Gauss did not start from any simple supposition of one or two magnets giving rise to the magnetism of the earth, nor did he assert or deny its electric origin. Considering the whole earth as magnetic, he aimed at determining how it must act as a whole at the different points on its surface. In order to make the equations he obtained theoretically in this attempt express the distribution on the earth, the magnetic elements of eight stations at a sufficient distance from each other on the earth's surface had to be ascertained and substituted in these equations. This done, from the longitude and latitude of any station he considered himself prepared to deduce its magnetic elements. The magnetic charts which he sketched, though founded on the imperfect observations to which he had access, are singularly in keeping with fact, and go far to establish the correctness of his reasonings.

The secular variations are as yet wholly unaccounted for. The cause of the diurnal variation is universally attributed to the sun. Secchi, who carefully studied the diurnal variation of the needle, considers that the sun, so far as they are concerned, acts upon the earth as a powerful magnet at a distance.

Historical Sketch.—The discovery of the change in declination at different places is generally attributed to Columbus, and was one of the many important observations of his memorable voyage across the Atlantic. Robert Norman, an instrument-maker in London, first discovered the dip of the needle in 1576. He was led to it by finding that needles nicely balanced before magnetization had to be slightly loaded on the south end, to keep them horizontal after being magnetized. Gilbert (1600) gave the first theory of terrestrial magnetism, viz., that of the single magnet. Halley, the astronomer-royal, published his theory of the four poles in 1683. In 1688 and 1689, at the expense of government, he made two magnetic voyages, the results of which he embodied in his charts of the lines of equal declination, published in 1701, which were the first magnetic charts ever published. In 1722, the diurnal variation was discovered by Graham, the celebrated instrument-maker of London. The first inclination chart was published by Wilke at Stockholm, 1768. Humboldt inaugurated the present system of careful observations of terrestrial magnetism by taking comparative measurements of the magnetic elements at Peru and Paris (1799—1803). Hansteen's work on the *Magnetism of the Earth* was published at Christiania, 1817; in 1826 he published the first isodynamic charts. Barlow (1831) suggested the electric origin of terrestrial magnetism. In 1831, Captain Ross came upon the north magnetic pole. In 1835, stations were established throughout Europe, and the observations were published by Gauss and Weber, 1836. Gauss (1833—1840) perfected his theory. In 1837, Colonel Sabine published an isodynamic chart of the whole globe. Observations were made (1840—1854 at stations throughout the British Empire by British officers, under the direction of Colonel Sabine.

TERRESTRIAL TEMPERATURE. The distribution of heat over the globe is represented by isothermal lines, or lines drawn through all places having the same mean temperature. The mean annual temperature is shown by the lines in fig. 1, and the warmest and coldest months in fig. 2, the dotted lines showing the mean temperature for January, and the solid lines the temperature for July.

The part of the globe having the highest mean annual tempera-

ture forms an irregularly shaped belt, lying along the equator, and comprised between the north and the south isothermals of 80°. On either side of this warm belt, the temperature diminishes towards the poles; and the lines showing successively this diminution are, speaking in a very loose sense, arranged parallel to the equator, thus showing the all-predominating influence of the sun as the source of terrestrial heat. The coldest portion of the earth's surface is a small oval-shaped patch near to but not surrounding the north pole, its mean temperature being —4°. Its narrowest diameter lies north and south, nearly touching the pole on the one side, and extending on the other as far south as 72°·30 N. lat. in 130° W. long. Part of it is seen in the diagram. On looking at the isothermal of 0°, one might be led to suppose that there are two centers of greatest cold, one north of Siberia, and the other north of British America. Such, however, is not the case—the apparent double center of greatest cold being solely due to the isothermals being drawn on Mercator's projection of the earth; for if an isothermal map be drawn on a polar projection, the lines of mean annual temperature enclose one connected space of greatest cold, and not two such spaces, as is not unfrequently stated.

While the decrease of temperature in advancing towards the poles corresponds in a general way to what may be called the solar climate, there are deviations brought about by disturbing causes too important to be overlooked. These disturbing causes are (1) the currents of the sea; (2) the prevailing winds; and (3) large surfaces of water which are frozen during part of the year.

The influence of an oceanic current depends on the temperature of the place it leaves and the place at which it arrives. Hence the great equatorial current, flowing from east to west, does not require to be considered here, because the heat remains the same throughout its course; but only those currents which convey the waters of the sea to higher or to lower latitudes. Of these, the most marked and important is the Gulf Stream in the North Atlantic, which, by conveying warm water to the arctic regions, pushes the isothermals many degrees to the northward. There is a similar, though much feebler, current passing from the North Pacific to the Arctic Sea through Behring's Strait, and there, accordingly, the isothermals are pushed a little to the northward. In the southern hemisphere, there are two currents, one discovered by Humboldt, passing from the Antarctic Ocean northward by the coast of Peru as far as Lima; the other flowing from the Cape of Good Hope northward along the west coast of Africa: these currents, flowing from colder to warmer latitudes, lower the temperature, and thus drive the isothermals towards the equator. Again, the great equatorial current, after impinging on the east coast of Africa, turns southward, and by the warmth it imparts, pushes the isothermals into higher latitudes. For the same reason, the current flowing southward past the coast of Brazil, raises the temperature in the east of that country.

The influence of these great currents is more distinctly marked in the forms of the isothermals for January and July. Thus, in January, when the relative excess of the temperature of the Gulf Stream is greatest, the isothermals are driven very far to the north; and similarly in the southern hemisphere, the currents from the Antarctic Ocean being coldest in July, the isothermals are deflected more towards the equator during that month. The most remarkable lowering of the isothermals occurs in Labrador and Newfoundland during May and June, and is caused by the icebergs which then descend on these coasts from Davis' Strait.

Since winds bring with them the temperature of the regions they have crossed, the equatorial current is a warm wind, and the polar a cold wind; also winds arriving from the ocean are not subject to such variation of temperature during the year as winds from a continent. As an atmosphere loaded with vapor obstructs both solar and nocturnal radiation, it follows that moist winds are accompanied with a warm temperature in winter, and a cool temperature in summer; and dry winds with cold winters and hot summers. The direction of mountain-ranges is also an important element to be taken into account in estimating the influence of winds on temperature. These considerations explain the position of the isothermals in the north temperate zone, where the prevailing wind is the south-west or anti-trade (see WINDS). In January, the western parts of each continent enjoy a comparatively high temperature, from their proximity to the ocean, whose high temperature the winds waft thither; and they are further protected from extreme cold by their moist atmosphere and clouded skies. But in the interior of the continents it is otherwise; for the winds getting colder as they advance, and being deprived of their moisture as they cross the mountains in the west, the soil is exposed to the full effects of radiation during the long winter nights, and as a consequence the temperature rapidly falls.

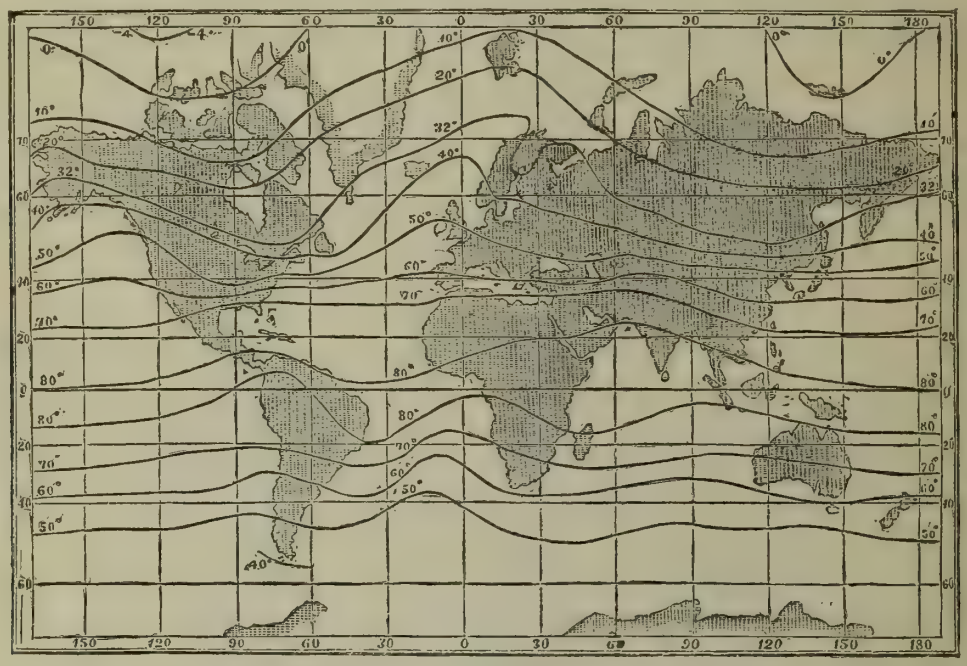


Fig. 1.

In the center of Siberia, the January temperature falls to —40°, which is 9° colder than the coldest part of the American continent; and this center of greatest cold lies near the eastern part of the continent of Asia. On the other hand, in July, the interior of continents is much warmer than their western parts. Hence the interior and eastern parts of Asia and America are characterized by extreme climates, and the western parts by equable climates. Thus, at Yakutsk, in Siberia, the July temperature is 62°·2, and the January —43°·8 the difference being 106°·0; whilst at Dublin these are respectively 60°·8 and 38°·5, the difference being only 22°·3. This constitutes the most important distinction of climates, both as respects vegetable and animal life. On man especially the effect is very great—the severity of the strain of extreme climates on his system being shown by the rapidly-increasing death-rate as the difference between the July and January temperatures increases.

The great fresh-water lakes of North America—Lakes Superior, Huron, Erie, Michigan, Ontario, Bear Lake, &c.—exercise an important influence on the climate of the central parts of North America, for in winter, America, with its frozen lakes, is a truly unbroken continental mass, and its winter climate is therefore continental; whereas in summer its numerous large sheets of fresh water communicate to it many of the features of an insular summer climate.

The whole effect of the disturbing causes is seen at once, if we compare the observed temperature of a place with its normal temperature, that is, the temperature due to it in respect of its latitude. In the northern hemisphere, in January, the sea and the western parts of the continents are in excess of their normal temperature; elsewhere, there is a deficiency. There are two centers of excess, one to the north-east of Iceland, amounting to 41°; the other in Russian America, amounting only to 18°; and two centers where the temperature is deficient, one at Irkutsk, amounting to 41°; and the other west of Hudson's Bay amounting to 27°. In July, the United States, Europe, Asia, the Indian Ocean the north of Africa, and the extreme north of South America, have their temperature in excess, while elsewhere it is deficient. The centers of excess are, north of Siberia, 13°·5; Red Sea, 11°·0; and north-west of the United States, 4°·5; and the centers where the temperature is deficient are, the entrance to Hudson's Bay, 11°·0; and the Aleutian Islands, 11°·0.

As to *underground temperature*, the protracted investigation of a committee of the British Association (who had data, widely differing, from very various deep mines and borings in remote parts of the earth) led to the conclusion that a descent through 64 feet through the crust of the earth corresponds to a rise of 1° Fahrenheit.

Fig. 2.

TERRIER, a small kind of dog, remarkable for sagacity, vivacity, courage, and eagerness in the pursuit of 'vermin,' which it readily follows into burrows, from Lat. *terra*, the earth (hence the name). It will readily attack animals much larger than itself. Terriers are of great use for killing rats in places much infested by them. They are also used for compelling the fox to leave his retreat; and a large variety called the *Saufinder*—that is, Boar-

Scotch and English Terriers.

seeker—is employed in Germany to rouse the fiercest beasts of the forests from their lairs. The varieties of T. are numerous. In Britain, two are particularly prevalent, known as Scotch and English terriers—the former with long, rough, wiry hair, with which even the face is much covered; the latter with smooth, short hair. The ears are either erect and pointed, or have pendent tips. The Skye T. is a breed of Scotch T., peculiarly prized. If any kind of dog may be regarded as truly indigenous in Britain, it is the T.; but there is no certainty that it was not imported by the first inhabitants. Dogs very similar have existed in the north of Europe in a domesticated state from remote antiquity. The BULL T. is probably a cross between the T. and the Bull-dog (q. v.).

TERSCHE'LLING, one of the chain of islands to the north of Holland, lies in 53° 24′ N. lat., the principal villages being Oosterschelling, Westerschelling, and Midsland. It consists of fertile arable and meadow lands, is protected on the south by large dykes, and in other parts by downs, which are carefully preserved. Area about 45 sq. miles. Pop. 3128. There is a good haven, a shipbuilding-yard, a woollen dyework, &c. T. was the birthplace of Barentz, the explorer.

TE'RTIAN FEVER. See AGUE.

TE'RTIARY (Lat. *Tertiarius*, one of the third rank), a name given by church writers to a class in the Roman Catholic Church, who, without entering into the seclusion of a monastery, aspire to practise in ordinary life all the substantial obligations of the scheme of virtue supposed to be laid down in the Gospel. Whatever earlier traces of this institution may be observable, there is no dispute that it was under St. Francis and the mendicant orders generally that the institute of T. reached its full development. The rules of the institution of T., such as they have since substantially been maintained, were made public in 1221. The associates must, of course, all be members of the church; and it is moreover required that all shall be of good repute and blameless life. The intending members must restore all ill-gotten goods, must renounce all evil practices, and abandon all feuds and enmities with their neighbors. Wives cannot be received without the consent of their husbands. The obligation of T. once accepted, is irrevocable, unless the party should be released, or should enter into a more strict religious order. The members are required to renounce luxury of life, profane exercises and amusements, costly or unseemly dress, and the use of arms, except in the necessity of self-defence. They must frequent the sacraments; hear mass, if possible, daily; observe the fasts of the church, as well as certain special austerities; avoid contention, litigation, and unnecessary oaths; cultivate charity towards all, with special obligation towards needy, sick, or afflicted brethren, and practise with more than common fervor the great Christian virtues.

The T. are placed under the authority of superiors elected at intervals, and for a stated period, and are liable to an annual visitation, conducted by a priest appointed for the purpose. It is to be observed, however, that none of these obligations were supposed to bind the members under pain of mortal sin.

Such was the celebrated institute of the T., or the Third Order of St. Francis. Similar lay associations were organized in connection with the Dominican, Carmelite, and Augustinian, as well as with certain of the more modern orders; and a brotherhood of the same character had already been formed by the Templars. It ought to be added, that the T. institute, properly so called, is quite distinct from that of the lay 'confraternities' which exist in connection with the several orders, and the objects of which are very similar.

TERTIARY, the term applied in the science of Geology (q. v.) to all the strata of the earth's crust above the Cretaceous Rocks, with the exception of those superficial beds which have recently been raised to a distinct group, under the title of the Quaternary System, or Recent Period. There is considerable difference of opinion as to the division-line between the two systems, some including the boulder-clay and its associated beds in the one, and some in the other group. Tertiary is synonymous with Cainozoic, and is divided into the Pleiocene (q. v.), Meiocene, and Eocene (q. v.) periods.

TERTU'LLIAN, a Father of the church, and one of the earliest who used the Latin language in written compositions. In one passage, the genuineness of which there is no reason to doubt, he calls himself Septimius Tertullianus. The best manuscripts call him Quintus Septimius Florens Tertullianus. He was the son of a proconsular centurion—that is, a centurion who attended on the proconsul. He was born in Carthage. He was brought up a heathen, and from his own writings we learn that he was licentious in his conduct, and fond of the public shows. We know nothing more of his heathen life. Eusebius describes him as a man exceedingly well acquainted with the laws of the Romans, and his writings bear out the assertion. From this circumstance, some have identified him with a Tertullianus whose name occurs in the index of the Pandects, and have supposed that he acted as an advocate; but the supposition is a mere conjecture. We know nothing of his conversion. He became a presbyter in the church, but whether he held this office in Rome or in Carthage, is matter of dispute, and there are no data to determine the question. It is certain that he visited Rome, and was well acquainted with the affairs of the Roman Church. He also married; and as his wife was a Christian, it is supposed that his marriage took place after his conversion. After remaining a presbyter until he had reached middle age, he became a Montanist. Jerome attributes his adoption of Montanism to the insulting treatment which he received at the hands of the Roman clergy. But this is not likely an entirely accurate account of the matter. Jerome himself had been ill treated by the Roman clergy, and was therefore inclined to blame them; and in the character and general tendency of T.'s opinions, we have ample explanation of his passing over to Montanism. See MONTANUS. He lived to a good old age, remaining a Montanist to the last. We have no clue to precise dates in the history of Tertullian. Jerome states that he flourished under Severus and Antoninus Caracalla. Allix places his birth at 145 or 150 A.D., and his death at about 220 A.D.; but these are conjectures.

T. was a man of strong and violent passions; he loved and hated with intensity. He possessed considerable culture, and was well versed in Roman law, in ancient philosophy, history, and poetry. He was not deficient in philosophical power, but he was narrow, bigoted, and uncharitable. He shows no sympathy with Greek speculation or with freedom of human thought; and he shows little sympathy with the joys and pleasures of man, being strongly inclined to asceticism. We need not wonder, therefore, that he came to believe in the Paraclete of Montanus as the revealer of the perfection of Christianity, and that he adopted the Montanist opinions, that second marriages were adulteries, and that it was unlawful to flee in times of persecution, and wrong to receive the lapsed back into the communion of the church.

His writings are numerous. Attempts have been made to divide them into those which were written before he became a Montanist, and those written after that event; but the attempts have failed; for in treating many subjects he would have no occasion to say a word in regard to the Paraclete, second marriages, or persecution.

His works are interesting, throwing much light on the internal circumstances of the church, on the social questions which perplexed Christians, on the opinions of heretics, and on the development of doctrine. Of his theology, Neander remarks: 'In Tertullian we find the first germ of that spirit which afterwards appeared with more refinement and purity in Augustine, as from Augustine the scholastic theology proceeded, and in him also the Reformation found its point of connection.' Among the peculiar opinions which he held, may be mentioned his belief in the corporeality of the human soul.

His writings had great influence on the subsequent ages, but especially on Cyprian. Jerome says: 'I saw at Concordia, in Italy, an old man named Paulus. He said that, when young, he had met at Rome with an aged amanuensis of the blessed Cyprian, who told him that Cyprian never passed a day without reading some portion of Tertullian's works; and used frequently to say: *Give me my master*, meaning Tertullian.'

There are many editions of Tertullian; the best is by Franciscus Oehler (3 vols. 8vo, Lps. 1853). The third volume contains the principal dissertations on the life and writings of Tertullian. The works of T., with many dissertations and notes, form the first and second volumes of Migne's *Patrologia Latina*. The English reader will find a full and satisfactory account of T.'s life, writings, and opinions in Bishop Kaye's *Ecclesiastical History of the Second and Third Centuries, Illustrated from the Writings of Tertullian* (8vo, 2d ed., Cambridge, 1829); and in Neander's *Antignosticus*, or *the Spirit of Tertullian*, translated by J. E. Ryland. A good translation of T.'s works will be found in Clark's *Anti-Nicene Christian Library*, edited by Drs. Roberts and Donaldson.

TE'SCHEN, a town of Austrian Silesia, on the right bank of the Olsa, 38 miles east-south-east of Troppau. Pop. (1880) 9267. Here, in 1779, a treaty of peace was concluded between Maria-Theresa and Frederick II., by which the dispute of the Bavarian Succession was brought to an end.

TE'SSERÆ, the small square tiles or cut stones used in forming tesselated pavements.

TEST ACTS, otherwise called *Corporation Acts*, the popular name given to two English statutes imposing certain oaths on the holders of public offices. Act 13 Car. II. c. 2, directs that all magistrates shall take the oaths of allegiance and supremacy, as well as an oath renouncing the doctrine that it is lawful to take arms against the king, and provides that they must receive the communion according to the rites of the Church of England within a year before their election. Act 25 Car. II. c. 1, imposed the like conditions on the holders of all public offices, civil and military, and obliged them in addition to abjure all belief in the doctrine of transubstantiation. These acts, which were practically evaded to a large extent by means of an act of indemnity passed every year, were repealed by 9 Geo. IV. c. 17, in so far as regarded the administration of the sacrament, for which a declaration set forth in that act was substituted.

A statute of William IV. substituted a declaration for an oath in most government offices. A new form of oath has been substituted for the oaths of supremacy, allegiance, and abjuration by 21 and 22 Vict. c. 48.

TE'STAMENT. See BIBLE.

TESTAMENT. See WILL.

TESTA'TUM is one of the clauses of an English deed, otherwise called the Witnessing or Operative part, commencing at the words, 'Now this indenture witnesseth that,' &c.; and it includes a statement of the consideration-money and the receipt thereof.

TESTER, or TESTOON, a flat canopy over a tomb, pulpit, &c.

TE'STICLES. See REPRODUCTION.

TESTIMO'NIUM, in an English deed, otherwise called the Attestation Clause, is that part which states that the party signed the deed, beginning with the words, 'In witness whereof.'

TESTING, in Chemistry, embraces a series of processes, the details of which would occupy far more space than the general plan of this work would admit of. Indeed, testing may be regarded as equivalent to qualitative analysis. As a simple illustration of the process of testing, we will assume that the most common of all chemical compounds, a salt, is submitted for examination. The student must pursue some such course as the following: 1. He must examine the dry substance before the blow-pipe, and note whether (*a*) it is volatile, as are the salts of ammonia and mercury; or (*b*) fusible, as are the salts of potash and soda; or (*c*) infusible, as are the salts of zinc, alumina, magnesia, lime, strontia, and baryta; or (*d*) reducible, as are the salts of silver, tin, lead, bismuth, antimony, and cadmium; and (*e*) whether it gives a coloration to the borax bead, and what that color is.

2. Having made his blow-pipe examination, he must bring his substance to a finely-divided state, and dissolve it, if possible, in water, and if it is insoluble in that fluid, even with the aid of heat, in hydrochloric or nitric acid. The solution, whether in water or acid, to which no test or reagent has been applied, is termed by Odling (*A Course of Practical Chemistry*, 2d ed., 1865) and others *the original solution;* and to this are added various tests, such as sulphuretted hydrogen, hydrosulphate of ammonia, ammonia, nitrate of silver, &c. The most common effect resulting from the addition of a gaseous or liquid reagent is to cause a *precipitate* or solid deposit of either the base or acid sought for. These precipitates differ in their color, consistency, &c.; and the student must note not only the color of the precipitate (although this is the most important point), but also whether the deposit is crystalline, gelatinous, clotty, &c. 3. He must then ascertain to which group the base he is seeking for belongs. There are three great groups of bases; the members of the first group being precipitated from

their acid or acidified solutions by sulphuretted hydrogen (hydrosulphuric acid); those of the second group not being thrown down by this reagent, but being precipitated from neutral solutions by hydrosulphate of ammonia (sulphide of ammonium); while those of the third group are not thrown down by either of these reagents. The first group includes tin, arsenic, antimony, bismuth, mercury, lead, silver, copper, and cadmium; the second, nickel, cobalt, manganese, iron, chromium, aluminium, and zinc; and the third, barium, strontium, calcium, magnesium, potassium, sodium, and ammonia. (See Odling, *op. cit.*, p. 64.) 4. Having ascertained to which base the group belongs, the next point is to identify it. For information on this point, the reader is referred to any of the standard works on qualitative analysis, or on practical chemistry. 5. The base being thus determined, it remains to determine the acid, and in searching for it, the student will be much assisted by a knowledge of the solubility of the most important classes of salts.

Knowing, for example, the insolubility of the sulphates of baryta and strontia, he need not search for sulphuric acid in a soluble salt of one of these earths. On the other hand, a salt insoluble in water is not likely to be a nitrate or chlorate, or acetate, or chloride (the only chlorides insoluble in water being chloride of silver and calomel). We cannot enter into the testing for acids further than to observe that the nitrates and chlorates deflagrate; the tartrates and citrates char; the carbonates effervesce when acted on by an acid more energetic than carbonic acid; the silicates, borates, and benzoates are precipitated by hydrochloric acid; and the arseniates and chromates react with hydrosulphuric acid. The presence of any particular acid is more or less indicated by its behavior, while still in union with the base, with strong sulphuric acid, which in many cases causes the evolution of characteristic fumes or vapors; and amongst the tests especially applicable for the detection of the acids (in acid solutions) are solutions of nitrate of baryta, nitrate of silver, chloride of calcium, and perchloride of iron. As the above remarks apply merely to the detection of the base and acid contained in a single salt, it will readily be understood how much the difficulties are increased when there is a mixture of several salts, or where, in place of a metallic oxide, a vegetable base is present, or where we have to deal with a complicated mixture of organic and inorganic substances, as, for example, in the investigation of the contents of the stomach in a case of suspected poisoning.—The following works on the subject may be referred to: Fresenius's *Qualitative Analysis*, Noad's *Qualitative Analysis*, Greville Williams's *Outlines of Chemical Manipulation*, Bowman's *Practical Chemistry*, and Odling's *Practical Chemistry*.

TESTING CLAUSE, in a Scotch deed, is the last clause, which narrates when and where the parties signed the deed, before what witnesses, the number of pages of which the deed consists, and who was the person who penned the deed. Moreover, if there have been any interlineations or erasures of important words during the engrossing, these should be mentioned in this clause. The clause is an essential part of a Scotch deed, and no deed which is written by another than the party is valid unless the testing clause is regular. The usual form is this: 'In witness whereof, these presents, written on this and the five preceding pages by John Smith, residing at, &c., were subscribed by the parties as follows—viz., by the said A. B. at Glasgow on the 26th day of June 1874, before these witnesses, W. X. of, &c., and Y. Z. of, &c.'—In English or Irish deeds, there is no necessity to enumerate these particulars in the attestation clause.

TEST-PAPERS are made by dipping unsized paper into an alcoholic solution of a vegetable coloring matter which changes color when exposed to the action of an acid or alkaline solution. The paper, after being gently dried, is cut into slips of a suitable size. Hence, by dipping the appropriate test-papers into any solution, we can ascertain whether it is acid, alkaline, or neutral. Litmus and turmeric are most commonly used as the coloring matters; litmus for the detection of acids, and turmeric for that of alkalies.

TESTU'DO. See TORTOISE.

TESTUDO, in Ancient Warfare, was a defensive arrangement of the shields, by means of which a body of men advancing against a wall for assault or mining sought to protect themselves from the darts and weapons of the defenders. The men standing in close order joined their shields above their heads, the edges overlapping, until the whole resembled the shell of a tortoise (*testudo*).—The name was also applied to a machine moving on wheels, and roofed over, under which soldiers worked in undermining or otherwise destroying the walls in a siege. See BATTERING-RAM.

TE'TANUS (derived from the Gr. *teinein*, to stretch) is one of the most formidable diseases of the nervous system, and is characterized by an involuntary, persistent, intense, and painful contraction or cramp (see SPASM) of more or less extensive groups of the voluntary muscles, nearly the whole of the body being sometimes affected. There is usually a certain degree of order in which the different sets of muscles are affected. The muscles of the neck, jaws, and throat are almost always the first to give evidence of the presence of the disease. 'The patient,' says Dr. Watson, who has written a most graphic description of this terrible malady, 'feels a difficulty and uneasiness in bending or turning his head, and supposes that he has got what is called a stiff neck. He finds also that he is unable to open his mouth with the customary facility. At length the jaws close; sometimes gradually, but with great firmness; sometimes (it is said) suddenly and with a snap. In four cases, perhaps, out of five, the disease begins in this way with *trismus* or *lock-jaw;* so that this last is the vulgar name for the complaint. Along with this symptom, or very soon after it, the muscles concerned in swallowing become affected; and in a short time there comes on, what is often the most distressing part of the disorder, an acute pain at the lower part of the sternum, piercing through to the back. This pain depends, it can scarcely be doubted, upon cramp of the diaphragm, and is subject to aggravation in paroxysms. The spasm extends to the muscles of the *trunk;* to the *large* muscles of the extremities; the muscles of the *face;* and last of all, in general to the muscles of the tongue, and of the hands and fingers, which often remain movable at the will of the patient, after all the other voluntary muscles of the body have become fixed.'—*Lectures on the Principles and Practice of Physic*, 4th ed., vol. i. p. 568.

The muscles that are affected remain permanently contracted till either recovery or death ensues, and some of them, as, for example, the muscles of the abdomen, are so rigid, as when struck by the fingers, to resemble a board, although a perfect remission of the spasm scarcely ever occurs, except sometimes during sleep. Exacerbations of the spasms, on the other hand, commonly occur every ten minutes or quarter of an hour, usually beginning by an increase of the pain at the sternum, and lasting for two or three minutes: and as the disease advances, these paroxysms become more frequent. The powerful muscles of the back generally overcome the muscles in the front of the body, and when this excess of morbid power in the back is marked, the result is that the patient during the paroxysms rests solely on his head and heels, while his body is raised in an arched form. Occasionally the muscular contraction predominates in the opposite direction, and brings the head and knees in contact; and still more rarely, the body is bent to one side.

During the exacerbations, the face of the patient often presents a positively frightful appearance. The tongue is apt to get bitten during the contractions, which are occasionally so violent as to break the teeth, rupture powerful muscles, and at least in one case, to fracture the thigh-bone. Death usually results from a mixture of causes, but mainly from apnœa (breathlessness), due to the fixed condition of the respiratory muscles, associated with asthenia (loss of power), and flagging of the heart's action.

There are two principal causes of this disease, viz. (1) exposure to cold and damp, and (2) bodily injuries. When tetanus arises from the *first* of these causes, it is termed *idiopathic;* and when from the second, *traumatic*. Idiopathic tetanus is so rare, at all events in this country, that we may pass on at once to the consideration of the traumatic variety. The disease is liable to follow any kind of injury, from a trifling cut or scratch to a compound fracture or the most severe operation, and is much more common in tropical than in temperate climates.

The following table, given by Mr. Poland in his article 'Tetanus' in Holmes's *System of Surgery*, vol. i. p. 306, gives the relative proportions which the occurrence of tetanus bears to various classes of surgical lesions observed at Guy's Hospital during seven years:

There were of—					
Major and minor operations,	1364	cases—tetanus occurred in			1
Wounds of all varieties,.....	594	"	"	"	9
Injuries and contusions.....	856	"	"	"	1
Burns and scalds,..	458	"	"	"	3
Compound fractures,.....	396	"	"	"	9
Total,.....	3668				23

From the large experience thus afforded, it appears that tetanus is most frequently met with in the more severe varieties of injury and accident, such as compound fractures, burns, and injuries to the fingers and toes. It is still a disputed point, whether the seat of the injury forms any special connection with the disease. Hennen, one of our greatest authorities on military surgery, observed it oftener after wounds of the elbow and knee; others, again, more frequently from injuries of the thumb and great toe. There is certainly a popular belief that wounds of the ball of the thumb are especially likely to be followed by tetanus.

The interval between the reception of the injury and the first tetanic symptoms commonly varies from the 4th to the 14th day, and rarely exceeds 22 days, some time in the second week being

the most common period. As a general rule, the more rapidly the disease comes on, the more fatal will be the result.

Mere *trismus* or lock-jaw may be induced by affections of the teeth, especially by difficult dentition of the wisdom-teeth; but this is a purely local affection, in which the muscular contraction, though persistent, is never increased by painful spasmodic paroxysms, and which usually disappears on the removal of the exciting cause; and the general knowledge of this fact may tend to remove unnecessary terrors. Hysteria sometimes mimics the phenomena of tetanus with marvelous fidelity; and hydrophobia and tetanus have been mistaken for one another, in consequence of the spasm of tetanus sometimes affecting the muscles of deglutition, and inducing a fear of swallowing. There is, however, seldom any serious difficulty in detecting the difference between tetanus and any other disease. But there is a form of poisoning which produces almost every symptom of tetanus, and which may be termed *artificial tetanus*. If strychnia or brucia, or their salts, or vegetable matter containing either or both of these alkaloids, as nux vomica, St. Ignatius's beans, or the juice of the upas tiente, be administered, either by the stomach or by inoculation, into the system, it induces all the symptoms of intense tetanus, and there is no test by which to distinguish the results of the disease and of the poisoning, except that, according to Dr. Christison, the disease never proves so quickly fatal as the rapid cases of poisoning with strychnia. See NUX VOMICA. And those who wish to study more minutely the comparative symptoms of strychnia-poisoning and tetanus, may consult the authorized *Report of Palmer's Trial*.

In the way of treatment almost every known medicine has been prescribed, and whatever plan be adopted, a vast majority of the cases terminate fatally. As is the case with certain fevers, so tetanus seems to have a definite course to run; and as Mr. Poland wisely suggests: 'All we can do is to enable our patient to weather out the storm by giving him as much strength as possible, and not adding fuel to the fire by all sorts of applications and internal remedies, which have over and over again signally failed. If we can help our patient on one day after another, we gain much: constant watching and constant attention are required by night as well as by day; an unflinching perseverance on the part of the sufferer in carrying out these views; besides the avoidance of all causes of excitement, and more especially the cold air or winds; taking care to preserve a uniform temperature as much as possible.' When, in consequence of the strong contraction of the muscles of the jaw, it is impossible to open the patient's mouth, food and physic should be introduced into the stomach by means of a flexible tube passed through one of the nostrils.

The peculiar form of tetanus that occurs in newly-born children, differs in so many respects from the disease described in this article, that we shall briefly notice it in a separate article under the title of TRISMUS NASCENTIUM.

TETANUS, or LOCK-JAW, occurs in most of the domesticated animals, but most frequently in horses and sheep. It is usually produced by cold and wet, by intestinal worms, obstinate constipation, or injuries. The symptoms usually come on gradually, involve tolerably equally most of the muscular structures, which become hard and rigid; the nose is protruded, the limbs move stiffly, the tail is upraised, the bowels are constipated. The patient must be kept perfectly quiet, and in an airy but tolerably warm place, and plentifully supplied with cold water, and with soft, sloppy, but tolerably nutritive food, which he will usually greedily suck in through his firmly closed teeth. A full dose of purgative medicine must at once be given; extract of belladonna repeated twice or thrice daily, is occasionally serviceable; any discoverable wound or injury should be fomented or poulticed; bleeding, sedatives, and all causes of irritation must be avoided. In adult animals, most cases are fatal; but amongst young animals, especially when the attack results from exposure to cold, many recoveries occur.

TETE-DU-PONT. See BRIDGE-HEAD.

TETRAGONIA'CEÆ, a natural order of exogenous plants, formerly included in *Mesembryaceæ* (q. v.), from which it differs chiefly in the want of petals. The species are herbaceous plants or small shrubs, with alternate, thick, succulent leaves. A few are found on the shores of the Mediterranean, and some in Asia and the South Sea Islands, but the order abounds chiefly in the south of Africa. New Zealand Spinach (q. v.) belongs to this order. Other species are also used like spinach, as *Sesuvium portulacastrum* and *S. repens* in the West Indies. Species of *Aizoon* are among the plants burned for barilla in Spain and the Canary Isles.

TETRAHE'DRON (Gr. *tettares*, four, *hedr*, a side), one of the five regular geometric solids, is a solid bounded by four equilateral triangles. The best idea of it is gained by considering it as a triangular pyramid, whose three sides and base are equilateral (and therefore equal) triangles. It is a form assumed by some crystals, and in crystallography is considered as a secondary form of the Octahedron (q. v.), produced by removing the alternate angles or edges of the latter.

TE'TRAO AND TETRAO'NIDÆ. See GROUSE.

TE'TRARCH (Gr. *tetrarches*, Lat. *tetrarcha*, 'governor of the fourth part,' i. e., of a country), a title originally designating what is signified by its etymology, the governor of one of four divisions of a kingdom or country; but in the usage of the later Roman Empire, given undistinguishingly to all minor rulers, especially in the east, possessing sovereign rights within their territory, but dependent on the emperor, and in many cases removable at his pleasure. This was especially the case in Syria, where the princes of the family of Herod are called indiscriminately by this title (Luke iii. 1) and by that of king (Matt. xiv. 9). The tetrarch in this latter sense was in truth a sovereign, although a dependent sovereign; and there are instances in which it seems to have been applied to really independent sovereigns of small principalities.

TETTER, the popular name for skin diseases of the kind described under PSORIASIS and HERPES.

TETUA'N, a seaport town and small province on the north coast of Africa, 22 miles south of Ceuta, and 40 miles south of Gibraltar. Area, 914 sq. m.; pop. 17,600. It is surrounded by walls, flanked with towers, and is defended by a castle. Its harbor does not admit large vessels; but a brisk trade is carried on in wool, silk, girdles, leather, cotton, &c., and it exports provisions largely to Ceuta. Oranges are grown in great abundance in the vicinity, and are exported to Spain, Gibraltar, Oran, and recently to England. T. was taken by the Spaniards under O'Donnell (q. v.), February 1860, but was evacuated next year. In a year, above 200 vessels, of 2000 to 3000 tons burthen, enter the port of Tetuan.

TETZEL, or TEZEL (properly *Diez* or *Diezel*), JOHN, well known in connection with the controversy regarding indulgences, out of which the first beginnings of the Reformation took their rise, was born at Leipzig, between 1450 and 1460. His father was a goldsmith of that city. T., after completing the ordinary studies of the period in the university, entered the Dominican convent of St. Paul in 1489, and soon established a reputation as a popular and effective preacher. His personal character is a subject of much controversy. The questions as to the teaching of T. are more important. His ability and success as a preacher led to his being intrusted with the charge of preaching an indulgence, first on behalf of the Teutonic Knights, and afterwards, in 1516, on the far more momentous occasion of the celebrated indulgence published in favor of contributors to the fund for building the church of St. Peter's at Rome. In the discharge of this commission, it cannot be doubted that T. went to extremes which it is impossible to justify; but the worst charges, and especially that of preaching the efficacy of indulgences without repentance, and of offering anticipatory pardons for future sin, are strongly denied by Roman Catholic writers as being contradicted not only by contemporary authorities, but also by the very instructions contained in his official commission.

Much of the obloquy which he drew upon his cause was produced by the pomp and apparent luxury in which he traveled about upon his mission. It was in opposition to the preaching of T. that Martin Luther published his celebrated theses, on the 31st October 1517. T. replied first by publicly burning these obnoxious propositions; but he afterwards published a series of counter-theses (which were burned in retaliation by the students of the university of Wittenberg); and in May 1518, a detailed reply to Luther's celebrated Sermon on Indulgences. On the arrival of the papal delegate Miltitz, T. addressed to him a letter in reply to the charges of his adversaries; but notwithstanding this defence of his conduct, he was summoned to appear before Miltitz in Leipzig in the January of the following year, and underwent a severe rebuke for the excesses in language, and the improprieties in proceeding, which had brought so much scandal upon the church. Miltitz threatened him, moreover, with the severest animadversions on the part of the pope. He was required in consequence to withdraw to his convent at Leipzig, where he died in the August of the same year, 1519, according to some of the plague, but according to another account, of the chagrin and mortification resulting from the judgment of the papal representative. —See on the one side, Hechlein, *Vita Tezelii;* Hoffman, *Lebensbeschreibung Tetzel's* (1844); and on the other Gröne, *T. und Luther* (1853). See also Kayser, *Geschichtsquellen über T.*) 1877.

TEUTOBURGER WALD (Lat. *Teutobergiensis Saltus*). See HERMANN.

TEUTO'NIC, a term applied to a group of nations, as well as of languages, forming an important division or stem of the Aryan (q. v.) family. The T. languages will be found enumerated and classified in the table at the end of the article PHILOLOGY. The T. stock of nations, as they exist at the present day, is divided into two principal branches: (1) The Scandinavian, embracing Danes, Swedes, Norwegians, Icelanders; and (2) the Germanic,

which includes, besides the German-speaking inhabitants of Germany proper (see GERMANY) and Switzerland (q. v.), also the population of the Netherlands (the Dutch), the Flemings of Belgium, and the descendants of the Anglo-Saxons in Great Britain, together with their offspring in North America, Australia, and other British colonies. It is necessary in this case, as in all similar cases, to guard against making language the sole test of race. In many parts of Germany where German now prevails, Slavic dialects were spoken down to recent times, and in some places are not yet quite extinct. And in Great Britain, it is unreasonable to suppose that the Anglo-Saxon invaders exterminated the native Celtic population, or even drove more than a tithe of them into the Highlands. The mass undoubtedly remained as subject serfs, learned the language and customs of their masters, and gradually amalgamated with them; so that, in point of blood, the English are perhaps as much Celtic as Teutonic.

Of the various tribes and nations spoken of as inhabiting Northern Europe in ancient times, it is often difficult to determine which were really of Germanic race, and which Celtic or Slavic; the classic writers having no skill in detecting the affinities of language, had only confused notions of ethnology. Of undoubted German nations who took part in the destruction of the Roman Empire, the most prominent were the Goths (q. v.), Lombards (q. v.), Vandals (q. v.), and Franks (q. v.). The term Teutonic is derived from *Teutones*, the name of a nation or tribe first mentioned by Pytheas, who wrote about 320 B.C., as then inhabiting a part of the Cimbric Chersonesus, or Jutland. For the next 200 years there is no further mention of the Teutones, that is, not until 113 B.C., when they appear in history as ravaging Gaul, and in conjunction with the Cimbri and Ambrones, threatening the very existence of the Roman republic. The Cimbri having gone into Spain, the Teutones and Ambrones were at length defeated by C. Marius in a great battle at Aquæ Sextiæ, or Aix, in Gaul, 102 B.C., in which from 100,000 to 200,000 of the invading army were slain, and many thousands made prisoners. A similar victory was gained by Marius in the following year over the Cimbri in the plans of Lombardy. It is disputed among ethnologists and historians whether the Cimbri so defeated were of the Celtic or of the Germanic race, and doubts have even been thrown on the claim of the Teutones to be considered Germans, although the best German scholars hold the claim to be established. Be that as it may, Roman writers, after the time of Cæsar and Tacitus, began to use the adjective Teutonicus as equivalent to Germanicus; and this practice was adopted in the middle ages by Germans writing in Latin. The native term was *theodisk*, from Goth. *thiud*, people; and it is from this word, and not from Teutonic, that the modern *Deutsch* is derived. See GERMANY.

TEUTONIC KNIGHTS, one of the more celebrated of the military and religious orders to which the Crusades gave birth. The sufferings of the Christian soldiers at the siege of Acre excited the sympathy of certain merchants of Bremen and Lübeck, who rendered such important services by the erection of hospitals and otherwise, that Duke Frederick of Swabia, with the sanction of Pope Clement III. and the Emperor Henry VI., enrolled them in an order of knighthood, as the Teutonic Knights of St. Mary of Jerusalem. Only Germans of noble birth were made admissible to the order, the original founders having probably been ennobled before being enrolled. The members were at first all laymen, but priests were soon admitted as chaplains; and there was also added about 1221, a class of half-brothers similar to the serving-brothers of the Templars and Hospitallers. The habit of the order was a white mantle with a black cross; and the knights took vows of poverty and chastity, which in later times were not very strictly interpreted. Their first seat was Acre. On the overthrow of the kingdom of Jerusalem, the grand-master removed to Venice, and from thence in 1309 to Marienburg, on the banks of the Vistula. In 1237, this order became united with the Brethren of the Sword in Livonia. In the course of the 13th c., the Teutonic Knights were, with the sanction of the pope, engaged in a bloody war to enforce Christianity on the heathen nations inhabiting the southern shores of the Baltic, which resulted in the acquisition by the order of Prussia, Livonia, Courland, and other adjoining territories. Warriors from all parts of Europe in that and the following century joined their standard, including Henry IV. of England, accompanied by 300 attendant knights and men-at-arms. The conquests of the order raised it to the rank of a sovereign power, with a territory extending from the Oder to the Baltic, and embracing a population of between two and three millions, the grand-master having his seat at Marienburg in Prussia.

The decline of the order began in the 15th c., and its fall was brought about partly by internal dissensions, and partly by the attacks of neighboring states. Sigismund of Poland wrested West Prussia from the knights; and Albert of Brandenburg, who was chosen grand master in hopes of his aiding the order against Poland, ended an unsuccessful war with Sigismund by an arrangement, according to which the territories of the order in East Prussia were formed into a duchy, to be held by Albert and his successors. Mergentheim in Swabia then became the seat of the grand master, who was recognized as a spiritual prince of the empire. At the peace of Presburg in 1805, the Emperor of Austria obtained the rights and revenues of the grand master; but in 1809 the order was abolished by Napoleon, its lands passing to the sovereigns in whose dominions they lay. The Teutonic order, however, still continues to preserve a titular existence in Austria.

TEW'KESBURY, an ancient market-town and parliamentary and municipal borough of Gloucestershire, in the vale of Evesham, on the Avon, and near its confluence with the Severn, 10 miles north-east of Gloucester. The parish church, an ancient and noble edifice in Norman, is the most noteworthy architectural feature. Hosiery, shoes, nails, leather, and malt are manufactured, and there is an extensive carrying-trade, of which T. is the center, on the Avon and Severn; pop. (1881) 5100. T., a very ancient town, appears to be of Saxon origin. Within half mile of it was fought (May 14, 1471) the famous battle of T., in which the Yorkists under Edward IV. and Richard III. inflicted a signal defeat on the Lancastrians.

TEXA'S, one of the south-western of the U. S. of America, is bounded on the S. W. by Mexico, and on the E. by Arkansas and Louisiana. Area (smaller than Alaska, but much greater than the German Empire or even Austria), 265,780 sq. m. Pop. (1860) 601,039; (1870) 818,579; (1880) 1,591,749 (of whom 253,500 were colored. Among the chief towns are Austin, the capital; Galveston, the principal seaport; San Antonio, Houston, Brownsville, and Jefferson. Nearly the whole Gulf coast is lined with bays, generally long and narrow, with shallow inlets—that of Galveston being 12 feet. The chief rivers are the Red River, which separates Texas from the Indian territory; the Sabine, Trinity, Colorado, and Rio Grande. These rivers, mostly navigable from 300 to 400 miles, run south-east, nearly parallel to each other, and empty into the Gulf of Mexico. The country on the coast of the gulf is level, with a gradual ascent, the middle region undulating with rolling prairies; the west is a high table-land, and the salt plains and staked plains (*el llano estacado*) on the borders of Arizona, are deserts 3000 to 4000 feet above the sea, without trees and in the summer without grass. There are a few small mountains in the west—spurs of the Rocky Mountains. The river-bottoms are well timbered. In Eastern T., wooded lands, called cross-timbers, alternate with prairies, and the country has a park-like and delightful aspect. The coast-region is formed of alluvial beds of sand or gravel; the middle, of outcrops of tertiary formations. In some places, petroleum is found on the surface of acid springs, and the earth is so charged with bitumen as to be used for fuel.

There are fertilizing marls and gypsums, brown coal or lignite in beds of six inches to eight feet, and beds of hematite. Beyond the tertiary lies a wide range of cretaceous formations, beds of limestone, sandstone, clays, marls, and beyond these, 5000 sq. m. of coal-measures, four distinct seams, of eight or nine feet in all, resting on fire-clay. There are also fine marbles, and some deposits of lead and copper. The soil is of great fertility, the coast producing the finest cotton, sugar, &c.; and the interior, wheat, Indian corn, tobacco, fruits of all kinds, with abundant pasturage—making it one of the finest cattle-countries in the world. The climate is pure, temperate, and remarkably salubrious. The thermometer ranges from an average of 84° F., the hottest month in summer, to 50°, the coldest month in winter. The eastern region is rainy; the middle, moderate; the south-western, dry. The vegetation is in the greatest variety, from the oak, cedar, and pine, to the palmetto, muskeet, and nopal, which feeds the cochineal insect, with figs, oranges, grapes, vanilla, and flowers in wonderful profusion. The prairies abound in buffalo, immense herds of wild horses, and the forest with deer. There are also the puma, jaguar, black bear, wolf, &c. The coasts, bays, and rivers abound in the finest fish, shell-fish, turtles, &c. Though the country is generally level, it is not destitute of wild and grand scenery. In some places are found gigantic animal fossils and silicified trees. There is a large trade with Mexico, and by the Red River and Gulf with New Orleans. The chief exports are cotton, sugar, tobacco, cattle, and wool. The value of these and other commodities produced in 1881–82 in T. was about £20,000,000; of this amount, about £10,000,000 was the value of the cotton produced, which was 878,854 bales. The produce of wool was 22,300,000 lbs.; of hides, 13,572,000 lbs.; and the estimated value of cattle was £3,200,000, and of horses and mules, £200,000. The state deaf and dumb, orphan, blind, and lunatic asylums have each an endowment of 100,000 acres of state lands. The state debt in 1881 was 4,491,000 dollars: the value of assessed property is over 300,000,000 dollars. In the same year there were about 6000 miles of railway in the state.

La Salle, the French explorer, erected a fort on Matagorda Bay, 1687. A Spanish settlement and mission was formed in 1690, but soon abandoned. In 1715, the country was settled by

the Spaniards, under the name of New Philippines, and several missions established; but the Comanche and Apache Indians, among the most warlike in America, and still the terror of the border settlements, hindered the progress of the country. In 1803, when Louisiana was ceded by France to the U. S., T., claimed by both Spain and the U. S., became a disputed territory. From 1806 to 1816, settlements were formed, and several attempts made to wrest the country from Spain. In one of these, in 1813, 2500 Americans and Mexicans were killed, and 700 inhabitants of San Antonia. Mina, a Spanish refugee, gained some successes, but was defeated and shot. Lafitte, a Gulf pirate, made a settlement at Galveston in 1815, but it was broken up in 1821. In 1819 the river Sabine was established as the boundary. In 1820, Moses Austin, an American, got a large grant of lands in T. from the Mexican government, and began a settlement, which rapidly increased; but many of the settlers were of so lawless a character, that in 1830, the government forbade any more Americans coming into Texas. In 1833, a convention of settlers, now 20,000 in number, made an unsuccessful attempt to form an independent Mexican state; and in 1835, a provisional government was formed, Sam Houston (q. v.) chosen commander-in-chief, and the Mexicans driven out of Texas. Santa Anna, President of Mexico, invading the country with an army of 7500, after some successes, was entirely routed at San Jacinto, April 21; and T. became an indepedent republic, acknowledged 1837 by the U. S., and in 1840 by England, France, and Belgium. In December 1845, T. was annexed to the U. S., but was invaded by Mexico, which had never acknowledged its independence, and thus originated the war with the United States. In Feb. 1861, T. joined the secession. Not till 1870 was the state re-admitted to representation in congress, and regular civil government restored. In 1876, a new constitution was adopted by the vote of the people.

TEXEL, THE, an island in the province of North Holland, separated from the Helder by a narrow strait, called the Marsdiep, contains about 35,000 acres of arable and pasture lands, and has a population of 6408. Many sheep are kept, producing fine wool. Fishing, ship-building, grinding corn, &c., are also sources of prosperity. There is much wealth in the island, but recently no steamboat communication existed with the mainland. The northern part is called Eijerland, or the egg-country, immense flocks of birds coming thither from Scandinavia to deposit their eggs.

TE'XTILE FABRICS. See WEAVING.

TEZCU'CO (i. e., 'place of detention'), an ancient and much decayed city of Mexico, stands on the east shore of the lake of the same name in the state, and 16 miles east-north-east of the city of Mexico. In former times, it was the capital of a great state, and was the second city in Mexico. During the early part of the 15th c., the city rose to its greatest splendor. It then contained ranges of stately mansions, in which the nobles resided, and a magnificent and vast pile of buildings, which served as the royal residence and as public offices. T. is now a poor place, filled with heaps of rubbish and ruins, and containing only 5000 inhabitants.

THACKERAY, WILLIAM MAKEPEACE, novelist and satirist, was born at Calcutta in 1811. He was of a good old English family, represented about the middle of last century by Dr. Thackeray, an eminent scholar, and head-master of Harrow. His father was in the civil service of the East India Company, and dying young, he left his son a fortune of £20,000. The latter, when a boy of seven year of age, was sent to England and placed in the Charterhouse School, that ancient Carthusian foundation, which he loved to commemorate in his writings. He next went to Cambridge, but left the university without taking a degree. In 1831 he was at Weimar, and saw Goethe. His ambition was to become an artist, and he traveled over most of Europe, studying at Paris and Rome. His drawings were not without merit; they were quaint, picturesque, and truthful, but somehow they missed the bright touches of a master-hand. He next took to literature, beginning with rare patience and contentment at the lowest step of the ladder. Under the characteristic name of Michael Angelo Titmarsh, or that of Fitz-Boodle, he became a constant contributor to *Fraser's Magazine*, and wrote for it two of the best of his minor works, *The Great Hoggarty Diamond* and *Barry Lyndon*. The latter is the story of an Irish sharper, and is told with a spirit, variety of adventure, and humor worthy of Le Sage or Fielding. Under the pseudonym of Titmarsh, he also published *The Paris Sketch-book* (2 vols. 1840), *The Second Funeral of Napoleon*, and *Chronicle of the Drum* (1841) and the *Irish Sketch-book* (2 vols., 1843). The greater part of T.'s fortune having been spent in foreign travel and unsuccessful speculations at home, he continued to work steadily at literature as a profession. He was never widely popular, but a few good judges appreciated his keen wit, observation, and irony, and his command of a style singularly pure, clear, and unexaggerated. The establishment of *Punch* afforded a more congenial field for T., and his *Snob Papers* and *Jeames's Diary* were hailed with delight by all readers. Their author's reputation was still more advanced by his novel of *Vanity Fair* (1846—1848), published in monthly parts in the style of *Pickwick*, and illustrated by the novelist himself, or, as he expressed it, 'illuminated with the author's own candles.'

During the progress of *Vanity Fair* appeared *Notes of a Journey from Cornhill to Grand Cairo*, being an account of a journey undertaken for the benefit of his health; also *Mrs. Perkin's Ball*, a short Christmas tale, and two works of a similar kind entitled *Our Street*, and *Dr. Birch and his Young Friends*. In 1849, he began a second serial fiction, *Pendennis*, in which much of his own history and experiences are recorded. Next followed *Rebecca and Rowena* (1850), and *The Kicklebury's on the Rhine* (1851). The latter work was sharply criticised by the *Times*, and T. replied in a caustic and humorous *Essay on Thunder and Small Beer*, prefixed to a second edition of the satirical sketch. In 1851, the indefatigable novelist delivered a course of lectures on the *English Humorists of the Eighteenth Century*—light, graceful, discriminating sketches, with passages of real power and eloquence. In 1852—1855, appeared two more novels, the most richly imaginative and highly finished of his works, *Esmond* and *The Newcomes*. These were followed by *The Virginians* (a much inferior novel), by *Lectures on the Four Georges* (first delivered in America), by *Lovel the Widower* and *Philip* (two short tales of somewhat coarse texture), and by a series of pleasant gossiping essays, entitled *Roundabout Papers*. These originally appeared in the *Cornhill Magazine*, of which T. was for a time editor; and in the same miscellany he had begun and published part of a new novel, *Dennis Duval*, which promised to be one of the most carefully elaborated and successful of his works of fiction. He contemplated also *Memoirs of the Reign of Queen Anne*, which would have served as a continuation to Macaulay's *History*. He knew that period well, from his previous studies for *Esmond*, and as a moral anatomist and master of English he stood unrivalled. But, alas! such dreams and anticipations were suddenly dispelled. To the grief of all lovers of genius and of manly and noble character, T. was cut off in the fulness of his powers in his 52d year, dying alone and unseen in his chamber before daybreak on the morning of the 24th of December 1863. His medical attendants found that death was caused by effusion on the brain, and that his brain was one of the largest, weighing no less than 58½ ounces.

In his delineation of the character and genius of Fielding, T. has drawn his own. He had the same hatred of all meanness, cant, and knavery, the same large sympathy, relish of life, thoughtful humor, keen insight, delicate irony, and wit. There was, however, one personal difference: Fielding was utterly careless as to censure of his works, whereas his successor was tremblingly alive to criticism, and was wounded to the quick by the slightest attack. His morbidly delicate organization made him exquisitely susceptible of either pain or pleasure. He had suffered much from physical maladies and from domestic calamity; and his earlier works, especially his *Vanity Fair*, were tinged with a degree of cynicism which seemed to countenance the charge of his unfriendly critics, that he delighted in representing the baser side of human nature, and was sceptical as to the existence of real virtue in the world. His strength lay in portraying character rather than inventing incidents; and in Becky Sharp, Colonel Newcome, Harry Foker, Laura Pendennis, and Paul de Florac, to say nothing of the picaroon, Barry Lyndon, he has left us a living gallery, certainly not surpassed by any modern novelist. In his later writings, the dark shades no longer preponderate. The mellowing influence of years and sickness, and calmer as well as more extensive observation of life, had sunk the merciless satirist in the genial humorist and philosophic observer. He had still ample scorn for falsehood and vice, and satire for folly and pretence; but he had also smiles and tears, and tenderness and charity, that gave a moral beauty and interest to the last decade of his brilliant career as an author. In deference to his wishes, no adequate biography of T. has yet appeared. See Trollope's *Thackeray* (1879); *English Men of Letters Series*. Besides several popular and uniform editions, a splendid *edition de luxe* of his writings, in 24 vols., appeared in 1881.—T.'s eldest and only surviving daughter, Anne Isabella (Mrs. Richmond Ritchie), is a careful and finished writer of fiction. Her novels are chiefly studies of character, within somewhat confined limits. She has issued amongst other works, *To Esther* (1869); *Old Kensington* (1873); *The Story of Elizabeth* (1876); and *Miss Williamson's Divagations* (new ed. 1882).

THA'IS, an Athenian courtesan, famous for her wit and beauty, who was in Asia along with Alexander the Great, and according to Cleitarchus—a doubtful authority—induced the Macedonian king, when excited with wine, to set fire to the palace of the Persian kings at Persepolis. After his death, she lived with Ptolemy Lagi, by whom she became the mother of several children.

THALASSIDRO'MA. See PETREL.

THALBERG, SIGISMUND, a very eminent pianist, born at Geneva in 1812, received the greater part of his musical education

at Vienna, where he was a pupil of Hummel. He made his first public appearance in 1827, and his *début* in Paris in 1835. After residing for a time in America, he returned to Europe, and died 27th April 1871. In graceful and brilliant execution, and in manual dexterity on the piano, he had hardly a rival. His compositions are principally fantasias and variations.

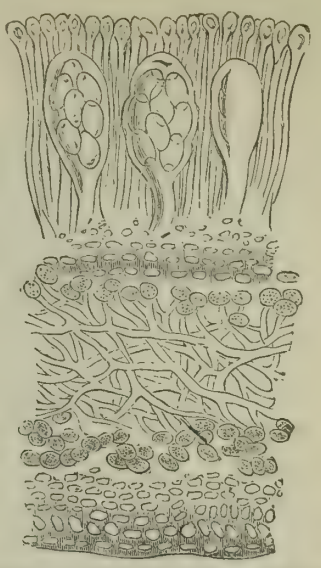
THALEI'A or THALIA (Gr. the blooming one), one of the nine Muses (q. v.), generally regarded as presiding over comedy. By Apollo, T. became the mother of the Corybantes.

THA'LÉS, an early Greek philosopher, founder of the Ionicor physical school of philosophy, and one of the Seven Wise Men (q. v.), was a native of Miletus, in Asia Minor, and flourished towards the close of the 7th c. B.C. Very little is known regarding his life. He is said to have recommended the Ionians, who were menaced by the Persians, to form a federation against their powerful enemy, and to select Teos as the capital. At a later period, we are told he induced the Milesians to withdraw from a union with Crœsus against Cyrus. He is also said to have predicted the eclipse of the sun which happened in the reign of Alyattes. His claim to the title of sage (as in the case of his compeers) was due to his practical wisdom rather than to his speculative achievements. Nevertheless, T. has a name in the history of speculative philosophy. He is even regarded by some as the *first* Greek that speculated on the constitution of the universe. According to him, the original principle of all things is water, from which everything proceeds, and into which it is again resolved. It would appear also that in connection with this doctrine he had some idea of a soul or force in water productive of all the phenomena we see. None of T.'s speculations were committed to writing, and it is only from the notices of later Greeks, such as Herodotus, Aristotle, &c., that we can gather an idea of his thinking.

THA'LLIUM (symb. Tl, equiv. 204, spec. grav. 11·9) is a metal which derives its name from the Greek word *thallos*, green, because its existence was first recognized by an intense green line appearing in the spectrum of a flame in which T. is volatilized. It was discovered by Mr. Crookes in 1861, in the seleniferous deposit of a lead chamber of a sulphuric acid factory in the Harz Mountains; and it was soon obtained in large quantities by M. Lamy. T. is slightly heavier than lead—a metal which it resembles in its physical properties. It is very soft, being readily cut with a knife, or drawn into wire; and its freshly-cut surface exhibits a brilliant metallic lustre and grayish color, somewhat between those of silver and lead. In contact with the air, it tarnishes more rapidly than lead, and becomes coated with a thin layer of oxide, which preserves the rest of the metal. It fuses at 290° C., and at a red heat becomes volatilized. It is crystalline in structure, crackles like tin when bent, but is highly malleable. The metal and its compounds give a bright green tint to colorless flames; the spectrum of T. is marked by a single sharply defined green line. It is used to produce a green light in firework displays, and is employed to render glass highly refractive. The metal can best be preserved free from oxidation by being covered with paraffin and kept below water. T. forms a number of compounds, including three oxides. Thallous oxide (Tl_2O) is the most important; it is easily soluble in water, producing a caustic alkaline solution. There was long a difference of opinion as to whether the salts of T. are or are not powerful irritant poisons. Lamy, by a series of experiments on animals, completely satisfied himself that they are, a very small quantity sufficing to destroy hens and puppies. Mr. Crookes was long inclined to an opposite opinion; but it is now agreed that the salts of T. are poisonous.—For further details regarding this metal, see Mr. Crookes's Memoirs in the *Philosophical Transactions* for 1862, and in the *Chemical News* for 1874, and Lamy's Memoir in the *Annales de Chimie et de Physique* for 1863.

THALLO'GENOUS PLANTS, are those acotyledonous plants which exhibit the greatest simplicity of structure, consisting of a mere Thallus (q. v.) with reproductive organs. Of this description are *Algæ*, *Characeæ*, *Fungi*, and *Lichens*. When apparent leaves exist in any of these, they do not exhibit the symmetry always found in true leaves; and although some of them have stems or stalks, which attain, as in some sea-weeds, both to a considerable age and to great strength, all is composed of cellular tissue without any proper woody fibre.—In the botanical system of Lindley, the T. P. form a class, under the name *Thallogens;* and in that of Endlicher, a corresponding place is assigned to them under the name *Thallophyta*.

THA'LLUS, in Botany, a structure composed of cellular tissue, without woody fibre, which in some of the lower cryptogamic orders, as *Algæ*, *Fungi*, and *Lichens*, constitutes the whole plant, except the reproductive organs, which are situated in or upon it. The T. assumes very various forms, sometimes crust-like, sometimes spread out like a leaf, simple, lobed, or branched; or, as in mushrooms, it becomes a stalk, cap, and gills.



Vertical Section of Thallus of *Parmelia parietina*, showing spores, &c

Copied from Lindsay's *British Lichens* (London: Routledge).

THAMES (Lat. Tam-*esis*; the root *tam* probably meaning broad, and *esis* or *isis*, being identical with *esk*, *ex*, *ouse*, &c., all from Cel. *uisg*, water), the most important river of Great Britain, and the longest in England, flows east-south-east across the south portion of the country. Its remotest springs—those of the upper waters of the Churn—rise on the south-east slope of the Cotswold Hills, 3 miles south of Cheltenham, and 7 miles west of the Severn at Gloucester. The springs unite about a mile from their sources, and form the Churn, which flows south-east 20 miles to Cricklade, and there receives the T., which joins it from the west after a course of 10 miles. The T., or Isis, then flows east-north-east for about 35 miles, when, curving south-east it passes Oxford, and flows on to Reading, where, after receiving the Kennet from the west, it again changes its course: and with a generally eastward course it passes Windsor, Eton, Richmond, London, Woolwich, and Gravesend, a few miles below which it expands into a wide estuary, and enters the North Sea. The length of the T. is estimated at 250 miles, the area of its basin at upwards of 6000 sq. miles. Throughout the greater part of its course, it is of importance as forming the boundary-line between several of the southern counties. Passing Cricklade, it forms part of the northern boundary of Wilts, and below this point it separates the counties of Oxford, Buckingham, Middlesex, and Essex on the north from those of Berks, Surrey, and Kent on the south, except certain outlying bits of some of these counties. Its chief affluents are the Coln, Leach, Windrush, Cherwell, Thame, Colne, Lea, and Roding, on the left; and the Kennet, Loddon, Darent, Mole, and Medway, on the right bank.

At Vauxhall Bridge, the width of the river is about 230 yards; at London Bridge, 290 yards; at Woolwich, 490 yards; at Gravesend Pier, 800 yards; three miles below Gravesend, 1290 yards; and at its mouth, between Whitstable and Foulness Point, about 8 miles below the Nore, it is 18 miles across. At the Nore Light, the commonly reputed mouth of the T., the breadth is 6 miles. The river is navigable for barges to Lechlade, upwards of 200 miles above its mouth, and it is connected with the Thames and Severn, Oxford, Wilts and Berks, Grand Junction, and several other important canals, by means of which it maintains free communication with the west and south coasts, and with all parts of the interior of the country. Vessels of 800 tons can reach St. Katharine's Docks, while those of 1400 tons can ascend to Blackwall, 6 miles below London Bridge. The part of the river immediately below London Bridge is called the *Pool;* and the part between the Bridge and Blackwall is called the *Port*. Two embankments have been formed, one on the north shore from Blackfriars Bridge to Westminster, and one on the south shore from Westminster Bridge to Vauxhall. See LONDON.

THANA'TICI is the term used by the Superintendent of the Statistical Department in the Registrar-general's Office, Dr. Farr, in his *Nosology*, to indicate 'lesions from violence tending to sudden death.' These lesions are the direct results of physical or chemical forces, acting either by the will of the sufferer or of other persons, or accidentally.

THANE, or THEGN (A.-S. *thenien*, analogous to Ger. *dienen*, to serve), a title whose use in the early feudal ages has been the subject of much discussion. In England, in Saxon times, the king's thane was a 'miles emeritus,' who, on the cessation of his actual service about the king's person, received a benefice or grant of land. The term 'miles,' when used by Bede, is uniformly rendered 'cyninges thegn' by his Saxon translator.

In the 10th c., all who would, in the feudal era, have been known as tenants *in capite*, were thanes. After the Conquest, thanes and barons are classed together; and in Henry I.'s time, the terms seem to be used synonymously. The office or dignity appears to have been attached to particular estates; thane lands are frequently mentioned in Domesday. After the reign of Henry II., the term fell into disuse. The title thane was introduced at a later period into the northern parts of Scotland, where, however, it did not express the same rank and dignity as in England; the tenure not being military, but in fee-farm.—The Scottish thane seems to have been a hereditary tenant, paying the sum at which the land stood in the king's rental, and retaining his ancient authority strengthened and legalized. The title was in occasional use in Scotland down to the end of the 15th century. Hector Boece's notion of the Scottish thanes being all made earls, which has been adopted in Shakspeare's *Macbeth*, is devoid of historical foundation.

THA'NET, ISLE OF, forms the north-eastern corner of the county of Kent (q. v.), from the mainland of which it is cut off by the river Stour and its branches, and is bounded on the N. and E. by the sea. It is 10 miles in length, and from 4 to 8 miles broad; and contains 26,500 acres, of which 23,000 are arable, and 3500 in marsh and pastures. The surface is high, but in the main, level; the soil is in general light and chalky; the island, however, is rich and fruitful—agriculture being successfully pursued. Besides the ordinary crops, canary and radish seeds are largely grown. On the shores of the island are the well-known watering-places, Ramsgate, Margate, and Broadstairs; and on the North Foreland, in the north-east, there is a light-house, 340 feet above sea-level, and visible at the distance of 22 miles. Pop. (1871) 42,129; (1881) 50,646.

The Isle of T., the British name of which was *Ruim* (a headland), was at one time separated from the mainland by a sea-passage, called the Wantsome, which in Bede's time was one-third of a mile wide, and was passable only at Sarre and Wade. The Wantsome was the general sea-passage toward London for the Danish ships, but in 1500 it became finally closed.

THANN, a town of Germany, in the province of Alsace-Lorraine, at the foot of a hill crowned by the ruins of the castle of Engelburg, 13 miles west-north-west of Mulhouse. It contains a superb Gothic church, surmounted by a spire of delicate open work, upwards of 300 feet high. Cotton cloths, chemicals, and machinery are manufactured. Pop. (1875) 7532; (1880) 7535.

THA'SOS, the most northerly island in the Ægean Sea, a few miles off the coast of Macedonia. Circumference about 40 miles; pop. about 5000, scattered over a dozen villages. T. is mountainous, and on the whole, barren. The description of it given by Archilochus is still applicable: 'An ass's backbone overspread with wild wood.' It exports some oil, honey, and timber. In ancient times, the island was famous for its gold mines, which appear to have been worked from a very remote antiquity, and which, immediately before the Persian wars, yielded upwards of 300 talents yearly; but they have long since been abandoned. Some remains of the ancient town of T. still exist.

THEA. See TEA.

THE'ATER, a place for public representations, chiefly of a dramatic or musical description. Theaters are of very ancient origin. They were found in every Greek city, both at home and in the colonies, and many very interesting specimens of the Greek theaters still exist in very good preservation. These were not built like modern theaters, with tiers of galleries rising one over the other, but were constructed with concentric rows of seats rising in regular succession one behind and above the other like the steps of stairs. These seats were frequently cut in the solid rock; and a place where the natural curve and slope of the ground rendered such excavation easy, was generally chosen. The seats, or audience department, were arranged in a semicircular form. In the center, at the lowest point, stood the orchestra; and the proscenium, or place for the dramatic representation, formed the chord of the semicircular auditorium. Behind this was the scena, closing in the building with a solid wall, generally ornamented with pillars, cornices, &c. There was no roof, but the audience was probably protected from the sun's rays by a curtain stretching across the theater. This form of theater was also that adopted by the Romans, who built or excavated large theaters in many of their important towns. The theaters of the Romans differed from their *Amphitheaters* (q. v.), the former being semicircular, the latter oval, and with seats all round. Of the theaters still remaining, that of Orange, in the south of France, is one of the finest, the auditorium being 340 feet in diameter. The illustration (fig. 1) shows the general form of these ancient theaters; and in this case the scena is more elaborate than usual. During the middle ages, theaters were unnecessary, and were never built. The few dramatic performances then in use, which were chiefly of the nature of holy mysteries, were represented in the cathedrals. From the remains still existing, however, there would seem to have been large open-air theaters at an early age in this country. Of these, Piran Round in Cornwall is the best example. It is circular, with raised platforms all round for spectators, after the manner of the Greek theaters.

With the revival of classical literature in the 16th c., the classical drama was also reproduced, and naturally along with it the classical form of theater. The first specimens of what may be called modern theaters (although founded on the old Greek model, according to Vitruvius's description) were the Theatro Olympico, erected by Palladio in Vicenza; a similar one in Venice, also by Palladio; and another in Vicenza, by Serlio. In Italy and Spain, open courtyards, with galleries round them, were at

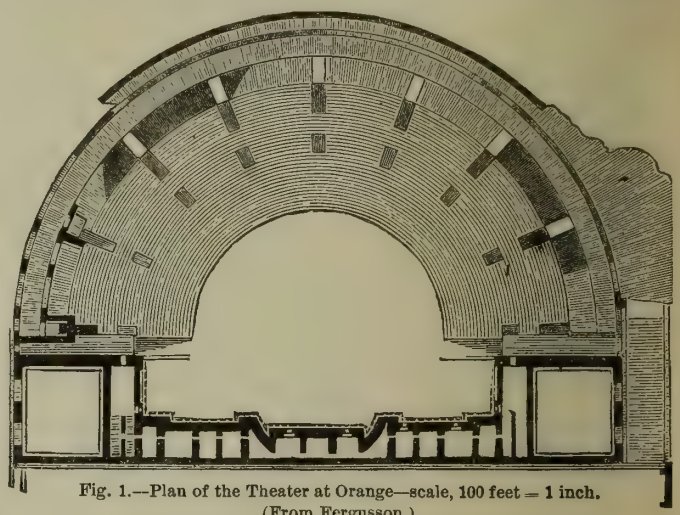


Fig. 1.—Plan of the Theater at Orange—scale, 100 feet = 1 inch. (From Fergusson.)

first the scenes of dramatic performances. In France and England, where the climate did not so readily admit of open-air representations, the first plays performed were exhibited in tennis or racket courts, in which there were usually galleries at one end; and as this accommodation was found too limited, these were afterwards carried along the sides also. But dramatic literature soon became so important that buildings had to be designed for the express purpose of its representation. Accordingly, in Paris, the theater of the Hôtel de Bourgogne was erected in the beginning of the 17th century. It was rebuilt 1645, with tiers of boxes on a square plan. In 1639, the theater of the Palais Royal was erected by Richelieu, and was long considered the best model. The present circular plan of the galleries, with pit sloping backwards, seems to have been first introduced in Venice in 1639; and the horse-shoe form of the boxes was first carried out by Fontana in the Tordinoni Theater at Rome, in 1675. The modern form of the auditorium was thus invented, and gradually improved and perfected, till in about a century similar theaters were erected all over Europe; the Scala Theater at Milan, the largest in Italy, and the great theater at Bordeaux, being built, the former in 1774, and the latter in 1777.

The annexed plan of the Scala Theater at Milan (fig. 2), will show the general disposition of all the parts of the modern theater on the largest scale. Modern theaters are all very similar in their general distribution. They are divided into two distinct departments—viz., the auditorium or audience department, and the stage or scenic department. In the former, the seats are invariably arranged on a sloping ground-floor or 'pit;' and on several tiers of galleries, extending in a semicircular or horse-shoe form round the house. On the ground-floor, the front rows of seats are generally set apart as 'dress stalls,' and the back part only is then called the 'pit.' In opera-houses, the stalls generally occupy the greater portion of the space, and the 'pit' is reduced to a minimum. In dramatic theaters, the tiers of galleries have the floors arranged in stages, rising above one another in such a manner as to enable the spectators all to see over those before them to the front of the stage. In theaters for operatic representation, the galleries have the floors laid level, and are divided all round into private boxes. The top tier is, however, sometimes left partially open, and has the seats on stages. In the larger opera-houses, there are usually retiring-rooms connected with

each of the private boxes. There is also a 'crush-room,' or large saloon, in which the audience may promenade between the acts.

In all French theaters and opera-houses, these saloons, or *foyers*, are very large, and elegantly fitted up. They are almost always over the entrance-hall. In some of the modern French theaters, there are two foyers, one over the other, for the different classes who occupy the dress circle and the upper galleries. The question has often been raised as to the best form for a theater, both for hearing and seeing. It is a most difficult question to decide theoretically as regards hearing, but it is quite clear that the old semicircular plan of the Greeks is as nearly as possible the best for seeing, as it places the seats all round at an equal distance from the center of the proscenium; and therefore we find, in cases where seeing well is all-important, as, for instance, in a *lecture theater*, this old form is usually adopted. In an oblong house, on the other hand, the seats at the center of the galleries are much further removed than those at the sides from the center of the stage, and are thus at a disadvantage as regards hearing; while the side boxes are badly placed for commanding a view of the stage. The entrances and staircases of theaters are not generally so well arranged or so spacious as they should be. In French theaters, this is especially the case. In these, there is often only one narrow wooden stair on each side of the house, leading to all the galleries. Recent accidents by fire, and the risk the audience runs in case of want of proper exits, have drawn attention to this subject, and the legislature will probably determine that there must be a separate, wide, and easy stair to each gallery—as, indeed, there usually now is in theaters recently built in this country. For large galleries, these stairs should be at least six feet wide; and a strong iron hand-rail down each side of the stair would be found useful in case of a panic, to prevent a fatal crush. Besides the main passages for the use of the public, there ought to be private passages and doors leading to every part of the house, so that the manager may pass with ease to any point in the audience where his presence may be required.

The orchestra occupies the space immediately in front of the proscenium, and this space is arranged so as to be capable of being enlarged or contracted as occasion may require. The proscenium is a small portion of the stage which projects a few feet in front of the curtain, so as to enable the actors to stand well forward, that they may be distinctly heard by the audience. The part of the house on either side of the proscenium is that on which there is usually the greatest amount of ornament. The

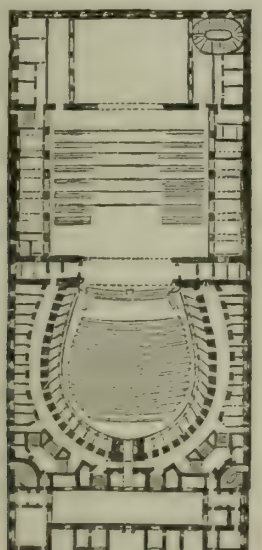


Fig. 2. —Plan of La Scala Theater at Milan—scale, 100 feet = 1 inch.
(From Fergusson.)

sides and ceiling of the proscenium form, as it were, the frame through which the picture represented on the stage is seen; and as on it every eye must rest, it is made more ornate than the rest of the auditorium. The ceiling, presenting as it does a large broad surface, and being well seen from many parts of the house, is also a place well adapted for ornament, and is generally made as handsome as possible. The same remark applies to the fronts of the dress circle and galleries. The stage extends backwards from the proscenium, and ought to be of considerable depth, so as to admit of the scenic effects, dissolving scenes, &c., now so much run upon. The great length of the stage from front to back is one of the most striking differences between the modern and the ancient theater, and arises entirely from the introduction and development of movable scenery—an invention of the architect Baldassare Peruzzi, and first used in Rome before Leo X., in 1508. The floor of the stage is not laid level like the floor of a room, but is sloped upwards from front to back, so as to elevate the performers and scenes at the back, and render them more easily seen. The inclination of the stage is generally about half an inch to every foot. The stage department of a theater not only requires to be very long, but also very lofty above, and deep below the stage, so as to allow the large frames on which the scenes are stretched to be raised or lowered in one piece.

The stage itself is a most complicated piece of mechanism, a considerable part of it being made moveable either in the form of *traps*, for raising or lowering actors, furniture, &c., or in long pieces, which slide off to each side from the center, to allow the scenes to rise or descend. There are also *bridges*, or platforms constructed for raising and lowering through similar openings, some of them the full width of the stage. The traps and bridges are almost all worked by means of balance-weights, and the slides by ropes and windlasses. Besides the large *frames* above described as containing pictures occupying the full opening of the stage, there are other scenes which are pushed from the sides to the center, each being only one half the width of the opening. These are called *flats*, and usually slide in grooves above and below. The grooves are arranged in clusters at intervals, having clear spaces between, called the *entrances*, through which the actors pass on and off the stage. But in modern French theaters and in the opera-houses—such, for instance, as Covent Garden Theater—these grooves are regarded as an encumbrance to the stage, and are entirely done away with. Their place is occupied by narrow openings or slits in the stage, below which are blocks running on wheels, and containing sockets, into which poles are dropped from above, and to these the flats are attached. Another advantage of this system is, that the gas-wings and ladders may be made movable, and slip backwards and forwards in the same manner as the flats. When occasion requires, the whole stage can thus be entirely cleared.

According to the old plan of fixed grooves, only the center of the stage can ever be cleared without unscrewing all the grooves, and the gas-wings must always remain in the same relative position. Besides the flats, there are also smaller scenes which move in the grooves. These are called *wings*, and are used to screen the entrance. Corresponding to the wings are similar narrow scenes dropped from above: these are called *borders*, and are used to hide the gas-battens. These and the scenes which are drawn up, the gas-battens, &c., are all worked by means of ropes from the *flies*, or galleries running along the sides of the stage at a high level. The ropes from these passing up into the barrel-loft (a space in the roof filled with large drums and barrels on which the ropes are coiled) and down again to the flies, form a complication which seems to the uninitiated observer an inextricable mass of confusion. While such is the usual arrangement connected with movable scenery, it is to be noted that latterly a very great change has been introduced into the higher class of theaters. This change consists in the dismissal of wings or sliding side portions of scenes with intervening gaps, and substituting for them large pieces of scenery resembling the sides and further end of a room—an arrangement every way more natural. In cases of this improved kind, the actors enter on the stage and depart by doors. In connection with the stage, it is usual to have a large space set apart for containing scenery, called the *scene-dock*.

This is frequently placed at the back of the stage, and may, on occasion, be cleared out, to give extra depth to the scene. There are also numerous apartments required in connection with the stage for the working of the theater—such as manager's room; dressing-rooms for the actors and actresses; the 'green-room,' in which they assemble when dressed, and wait till they are called; 'star-rooms,' or dressing-rooms for the stars; the wardrobe, in which the costumes are kept; furniture stores, scene stores; 'property'-maker's room; and workshops for the carpenter, gas-man, &c. There must also be a good painting-room, which must necessarily be a large apartment, from the size of the pictures which have to be painted—each being the full size of the opening of the stage. The canvas for these scenes are stretched on frames, which move up and down by means of a winch with balance-weights; and thus the painter stands comfortably on the floor, and moves his picture up or down, so as to get to any part he wishes. An interesting point on the stage is the prompt corner, from which the prompter has command of all the lights of the house, and bells to warn every man of his duty at the proper moment. He has a large brass plate, in which a number of handles are fixed, with an index to each, marking the high, low, &c., of the lights; and as each system of lights has a separate main pipe from the prompt corner, each can be managed independently. The side of the house on which the prompter is seated is called the 'prompt side,' and the other side is called the 'O. P.' or *opposite* side.

The house, or auditorium department, is generally lighted by means of a large lustre or sun-light in the center of the ceiling, and much of the effect of the building depends on how this is managed. There are also usually smaller lights round one tier of the boxes at least. The proscenium is lighted by a large lustre on each side, and by the foot-lights, which run along the whole of the front of the stage. These are sometimes provided with glasses of different colors, called mediums, which are used for throwing a red, green, or white light on the stage, as may be required. The stage is lighted by rows of gas-burners up each side and across the top at every entrance. The side-lights are called *gas-wings*, or *ladders;* and the top ones, *gas-battens*. Each of these has a main from the prompt corner. They can be pushed in and out, or up and down, like the scenery. There is also provision at each entrance for fixing flexible hose and temporary lights, so as to produce a bright effect wherever required. The mediums for producing colored light in this case are blinds of colored cloth. Another means of producing brilliant effects of light is the lime-light, by which, together with lenses of colored glass, bright lights of any color can be thrown on the stage or scenery when required.

Theaters are usually either very cold or insufferably hot. This arises from want of proper means of heating, and insufficient ventilation. The center lustre is the great cause of ventilation, the draught caused by its heat drawing off the foul air at the ceiling. The suction caused by this withdrawal of air is naturally supplied from the great body of air in the stage. The stage ought, therefore, to be moderately heated by means of hot-water pipes or otherwise, so as to prevent cold draughts. The passages and lobbies round the house should also be heated in the same way, so that any air drawn in to the house may be properly tempered.

An attempt has been made in Paris, of late years, to obviate the great heat and draught caused by the center lustre, by doing away with the lustre, and making the ceiling partly of glass, with powerful lights and reflectors behind the glass in the roof. This mode of lighting is, however, of rather a subdued character for a theater, although very appropriate to such chambers as the House of Commons, where it acts admirably. In Paris, they have also tried to supply fresh air from the gardens outside by means of a large tube, from which numerous small tubes branch. The theater built at Baireuth in 1876 for Wagner, and designed to carry out his views as to dramatic representation, has various devices for heightening the dramatic illusion; the orchestra, for example, being beneath the level of the stage, and wholly invisible to the spectators.

There is a class of theaters in Germany which have a double auditory, one at each end of the stage. One of these auditories is arranged and lighted in the usual manner, and is called the Winter Theater. The other auditory is called the Summer Theater, and is so arranged that performances may be represented in daylight during the summer season. It is lighted by large windows in the outer wall, which corresponds in form to the interior curves of the galleries, and also by windows in the roof.

The new Grand Opera of Paris, opened in 1875, is admittedly the finest theater in the world; it was built by government at a cost of upwards of 36,000.000 of francs. Its auditorium is, however, seated only for 2200 persons.

The art of *dramatic representation* has undergone great changes. In ancient Greece, partly from the character of the subjects selected, and partly from the origin of the drama itself, costume and acting were conventional, artificial, and stereotyped. On this point, we quote the words of Witzschel, who has written a Handbook for Students on the Athenian Stage (Eng. transl. by Paul; ed. by T. K. Arnold, Lond. 1850): 'There can be no doubt,' says he, 'that the somewhat fantastic costume which was handed down without any change from one generation of actors to another was closely connected with the religious character of their tragic performances. The peculiar fashion and brilliant colors of the tragic wardrobe belonged rather to the Dionysian solemnities han to the stage. That Æschylus, by whom the greater part of it was invented, kept steadily in view the original intention of tragedy, is evident from the notices which we find in ancient writers of his theatrical dresses having been worn in other religious ceremonies and processions. It is only reasonable to suppose that he would have given to the tragic stage a wardrobe of a very different description, had he not been influenced by the conviction, that theatrical performances were in some sort a religious ceremonial. Another proof of the feeling generally entertained on this subject may be found in the ridicule with which Aristophanes overwhelms Euripides for introducing his heroes, not only in pitiable situations, but in dirty, ragged, and beggarly weeds, to the great disgust of all true-hearted Athenians, and the utter annihilation of tragic ideality. In the *Acharnenses*, the whole of the tragic poet's squalid wardrobe is held up to public derision.

'The tragic costume for male characters of the highest rank consisted of an embroidered tunic with sleeves, which, in the older personages, reached to the feet (*chiton poderes*), and in the younger to the knees. Over this was thrown a green pall, or long mantle (Gr. *surma*, Lat. *palla*), which also reached to the feet, and was richly ornamented with a purple and gold border. Persons of high but not royal rank wore a shorter red mantle, embroidered with gold, which was partially covered by a richly-embroidered, high-fitting scarf. Soothsayers wore over the tunic a kind of network, composed of woollen threads. A sort of waistcoat (*kolpoma*) was also worn over the tunic. This was the costume of powerful and warlike sovereigns, such as Atreus, Agamemnon, &c. Dionysus (Bacchus) appeared in a purple tunic, which hung negligently from an embroidered shoulder-knot, and a thin, transparent, saffron-colored upper robe, with a thyrsus in his hand. Even Hercules himself was not the athletic hero of the old mythology, with a lion's skin thrown loosely round his muscular limbs, but a solemn, theatrical personage, enveloped in a long mantle. The costume of a queen was a flowing purple robe, with a white scarf; and for mourning, a black robe, and blue or dark yellow shawl. Persons in distress, especially exiles, wore dirty-white, dark-gray, dingy-yellow, or bluish garments. . . . . To increase their height, the tragic performers wore the cothurnus, a sort of buskin, with high soles and still higher heels, which compelled them to walk with a measured and sounding tread, and a top-knot of hair, or toupet (Gr. *ongkos*), suitable to the age and condition of the character represented. A corresponding breadth of figure was produced by means of padding and by a sort of glove. Thus equipped, the tragic hero seemed a giant as compared with ordinary mortals. Lastly, they had the mask, a part of the ancient theatrical costume, which seems to us so strange and unnatural. For its meaning and origin, we must go back to the Dionysian festival, at which the excited crowd were wont, in honor of the jolly god, to smear their faces with lees of wine; and at a later period, when dramatic interludes were attempted, with vermilion, or to cover their cheeks with rude masks of bark.

'In the course of time, these primitive inventions were discarded, and their place supplied by linen masks, characteristically painted. For the sake of retaining this uncouth but distinctive appendage of the Dionysian festival, the Greeks were content to forego the delicate expression of feeling and eloquent play of features which are indispensable to a modern actor; but on the other hand, when we remember the enormous size of their theaters, which scarcely permitted the assembled thousands to hear what was said by the actors, still less to distinguish their features, we are forced to acknowledge that the practice of wearing masks was rather an advantage than an inconvenience.' The above description is, in the main, applicable to the Roman as well as the Greek theaters. The only additional point which it is necessary to notice is that, among the ancients, the acting of plays was not (as it is now) a regular and daily, but only an occasional affair, at festival seasons and the like. With the fall of the Western Empire, the disappearance of classic paganism and classic tastes, and the triumph of the christianized barbarians of the north and east, theatrical performances ceased. But the liking for such things is not artificial; it is natural and irrepressible; and gradually, as the ancient culture resumed something of its former sway, efforts were made, not, indeed, to re-enact the majestic tragedy of Greece (for its language was scarcely known), or the pungent comedy of Rome, but to throw into dramatic form the 'mysteries,' 'miracles,' and 'moralities' of the Christian religion. The rudeness of these medieval plays may perhaps suggest to us what Greek performances were before the days of Thespis. In fact, they were introduced as a means of edifying, as much as of amusing the ignorant laity, were customarily the work of monks, and were performed on festive occasions in the churches. It does not, however, appear that they were accompanied by any *scenic* representations. A raised wooden stage like that which forms the front of a traveling show, was all that the untutored taste of the times demanded. Nor are we to suppose for a moment that the slightest attention was paid to propriety of costume or speech. The personages rather than the actions, the ceremony rather than the dialogue, the moral rather than the matter, were the things looked to, and hence no subtle or artistic representation of life and character was possible.

The development of the Modern Drama (q. v.) ultimately restored the art of the actor to its ancient dignity and importance; but it was long before those changes took place that gave theatrical performances their modern character. Good acting—that is to say, skilful impersonation of character and varied elocution—became quite common in England after the Restoration, and was not unknown before it; but appropriate costume and scenery were scarcely thought of until the time of Talma (q. v.), towards the close of last century. Since then, the best theaters have displayed a most creditable desire to reproduce, with something like verisimilitude, the outward 'form and pressure,' the garb, deportment, and air of the age represented.

The employment of female actors is of French origin, and

dates from the first half of the 17th c.; but they were not permitted (without molestation) to tread the English stage till 1661. Before this innovation, female parts were performed by youths; and though it ill consorts with *our* ideas of adequate representation to conceive the parts of Desdemona, Ophelia, Cordelia, &c., executed by those of another sex, it would appear that several actors obtained a wonderful success in this line.

The title of 'His Majesty's Servants,' which English actors once bore, originated in the fact that some of them were really members of the royal household. The king and particular nobles kept troops of actors for their own pleasure, whom they sometimes permitted to go about the country and perform. The first prince we read of that gave his 'servants' such permission, was Richard, Duke of Gloucester (afterwards Richard III.). In Queen Elizabeth's time (1571), the Earl of Leicester's 'servants' were licensed to open the first *public* theater in England, and it is owing to the circumstances of actors having originally formed part of the household of the king that a license from the Lord Chamberlain is still necessary to the opening of a theater.—For an anecdotical and amusing history of the English stage, see *Their Majesties' Servants*, by Dr. Doran (1865); see also Dutton Cook's *Book of the Play* (1876).

THEATERS, Laws as to. In Great Britain all theaters must be licensed, either by virtue of letters patent from Her Majesty, or by license from the Lord Chamberlain for the time being, or from justices of the peace. The Lord Chamberlain grants licenses to all theaters (not being patent theaters) within the English metropolis, and within the places where Her Majesty occasionally resides, except New Windsor and Brighton. For every license of the Lord Chamberlain, a fee not exceeding 10*s.* per month is charged. In other parts of Great Britain, the justices of the peace of the county, city, or borough must be applied to for a license; and after the usual notice, they hold a special session, for the purpose of granting licenses to theaters, the fee payable being a sum not exceeding 5*s.* per month. It is only to the actual and responsible manager of the theater that a license can be granted, and his name and place of abode must be printed on every play-bill. The manager must find sureties to observe the rules issued by the Lord Chamberlain and justices, which rules relate to the days and hours of keeping open, and the insuring of order and decency. A penalty of £10 is imposed, by statute 6 and 7 Vict. c. 68, on any actor or manager concerned in unlicensed places.

A copy of every new play, epilogue, or prologue, or alteration of the same, intended to be produced at any theater in Great Britain, must be sent to the Lord Chamberlain, by the manager, seven days before such production; and for examination of such plays and alterations of plays, he may charge fees not exceeding ten guineas, according to a scale fixed by him. He may forbid the acting of any play, whenever he considers it to be fitting to the preservation of good manners, decorum, or the public peace, to do so. To act a play not allowed or disallowed, subjects each actor and manager to a penalty of £50. It has been decided by the courts, that a booth used as a temporary or portable theater requires a license, and that any dialogue or dramatic performance by two persons is a stage-play, and therefore subject to the license. Of late, the policy of placing the theaters so entirely under the control of the Lord Chamberlain and justices has been disputed, especially as the increasing practice of introducing theatrical performances at public supper-rooms has led to some vexatious prosecutions at the instance of the licensees of regular theaters.

THE'ATINES, one of the more modern religious brotherhoods of the Roman Catholic Church, which played a very important part in the well-known internal movement for reformation which took place in central and southern Italy towards the middle of the 16th c., and which Ranke has described in his *History of the Popes*. The founders of this association were a party of friends: Cajetan di Thiene; John Peter Caraffa, at that time Bishop of *Theate* (from which the Congregation took the name *Theatine*); Paul Consiglieri; and Bonifazio di Colle. Cajetan and Caraffa, in concert with the two other friends named above, having resigned all their preferments, obtained a brief of Clement, dated June 25, 1524, formally constituting the new brotherhood, with the three usual vows, and with the privilege of electing their superior, who was to hold office for three years. One peculiarity of their vow of poverty deserves special notice: they were forbidden to possess property, and were to subsist entirely upon the alms of the faithful; and yet they were strictly forbidden to beg, or in any way to solicit charitable contributions. Their first convent was opened in Rome, and F. Caraffa was chosen as the first superior. He was succeeded in 1527 by Cajetan, and the Congregation began to extend to the provinces. After a time, however, it was thought advisable to unite it with the somewhat analogous order of the Somaschans; but this union was not of long continuance; Caraffa, who was elected pope, under the name of Paul IV., having restored the original constitution in 1555. By degrees, the T. extended themselves, first over Italy, and afterwards into Spain, Poland, and Germany, especially Bavaria. They did not find an entrance into France till the following century, when a House was founded in Paris under Cardinal Mazarin in 1644. To their activity, devotedness, and zeal, Ranke ascribes much of the success of that remarkable reaction against Protestantism which took place in the latter half of the 16th century. In later times, however, they do not appear to have played any notable part. Their most remarkable member in modern times has been the celebrated Sicilian, Father Ventura, author of the well-known work *Bellezze della Fede*, and familiar to Englishmen by the part which he took in the Italian revolution of 1849. At present, the Theatine order is confined to Italy and Sicily.

THE'BAINE. See Opium.

THEBES, the name of a celebrated Egyptian city, called by the Egyptians Taape, or Taouab; by the Hebrews, No-Amen; by the Greeks, Thebæ; and at a later period, Diospolis Magna. It lies in the broadest section of the valley of the Nile, in about lat. 26° N., and was formerly the capital of Southern or Upper Egypt. Its ruins, the most extensive in that country, comprise nine townships, the most remarkable of which are Medinat Habu, Gournah, Karnak, and Luxor. Its local and eponymous god was Amen-Ra, or Jupiter Ammon; and its foundation traditionally dated from the time of Menes, the founder of the monarchy, although no remains of so early a date have been discovered on the site. Recently, however, excavations have brought to light constructions of the 11th dynasty, who appear to have founded the original temple of the god. The Nile flows through the midst of the ancient city, and divides it into four principal quarters: Karnak and Luxor, which lie on the east bank, and Gournah and Medinat Habu, on the west bank of the river. The most flourishing period of the city was under the 18th, 19th, and 20th dynasties, or from about 1500 to 1000 B.C., when it had supplanted Memphis, the ancient capital of the Pharaohs. The more central situation of this city probably caused it to rise into importance, for it was secure against the northern enemies of Egypt; hence, under these Diospolitan dynasties, the worship of Amen-Ra arose in all its splendor; magnificent palaces and temples were built in its different quarters, to which additions were made by later monarchs, and even by the Ptolemies and Romans till the time of the Antonines, in the 2d c. A.D. Here, too, were the cemeteries of the Theban monarchs and the officers of their courts, colleges of priests, and the seat of royal government. It was enriched by the spoils of Asia and the tributes of Ethiopia, and its fame and reputation had reached the early Greeks, Homer describing it by the epithet of Hekatompylos, or City of a Hundred Gates, in allusion to its propylæa, for T. was never a fortified city. In the plentitude of its power, it sent forth an army of 20,000 war-chariots; but the Bubastite and Tanite dynasties removed the capital again to Sais and Memphis, and T. declined in importance, although retaining much of its ancient grandeur.

At the Persian conquest, Cambyses obtained a spoil of nearly £2,000,000 from the city, destroyed many of its noblest monuments, and injured its political pre-eminence. The foundation of Alexandria still further injured the city; and at the time of Strabo, T. was only a cluster of small villages; its extent being about 9½ miles in length (according to Diodorus), and its circuit about 16 miles. Its temples, tombs, and ruins were visited by Roman travelers, including Hadrian. At a later period, a considerable Christian population existed under the empire; but the inhabitants fled at the Arab invasion to Esneh; and T. is now inhabited only by a few Arab families of Fellaheen, who obtain a precarious livelihood by guiding travelers over the ruins, or rifling the tombs for antiquities. At Gournah, is to be seen the Memnoneion, built by Ramesses II.; with a colossus of that monarch, weighing 887½ tons, the largest statue in Egypt, broken. This is supposed to be the palace of Osymandyas, described by Hecataeus, and is of considerable extent. In this quarter are two palace-temples of Amenophis III., and the vocal Memnon, or celebrated colossus of that monarch, supposed by the ancients to emit a sound at sunrise. At Medinat Habu is a pile of buildings, commenced by Thothmes I., of the 18th dynasty, with courts and propylæa, built by Ramesses III. or Rhampsinitus, and sculptures representing his victories over the Philistines, the life in his harem, the riches of his treasury, and a calendar with inscriptions dated in the twelfth year of his reign. Here, 8000 feet to the north-west, are the cemeteries of sacred apes; and 3000 feet beyond, the valley of the Tombs of the Queens, consisting of 17 *syringes*, or sepulchres, supposed to be the tombs of the Pallacides of Amen, mentioned by Diodorus and Strabo. Near them are the Biban-el-Meluk, or tombs of the monarchs of the 19th and 20th dynasties, 16 in number, the most interesting of which are that of Sethos I., called Belzoni's, after its discoverer, and those of Ramesses III. and Siptah.

At Gournah itself are the tombs of functionaries and others, and this latter site has enriched the museums of Europe with antiquities of various kinds. The palaces of the Luxor quarter were founded by Amenophis III. From hence was removed the

obelisk of the Place de la Concorde in Paris. Still more magnificent than any of these is the temple of Karnak, the sanctuary of which, built by Osertesen I. of the 12th dynasty, was added to by the monarchs of the 18th dynasty. The most remarkable part of this wonderful mass of courts, propylæa, and obelisks, is the great hall, 170 feet by 329 feet, built by Sethos I. and Ramesses II., having a central avenue of 12 massive columns, 60 feet high, 12 feet in diameter; 122 other lofty columns, and 2 obelisks, 92 feet high. Here is the so-called Portico of the Bubastites, built by Shishak I., recording his expedition against Jerusalem, 971 B.C. An important discovery was made in 1881 in a rock-cut gallery in cliffs 4 miles east of T., including 39 mummies of royal and priestly persons, five perfect papyri, and thousands of mortuary statues and other objects. They may have been hidden here by the priests in the invasion by Cambyses. The mummies belong to personages from the 17th to the 21st dynasties, and amongst them are those of Thothmes III., who erected the obelisk now on the Thames Embankment, and Ramesses II. (q. v.).

THEBES, the principal city of Bœotia, in ancient Greece, was situated in the southern part of the country, on the slopes of Mount Teumessus, and between two streams, the Dirce and the Ismenus. According to the prevalent tradition, T. was founded by a colony of Phœnicians under Cadmus (q. v.), after whom the city was called Cadmeia—a name subsequently restricted to the citadel; but passing over the long series of picturesque and tragic myths that have given it its pre-historic fame (in which the central figure is (Œdipus), we first catch a quasi-authentic glimpse of Theban history in the 8th c. B.C., when one Philolaus, a Corinthian, settled in the place, and drew up a code of laws for the inhabitants.

It is not till near the end of the 6th c. B.C., however, that we reach a purely historical period—the earliest well-attested event being the dispute between T. and another Bœotian city, Platææ, which involved the former city in an unsuccessful war with Athens. Henceforth, the relations of T. and Athens were, except for brief intervals, marked by bitter enmity. During the Persian war, T. shamefully sided with the Asiatic invader, and, in consequence, lost much of her power and prestige. Athens proposed to deprive her of her supremacy over the Bœotian confederacy; but Sparta, always jealous, even to spitefulness, of her Attic rival, interfered, and positively forced the other Bœotian cities to acknowledge anew their unworthy mistress. When the Peloponnesian war broke out, T. took part with Sparta, and at its close, was eager for the destruction of Athens; but soon after, it became jealous of the overgrown power of its ally, and gave a friendly welcome and shelter to those Athenians whom the oppression of the Thirty Tyrants (q. v.) compelled to abandon their city. It was from T. that Thrasybulus and his copatriots started on their famous expedition for the deliverence of Athens, accompanied by a body of Theban citizens. A keen and bitter antagonism now sprung up between T. and Sparta, which after many vicissitudes, ended in a great military struggle (379—362 B.C.), in which the former city, under the heroic guidance of Epaminondas (q. v.), achieved a brilliant triumph, and for a time held the position of the foremost power in Greece. It was now the time for Athens to revive her ancient animosities; and for a while they had free play. At length, the eloquence of Demosthenes induced both states to unite in opposition to the encroachments of Philip of Macedon; but it was too late; and in 338 B.C., the battle of Chæroneia crushed the liberties of Greece. After Philip's death, the Thebans made a fierce but unsuccessful effort to regain their freedom. Their city was taken by Alexander, who leveled it to the ground, and sold the entire population—men, women, and children—into slavery. For 20 years it remained an utter desolation; but in 315 B.C., it was rebuilt by Cassander, who gathered into it all the Thebans he could find in Greece. It was again destroyed by the Romans, and did not recover till about the decline of the empire. During the 11th and 12 centuries, it was the seat of a considerable population, engaged in the manufacture of silk; but under the Turks it again declined, though it has still a modern representative, Thebes, or Thiva, with a pop. of 4000. Scarcely a single relic of antiquity has survived the ravages of time.

THE'CLA, a virgin saint of the early church, whose existence may be considered historical, although all, or almost all, the details regarding her are legendary. According to the legend, T. was a member of a noble family of Iconium in Lycaonia, where she was converted by the preaching of St. Paul, and having devoted herself to a life of virginity, suffered a series of persecutions from her intended bridegroom, as well as from her parents. She is styled in the Greek martyrologies the *proto-martyress*, as Stephen is the proto-martyr; while in the Roman Breviary, she is said to have died at the age of 90 in Seleucia. The apocryphal *Acts of Paul and Thecla* were edited by Tischendorf.

THEFT. See LARCENY.

THE'INE. See CAFFEINE and TEA.

THEISM is a system of belief that acknowledges the existence of God; and the term, as ordinarily used, implies recognition of the personality of God, the one God being worshiped as Creator, Preserver, and Governor. Theism is therefore not merely opposed to Atheism, but to Polytheism and Pantheism; as also to Materialism, Secularism, Positivism, and Agnosticism. (See the articles, RELIGION, GOD, PANTHEISM, MATERIALISM, SECULARISM, AGNOSTICISM; also POSITIVISM.) Further, though from its etymology it might be assumed to signify the same as Deism (Theism being from the Greek *Theos*, God; and Deism from the Latin *Deus*), Deism is ordinarily understood to signify a system which, while admitting the belief in God, denies the Trinity and Supernatural Revelation; while in Theistic systems, the emphasis is thrown on what is affirmed, not on what is denied. Christianity is accordingly ranked as a Theistic system; the other great Theistic churches being Judaism and Mohammedanism. Many of the separatists from orthodox Christianity are theists; as the Unitarians (q. v.), and the Brahmo Somaj (q. v.) of India. Some of these latter of course deny most that the Deists denied, though they lay more stress on the positive aspects of their religion than on their differences from orthodox belief. The philosophy of the younger Fichte (q. v.), and of some other modern German philosophers, is distinctively known as *Theistic* or as *Ethical Theism*.

THEISS, an important affluent of the Danube, and the chief river of Hungary, rises by two streams, the Black T. and the White T., in the Carpathian Mountains. It flows north-west, south-west, and finally southward, joining the Danube, after running parallel to it for 300 miles. The T. has several large and navigable affluents, as the Maros and Bodrog. The lower part of its course is sluggish, and it has often inundated the plains, flooding the cities on its banks, such as Szegedin (overwhelmed in 1879). The T. is extraordinarily rich in fish, and has been described as 'two-thirds water and one-third fish.' Its entire length, including windings, is 828 miles.

THELLUSSON ACT is an act of parliament, 39 and 40 Geo. III. c. 98, passed for the purpose of checking the disposition of testators to accumulate the income of their estates until it should form a large fortune. The late Mr. Thellusson had, by his will, directed his personal property to be invested in land, and the rents and profits of the land to be so purchased, and of his other real estate, to be accumulated during the lives of all his descendants who should be living at the time of his death, or born in a certain time thereafter; and then he limited the accumulated property in favor of certain of his descendants who might be then living at that distant time. The property was said to have consisted of landed estates worth £4000 a year, besides personalty of about half a million; and it was estimated that the accumulated fund would amount to above 19 millions. The testators's object was to create enormous wealth, for the purpose of founding three families to spring from his three sons. For three-quarters of a century, the questions arising out of this will have been discussed in various forms; but the legislature, soon after the testator's death, took the earliest opportunity of preventing in future testators accumulating the income in this way for more than 21 years, and the above act was passed for that purpose. Ultimately, the fund was distributed among a greater number of claimants. The litigation ended by a decree of the House of Lords in 1858.

THE'MIS, in Greek Mythology, was the daughter of Uranus and Gē, the wife of Zeus, and, by him, mother of the Horæ (Hours) and Mœræ (Fates), as also of Eunomia (Equity), Dikē (Justice), and Eirēnē (Peace). She was regarded as the personification of order and justice, or of whatever is established by 'use and wont;' and as such was charged by Zeus to convoke the gods, and preside over them when assembled, being likewise represented as reigning in the assemblies of men. In modern art, T. is represented as having her eyes bandaged, and at the same time holding a pair of evenly-balanced scales in one hand, with a sword in the other.

THEMI'STOCLES, the great Athenian general and statesman, was the son of an obscure citizen of Athens, and was born about 514 B.C. He was actuated by excessive ambition from a very early period, and began his public career by setting himself in opposition to the principal men of the state, and chiefly Aristides, 'the Just.' It is uncertain whether he was at Marathon, but there is no doubt that the laurels gained there by Miltiades fired T.'s ambition. From the time (483) that he got his inconveniently upright rival, Aristides (q. v.), ostracised, he was regarded as the political leader in Athens, being made Archon Eponymus in 481. In order to recover for Athens the naval supremacy in Greece, and that she might be prepared to meet the expected Persian invasion, he persuaded the Athenians to devote the proceeds arising from the silver mines at Laurium to the construction of a fleet, sagaciously foreseeing that his country's only chance of overcoming her enemy was by sea. In the battles of Artemisium and Salamis (480), disastrous for the Persians, T.,

commander of the Athenian fleet, the largest in Greece, to avoid dissensions, was content to serve under Eurybiades the Spartan. On both these occasions, it was only by the greatest tact, combined with threats and a judicious outlay of the bribes which he himself had received in profusion, that T. could induce the other commanders to come to an engagement with the Persians.

On the night previous to Salamis, he sent a faithful slave to tell Xerxes that unless he came up next day, the Greek fleet would be scattered, and he would miss the chance of an engagement; thus securing either victory to the Greeks, or the favor of Xerxes to himself in case of defeat. See SALAMIS. In several other ways did the wily T. contrive to provide for himself a safe retreat at the Persian court in case of disaster. The victory at Salamis raised his reputation to the highest point. Not neglecting his own personal aggrandizement, he sailed round among the Grecian islands, and on various pretexts, extorted enormous sums from the inhabitants. Shortly after the Persian invasion, his fellow-citizens began to see through him, and he was accused of bribery and extortion. In 471, he was ostracised, and retired to Argos; and finally, to escape being tried for treason, in which he was implicated by the correspondence of Pausanias, he betook himself, in 465, to the court of Artaxerxes, king of Persia; but before he would see the king himself, got permission to wait a year, during which he made himself master of the language and usages of Persia. At the end of this time, he managed to raise himself so highly in the king's favor, that, after the Persian fashion, the town of Magnesia was appointed to supply him with bread, Lampsacus with wine, and Myus with other provisions. He lived securely at Magnesia until his death in 449. Some authorities assert that he poisoned himself. A monument was erected to T. in the market-place of Magnesia, and it is said that his bones were secretly taken to Attica, and burned there. Undoubtedly T. was a man of very great sagacity and determination, had a quick and keen perception of difficulties both present and future, which his ready invention, backed by promptness of action, enabled him to meet and overcome. On the other hand, he appears to have been possessed of no moral principles, his greatest ambition apparently having been to make himself, by fair means or foul, the greatest man in Greece.

THE'NARD'S BLUE. See BLUE.

THEOBALD, LEWIS, was the son of an attorney at Sittingbourne in Kent, at which place he was born towards the close of the 17th century. His father's business, for which he was educated, proved not much to his mind; and betaking himself to literature, he published, in 1714, a tragedy entitled *Electra*, which he followed up by a number of other dramas. As a poet, he had scant success, and is long since utterly forgotten; but as the favorite butt of Pope, he is immortalized in the *Dunciad* of that writer. Besides this unenviable distinction, 'piddling Theobald,' as Pope contemptuously termed him, is not without some fair claim to be honorably remembered as one of the most laborious and useful of the early editors and commentators on Shakspeare. In this capacity, dull as he undoubtedly was, he did good service to the poet, which has since been sufficiently recognized. The hatred of Pope he incurred by a pamphlet published in 1726, entitled *Shakspeare Restored, or Specimens of Blunders committed or unamended in Pope's Edition of this Poet;* and if he could not compete with his adversary in wit, he proved himself a much more competent editor of Shakspeare, by his edition in 7 volumes 8vo, published in 1733, which quite extinguished that of his rival. His knowledge of our earlier drama was extensive and minute; and to his judicious application of it, in elucidating the text of the great poet, we remain to this hour not a little indebted. He died in September 1744.

THEOBRO'MINE ($C_{14}H_8N_4O_4$) is a crystallizable principle present in chocolate. It is extracted from the cacoa-nuts (the seeds of *Theobroma cacao*) in the same manner as caffeine or theine is extracted from the coffee, tea, &c., in which that substance occurs. It is less soluble in water than caffeine, but resembles that substance in forming crystallizable salts with some of the acids. By dissolving theobromine in a solution of ammonia, and adding nitrate of silver, a gelatinous precipitate is obtained, which, by boiling with a solution of ammonia, yields a crystalline mass of theobromide of silver ($C_{14}H_7AgN_4O_4$) in which 1 equivalent of hydrogen is replaced by 1 of silver. This compound, when treated with iodide of methyl, yields iodide of silver and caffeine, which latter may be extracted with alcohol. Hence we arrive at the remarkable conclusion, that caffeine ($C_{16}H_{10}N_4O_4$) must be regarded as methyl-theobromine, $C_{14}H_7(C_2H_3)N_4O_4$.

THEO'CRACY, literally, 'government by God,' is the name given to that constitution of a state in which the Almighty is regarded as the sole sovereign, and the laws of the realm as divine commands rather than human ordinances. Under such a view, the priesthood necessarily become the promulgators and interpreters of the 'divine commands,' and act as the officers of the invisible Ruler. The most famous example of a theocracy is that established by Moses among the Hebrews.

THEO'CRITUS, the creator and most celebrated composer of bucolic poetry, was the son of Praxagoras and Philinna, and born at Syracuse. The date of his birth is unknown, but the period of his greatest literary activity was probably 272 B.C. About the close of the reign of Ptolemy Soter, he visited Alexandria, where he received instruction, and made his first successful essays in poetry. He came to be patronized by Ptolemy Philadelphus, who assisted his father, Ptolemy Soter, in the government of Egypt, and in honor of his patron, he composed, about 285 B.C., his 14th, 15th, and 17th idyls. He further formed the acquaintance of the poet Aratus, to whom he addressed his 6th idyl. He subsequently revisited Syracuse, where he continued to reside under Hiero II. From his 16th idyl it may be concluded that he was dissatisfied with the political state of Sicily, and also with the insufficient rewards which his poems received from Hiero; and that, in consequence, he fixed his attention, during his declining years, rather on the life of the country than of the court, and on those scenes of rural nature which form the chief subject of his poetical remains. The idyls of T. are principally representations, dramatic and mimetic in their character, of the every day life of the Sicilian peasantry. They have been successfully imitated by Virgil and have given origin at least to that so-called pastoral literature of medieval and modern times, which is, however, totally deficient in the simplicity, fidelity, and therefore poetry of the Syracusan author.

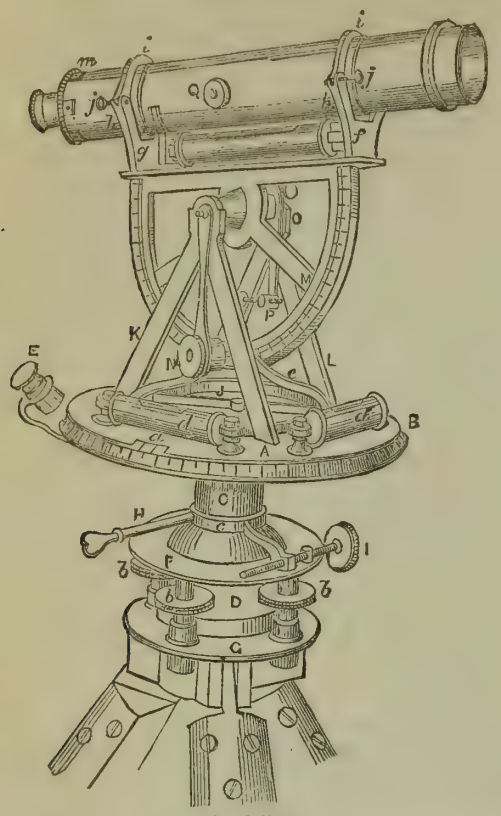
T. knows nothing of the imaginary shepherds of a fictitious Arcadia; his dramatic simplicity and truth are in wide contrast to the affected sentiment, the unnatural innocence, and the artifical simplicity of that unreal world. Comedy and pathos enter freely into his representations of rural Sicilian life, and his idyls retain the charms of freshness and nature even to the present day. They are 30 in number, though all of them are not strictly bucolic, or even genuine. They are written in a mixed dialect, in which the softened Doric prevails; and together with a few lines from a lost poem called *Berenice*, and 22 epigrams in the Greek Anthology, make up his remains, of which the best editions are those of Meineke and Paley; and the best translation in English, that of Dr. M. J. Chapman.

THEO'DICY (Gr. *Theos*, God, and *diké*, justice; Lat. *Theodicæa*, the judgment of God), a name given to the exposition of the theory of Divine Providence, with a view especially to the vindication of the attributes and particularly of the sanctity and justice of God in establishing the present order of things, in which evil, moral as well as physical, so largely appears to prevail. The name is of modern origin, dating from the close of the 17th c., or the beginning of the 18th c.; but the theory itself, as well as the mysterious problem which it is meant to resolve, is as old as philosophy itself. See EVIL. The first to consider the question in its integrity was the celebrated Leibnitz (q. v.). His work entitled *Essais de Theodicée sur la Bonté de Dieu la Liberté de l'Homme et l'Origine du Mal*, was published in 1710. It rose at once to the very highest point of popularity, and was translated into almost every European language. The leading principle of Leibnitz's vindication of God's goodness is the well-known optimistic theory which has been explained elsewhere (see OPTIMISM); but he has been followed by several writers in different countries—as Balguy, Werdermann, Kindervater, Crentzer, Benedict Kapp, and many others.

Of these writers, it may be said in general, that they have followed the same method, and have addressed themselves to the same view—viz., the reconciliation with the goodness, the sanctity, and the justice of the one God, the existence of those manifold evils, physical or material, as well as moral, which appear in the present order of things. This view, it will be seen, is strictly limited to one single problem. But in the discussions of the new philosophic systems, and especially that of Hegel, which have arisen in Germany, new difficulties regarding the Christian idea of God have arisen out of the rationalistic notions of existence in general. To meet those difficulties, a new theodicy has become necessary, and it has begun to occupy the attention of philosophers, especially in France. Two works in particular addressed to this view of the subject may be noticed: the first is M. Maret's *Christian Theodicée, or Comparison of the Christian and the Rationalistic idea of God*, 1845; the second is that of the Jesuit philosopher Père Gratry, who has devoted the first volume of his course of philosophy, *De la Connaissance de Dieu*, to this special subject. This work was published at Paris, 1853.

THEO'DOLITE (Gr. *theao*, I see, *dolichos*, long), an instrument much employed in land-surveying for the measurement of angles horizontal and vertical, is neither more or less than an altitude and azimuth instrument, proportioned and constructed so as to be conveniently portable. Like all instruments in very general use, the variations in its construction are almost numberless; but its main characteristics continue unaltered in all forms. It consists essentially of two concentric circular plates of copper, brass, or

other material (the upper plate, or *upper horizontal*, either being smaller, and let into the lower, or *lower horizontal*, or the rim of the lower raised round the outside of the upper), moving round a common axis, which, being double, admits of one plate moving independently of the other. Upon the upper horizontal rise two supports, bearing a cross bar, which is the axis of a *vertical circle* moving in a plane at right angles to the former. This latter circle



Theodolite:

A, B, the horizontal limbs; *a*, the vernier plate, which turns; C, the vertical axis; D, the ball or socket movement; *d*, *d*, spirit levels; E, a magnifier to read off the degrees; F, G, Plates held together by the ball D; *f*, a screw to adjust the level or line of collimation; *b*, *b*, *b*, milled screws to adjust the instrument, and set in level; *g*, a screw to adjust the telescope laterally; H, a clamping screw, by which means the collar *c* may be tightened to the axis C, and kept from moving; J, the magnet box; I, a slow-motion screw, by which the instrument is moved more exactly than could be done by the hand; *i*, *i*, clips, to reverse the telescope by screws. *j*, *j*; K, L, frames into which the pivots are placed, on which the vertical arc M is turned round, and on which the telescope is fixed; N, a microscope for reading off the degrees; O, a clamp screw; P, a slow-motion screw, by which the vertical arc and telescope are moved; Q, a milled screw for moving the object-glass of the telescope.—From Cresy's *Encyclopædia of Civil Engineering*.

either has a telescope fixed concentric with itself, or a semicircle is substituted for the circle, and the telescope is laid above, and parallel to its diameter. The circles, as their names denote, are employed in the measurement of horizontal and vertical angles. For these purposes, the outer of the horizontal circles is graduated, and the inner carries the index-point and the Verniers (q. v.); the vertical circle is also graduated, and the graduations are generally read off by an index-point and vernier firmly attached to the supports. The upper horizontal is furnished with two levels placed at right angles to each other for purposes of adjustment, and has a compass-box let into it at its center. The stand consists of a circular plate supported on three legs, and connected with the lower horizontal by means of a ball-and-socket joint; the horizontal adjustment of the instrument being effected by means of three or four (the latter number is the better) upright screws placed at equal distances between the plates.

The telescope is so fixed as to be reversible, and the adjustments are in great part similar to those of other telescopic instruments, but are too numerous and minute to be here detailed. Both horizontal plates being made, by means of the screws and levels, truly level, the telescope is pointed at one object, and the horizontal angles read off; it is then turned to another object and the readings-off from the graduated circle again performed; and by the difference of the readings, the angular horizontal deviation is given; and when vertical angles are required, the readings are taken from the vertical circle in a similar manner.

THEODORE, of Mopsuestia, a well-known writer of the Syrian Church, and especially notable in connection with the controversy of 'The Three Chapters,' was born of a wealthy and distinguished family at Antioch, in the first half of the 4th century. He was the school-fellow and friend of St. John Chrysostom, and his fellow-pupil under the philosopher and rhetorician Libanius; and he was induced, by the earnest exhortation of Chrysostom, to join with him in embracing the monastic life. His theological and scriptural studies were made under Flavian of Antioch and Diodorus of Tarsus; and having received priest's orders, he resided for a time at Antioch, where his learning and eloquence won the highest applause; and afterwards at Tarsus, under his old teacher Diodorus. About the year 390, or a little later, he was chosen Bishop of Mopsuestia in Cilicia. In 394, he preached in the presence of the Emperor Theodosius at Constantinople, on occasion of a synod held in that city. Of his further history, little is known; but his literary activity must have been prodigious, if we can judge by the contemporary accounts, and by the number of the works which are ascribed to him, but of which only fragments now remain. The most important of these consisted of commentaries on almost all the books of Scripture, and various polemical writings. A supposed tendency to Pelagian and Nestorian errors was observable in T., and was in part the occasion of the long controversy of the Three Chapters. This controversy, however, did not arise till long after the death of T., which took place about 427. Considerable fragments of T.'s commentaries have been published by Cardinal Mai in his *Spicilegium Romanum*, and some of his works still exist in Syriac; but by far the greater proportion has been lost.

THEODORE, king of Abyssinia, otherwise described as Negus or King of Kings of Abyssinia, was the nephew of a chief in Amhara, the central province—the others being (see ABYSSINIA) Tigré, in the north, and Shoa. His mother, left a widow in poverty, maintained herself by selling in Gondar a drug *kosso*, used as a specific against tapeworm. Her son, originally called Kassai, was born in 1820. He became distinguished as a soldier fighting against the Turks, and took advantage of a quarrel amongst his uncle's sons to wrest the chieftainship from them. He defeated Ras Ali, the powerful ruler of Amhara; obtained possession of the person of the titular emperor Johannes; and annexed Tigré. Securing the favor of the Coptic Church by banishing Roman Catholic missionaries, he was crowned as Theodore of Abyssinia in 1855. Through his mother, he professed to derive descent from King Solomon—a circumstance much in his favor. Nothing was left to conquer but Shoa, which was presently accomplished, and T. was really actual monarch of the country, though he still showed outward reverence to the titular king of the old family. He resolved to extend his dominions to the Red Sea, and to enter on a crusade with the Turks for the recovery of the seaboard, once Abyssinian. He had treated the conquered districts with great leniency, generally leaving one of the ruling family in power. He showed much favor to Messrs. Bell and Plowden, Englishmen who had established themselves in Amhara in the days of Ras Ali; and Mr. Plowden was still recognized as consul. T. heartily adopted many of their schemes, and was anxious to open up intercourse with England. But he was difficult to negotiate with; holding that he had the same claim to respect as a European monarch. He was kept in torture by imaginary slights, and especially by the respect shown to the Turks, whom he regarded as barbarians. But he permitted the founding of three Protestant missions, one under Mr. Krapf (under the auspices of Bishop Gobat of Jerusalem), one under Messrs. Stern and Rosenthal, and a Scottish mission. He soon quarreled with English diplomacy, being irritated by our refusal to receive an embassy without his assurance that he would renounce all idea of reconquering any territory from Egypt. Mr. Plowden was killed by a rebel chief, and a new consul, Mr. Cameron, was appointed without consulting T. In 1862, the Egyptians were advancing within T.'s frontiers.

T. resolved to appeal to the English and French governments, and wrote letters claiming their protection. That to the Queen was forwarded to Aden, but unfortunately did not reach London until February 1863, when it was thrust into a pigeon-hole, and ignored or forgotten. In the meanwhile, Consul Cameron was directed to visit Sennaar, on the frontier of Egypt and Abyssinia, to judge of its fitness to become a cotton-producing country. The object of this journey was not explained to T., and he naturally believed it to be a visit by a spy to his enemies the Turks. His suspicions were not allayed when the consul, on his return to Gondar, could produce no answer to the letter. He had received a dispatch, but it simply ordered him to go back to Massowah, and not to interfere with Abyssinian politics. 'So your queen,' said T., 'can give you orders to return to Massowah, but she cannot send a civil answer to my letter to her. You shall not leave till that answer comes;' and the consul was detained on parole at Gondar. In reply to the French letter, M. Lejean was sent to Abyssinia. A written answer to T. was read, in which, as if it

had been intended to irritate him, something was said of the protection accorded by the Emperor of the French to all Roman Catholics in the East. This aggravated the offence already committed by the French—that of aiding the prince of Tigré. The letter was torn and trampled upon, and M. Lejean, imprisoned for a few days, was ordered off to Massowah. T. declared he would no longer be 'humbugged by missionaries and consuls like a rajah of Hindastan,' and the European residents all felt that a crisis had come.

In October 1863, Consul Cameron sent letters to Massowah. His messengers were stopped, deprived of their dispatches, and beaten. On the same day, Mr. Stern, who happened to pay a visit of ceremony to the emperor, inadvertently gave him offence; and he and his two servants were ordered to be beaten. The servants died the same night. Mr. Stern himself was so seriously hurt that his life was despaired of. His papers were then examined, and found to contain remarks derogatory to the emperor. He and Mr. Rosenthal were arrested, and on the 20th of November, they were publicly tried with all the formalities of Abyssinian law—on a charge of having committed the *crimen læsæ majestatis*. Mr. Stern was accused of having circulated the report in Europe of T. being the son of a beggar-woman who sold kosso, and of his not being the descendant of Solomon and the queen of Sheba; while Mr. Rosenthal was accused of having said that the country would fare better under the Turks than Theodore. The prisoners were condemned to death, but the sentence was not carried out. Two days after the trial, dispatches arrived for Captain Cameron, but there was no reply to T.'s letter. Under these circumstances, the consul was injudicious enough to apply for permission to leave. He was arrested and thrown into the prison at Gondar with the missionaries, where they remained till the following summer, when they were removed to Magdala. The English government did not seem to interest themselves about the consul; but the case of the missionaries was warmly taken up by Lord Shaftesbury and the religious public. A letter of Captain Cameron's was published, in which he said: 'No release until an answer is sent to the letter to the Queen.' The subject was brought before parliament, and the government were compelled to search for this document. It was found in the pigeon-hole where it had been put, endorsed by Lord John Russell. It had been written in 1862; it was answered in June 1864. The reply was intrusted to Mr. Hormuzd Rassam, a native of Mosul, who had been employed in diplomatic service at Aden.

The choice of his envoy was most unfortunate—he being, in the eyes of Theodore, a mere Turk, and therefore a spy and an enemy. He was not received till January 1866, and then a second error was committed. Mr. Rassam accepted a large present from T., and did not, or was not enabled to repay it, as was expected, by a gift equal in value, although the necessity of doing so had been fully explained to the government. T. then sent the English envoy, who was treated as a mere beggar, to prison with the other captives. This was his first distinct breach of the law of nations. After this period, he conducted himself like a madman: he caused women and children to be tortured, dishonored, and starved in an unheard-of manner. 'Out of 3,000,000 inhabitants,' says Dr. Blanc in June 1867, 'he has destroyed more than a third by war, famine, and murder.' After some unsuccessful attempts to negotiate with T., through Mr. Flad, in the early part of 1867, Lord Stanley, in April, ordered him within three months to deliver up the prisoners. He took no notice of the communication, and accordingly an expedition was fitted out at Bombay for the invasion of the table-land. The force consisted of upwards of 10,000 soldiers. Early in November the advanced brigade landed at Zulla, on the Red Sea. From this point, the expedition advanced successfully in spite of many difficulties, and, in the beginning of April 1868, came within sight of Magdala. On the 10th of April, near Magdala, T. gave battle to the British forces, and sustained a defeat so decided that he forthwith made submission to the extent of surrendering all the European captives in his power; and on the 13th, Magdala, into which he had retired, was stormed, and with little difficulty was taken possession of by our forces. Neither in the battle nor the assault was there any loss of life on the British side, only a few being wounded; the Abyssinians sustained a loss of 500 killed and 1500 wounded, the most notable among the former being T. himself, who was found dead, shot in the head.—See *The British Captives in Abyssinia*, and other works, by C. T. Beke, Ph.D.; the government blue-books; an article in No. 65 of the *Westminster Review*, New Series; the works of Harris, Rudolph, Lejean, and Dufton.

THEODORE'TUS (Gr. *Theodoretos*, God-bestowed), a celebrated church historian and theological writer, was born at Antioch, about the year 393, and received his name from the circumstance of his being supposed to have been granted as the fruit of earnest prayer, to his parents, who had long been childless. He was educated from early childhood in a monastery, where, among his fellow-pupils, were Nestorius and John of Antioch, both afterwards celebrated in the controversy which takes its name from the former. He was admitted among the clergy of Antioch; and at a comparatively early age became Bishop of Cyrus, a city of Syria. His zeal and eloquence were the theme of universal praise, and his success in bringing unbelievers and heretics to the church was almost unprecedented. In the controversies on the subject of Nestorius and his doctrines, which followed the condemnation pronounced by the council of Ephesus in 431, T. for a time took a warm and active interest. The party of Nestorius was with difficulty brought to an accommodation with Cyril of Alexandria, in virtue of which the condemnation of Nestorius by the council was acquiesced in by John, Bishop of Antioch. For a time, T. dissented from this condemnation of Nestorius; and he not only expressed these sentiments in a letter addressed to Nestorius himself, but also wrote formally against the celebrated anathemas of Cyril directed against Nestorianism. But he afterwards saw the necessity of yielding, and concurred in the deposition of those bishops who still persisted in their rejection of the council of Ephesus. Nevertheless, he by no means fully accepted the views of Cyril; and when, on Cyril's death, the opposition to Nestorianism began to develop, under the turbulent partisanship of his successor in the see of Alexandria, Dioscorus, into the contrary error of Eutychianism, T. endeavored to induce Dioscorus to abandon his extreme opinions.

Failing in the attempt, T. composed the work which has often figured in modern controversy, on account of the well-known passage as to the change of the Eucharistic elements which it contains, entitled 'Eranistes or the Many-shaped.' This work was regarded by Dioscorus as a renewal of the Nestorian error, and he accused T. to Domnus, the new Patriarch of Antioch, of that heresy. T. replied with great moderation; but Dioscorus persisted; and having engaged the imperial court on his side, succeeded in obtaining from the Emperor Theodosius II. an order confining T. within the limits of his own diocese. Meanwhile, the Eutychian controversy reached its height, and Eutyches (q. v.) having been first condemned by Flavian, Bishop of Constantinople, in a synod held in 448, was afterwards absolved in the celebrated Robber-council of Ephesus, under Dioscorus, in 449. The latter council not only excluded T. from its sittings, but formally deposed him from his see; whereupon he was compelled to retire to the monastery at Antioch in which he had received his first education. All this, however, was reversed by the general council of Chalcedon, in 451. T. did not very long survive his restoration. He died about the year 457. His works fill four volumes folio, reprinted in ten parts 8vo by Schulze (Halle, 1768—1774), and consist of commentaries on many books of the Old Testament and the whole of St. Paul's Epistles; a *History of the Church*, from 325 to 429 A.D., in five books; *Religious History*, being the lives of the so-called Fathers of the Desert, a series of most curious and interesting pictures of early ascetic life; the *Eranistes*, a dialogue against Eutychianism; *A Concise History of Heresies*, together with orations and a large number of letters. Of these works, his *History of the Church* is by far the best known, as well as the most important and interesting. See Schulze's edition of *Theodoreti Cyrensis Opera*.

THEO'DORIC, surnamed THE GREAT, the founder of the Ostrogothic monarchy, which comprised Italy, Sicily, South-eastern Gaul, Rhætia, Noricum, Pannonia, and Dalmatia, was born on the banks of the Neusiedler See, to the south of Vienna, in 455 A.D. His father, Theodemir, was one of the three brothers (the other two were Walamir and Widimir) who, on the death of Attila (453 A.D.), freed their nation from the yoke of the Huns, and being the representatives of the royal line of the Amali, exercised a united sovereignty over it; but the death of Walamir, and the departure to Italy and Gaul of Widimir with a part of the nation, left T.'s father sole ruler of the Ostrogoths who remained in Pannonia. Previous to these events, T. had been given as a hostage to the Eastern emperor, in accordance with whose directions he had been accustomed to all kinds of athletic and martial exercises, so that after his return (473) home, he was well qualified to fill the post of ruler of his ferocious and valiant kinsmen, which, by the death of his father, was left vacant in 475. In the previous year, the Ostrogoths had obtained parts of Mœsia and Dacia as settlements from the Emperor Zeno, and for years they gallantly defended the empire from foreign aggressors, other Gothic tribes included; but the impolitic faithlessness of Zeno produced in revenge the devastation of Thessaly and Macedonia, and subsequently (487) a raid directed on the capital itself. The emperor, to free himself from his troublesome ally, gave him permission to invade Italy, a suggestion gladly adopted by the warlike monarch, who started for Italy in 488; and after forcing his way through the Gepidæ and others who attempted to bar his progress, and gathering recruits on the way, arrived in the summer of 489 on the frontiers of Italy. Odoacer was both forewarned and forearmed; and a desperate conflict between the two powerful armies took place near Aquileia (28th August 489),

distinctly to the advantage of the Ostrogoths. A second and more disastrous defeat was inflicted on Odoacer near Verona (27th September), after which he took refuge in Ravenna; but having again gathered a large force, he was totally routed a third time on the banks of the Adda (August 490), again blockaded in Ravenna, while the whole of Italy was being subdued; and having at last surrendered, was treacherously murdered (March 493).

T. now assumed the title of *King of Italy*, resisted the claim of suzerainty preferred by the Eastern emperor; and with the exception of a victorious campaign against the Franks, to compel them to cease their assaults on the Visigothic dominions, the suppression of a rebellion in Spain against the authority of the infant monarch, his own grandson Amalric (during whose minority T. administered also the government of the Visigothic kingdom), and an expedition against the robber-hordes of the Bulgarians, the whole of his long reign was devoted to the consolidation and development of his new kingdom. His followers only received one-third of the conquered country; the rest was legally secured to the then possessors, and by degrees his barbarous followers were placed upon a footing of harmony with their fellow-subjects. T. made Ravenna his capital; occasionally, when his northern frontier was threatened, removing to Verona. He died in 526. T. holds the very highest rank among monarchs. An uneducated barbarian, and master of a power which even the most formidable of his neighbors, the Franks, could not have long withstood, he showed no desire of conquest; cultivated the friendship and esteem of the surrounding nations; ruled all classes of his subjects with irresistible authority, but with corresponding justice and moderation; zealously promoted agriculture and commerce till Italy again took its old position as the most prosperous country in Europe; and, himself an Arian, exhibited a tolerance of all other sects, which the latter, when their turn for supremacy came, were very far from imitating. The foul blot on his character is the judicial murder of Boëthius (q. v.) and Symmachus, for a supposed connivance with the senator Albinus to restore the authority of the Eastern emperor in Italy; but every fact that can be gathered respecting this event bears out the belief that it was the result of a burst of passion, intensified by his extreme, nay, almost morbid, jealousy of Byzantine interference in Italy.

The one great error of his administration consisted in his wholly neglecting to assimilate his Ostrogothic subjects with the previous inhabitants, either by a common code of laws, or by common official preferment; for though, under his sway, the evil of this separation did not appear, yet, when the sceptre fell to weaker hands, an antagonism necessarily arose between the ruling and the subject races, which was the chief cause of the successful restoration of Byzantine authority in Italy by Belisarius (q. v.) and Narses (q. v.). T. left no son; but his third daughter, Amalaswintha, succeeded him as regent for her son Athalaric; the eldest, Theodichusa, having become queen of the Visigoths, and the mother of Amalric; and the second, Ostrogotha, the wife of Sigismund, the last king of the Burgundians.

THEODO'SIUS, the name of three later Roman emperors.—THEODOSIUS I., surnamed THE GREAT, and THE ELDER, to distinguish him from his grandson, was of Spanish descent, and was born either at Italica (as Gibbon and those who wish to make him of kin with Trajan maintain), or more probably at Cauca, near Segovia, about 346 A.D. His father, also named Theodosius, was the great general of the Roman Empire, who, after freeing South Britain from the savage Caledonians, who roamed over it at their pleasure, and annihilating the formidable rebellion of the Moor Firmus, which threatened to divorce the African provinces from the empire, was conspired against by his many malicious enemies at court, and summarily beheaded at Carthage in 376. T., who had accompanied his father in his British campaigns, and afterwards, by routing the Sarmatians, saved Mœsia from devastation, retired from active service after his father's murder, and occupied himself with the care of his patrimonial lands in Spain. But his many virtues and talents were not forgotten at court; and on the defeat and death of Valens (q. v.), his colleague, Gratianus (q. v.), feeling his inability to sustain alone the cares of empire, summoned T. from his retirement, invested him with the imperial purple, and confided to him, 19th January 379, the administration of Thrace, Dacia, Macedonia, Egypt, and the East, and especially the protection of the empire against the Goths.

This last charge called for the full exercise of the new emperor's abilities, for the army at his command dared not face the Goths in the open field; and even when, after the death of their able leader, Fritigern, the Ostrogoths and Visigoths separated, each breaking up into several bands, T. found it most prudent to sow jealousy and dissension among them by promises and bribes, and after a four years' so-called campaign, succeeded in pacifying the Visigoths, the Ostrogoths retreating towards Scythia. The latter returned in 386, their ranks swelled by Scythians, but were totally routed in attempting to pass the Danube, and the survivors were transported to Phrygia and Lydia. In 387, T. undertook to restore to the throne of the Western Empire Valentinian II. (whose sister, Galla, he married), the brother of Gratian, who had been expelled by Maximus; and after a uniformly successful contest, the usurper was captured and put to death at Aquileia. In 392, the suspicious death of Valentinian, and the elevation of the puppet Eugenius by Arbogastes, the real ruler of the West, again summoned T. to interfere; and after two years of preparation, his motley army of Byzantines, Goths, Alans, and Huns, aided by the treachery of some of Eugenius's generals, gained a complete victory over the Gauls and Germans, who chiefly constituted the army of the West; and the two portions of the Roman Empire were again united under one ruler. The union, however, lasted only four months, owing to the death of T., 17th January 395. T., though a professor of the orthodox Christian faith, was not baptized till 380, and his behavior after that period stamps him as one of the most cruel and vindictive persecutors who ever wore the purple. His arbitrary establishment of the Nicene faith over the whole empire, the deprivation of civil rights of all apostates from Christianity and of the Eunomians, the sentence of death on the Manicheans and Quarto-decimans (q. v.), all prove this; though the want of evidence for the direct execution of these severe laws, somewhat modifies the unfavorable impression they produce, and inclines us to believe, that, like the massacre at Thessalonica, they were the result of a sudden access of savage passion, carefully fanned by his interested ecclesiastical advisers. His humiliation before St. Ambrose, Bishop of Milan, for the massacre at Thessalonica, was regarded by the church as one of its greatest victories over the temporal power. See AMBROSE.

THEODOSIUS II., surnamed THE YOUNGER, the only son and successor of Arcadius (q. v.), was born 401 A.D., succeeded his father when eight years old, and occupied the throne of the East for 42 years. The chief events of his reign were the invasion of the empire by the Huns under Attila, a war with Persia, renewed efforts to extirpate paganism, and the compilation of the *Codex Theodosianus* (see CODE). The emperor himself was the feeblest of rulers, and was much better adapted for the cowl than for the sceptre and sword.

THEO'GONY, the name given in ancient Greece to a class of poems recounting the genealogy of the gods. Musæus (q. v.) is said to have written the earliest Theogony; but his work, as well as the Theogonies of Orpheus (q. v.) and others, have perished; that of Hesiod (q. v.) being the only one that has come down to us.

THEO'LOGY (Gr. *theologia*, lit., a speaking or writing about God) is a term employed to denote the theory of the Divine nature and operation. It first occurs in Plato and Aristotle, who understand by it the doctrine of the Greek gods, and of their relation to the world. Homer, Hesiod, Orpheus, &c., are called *theologoi* (theologians), on account of the subject matter of their verse. But their theology is at the same time called 'mythic,' to distinguish it from the 'physical' theology of the philosophers, which, reversing the mythic order, concerned itself with speculative inquiries regarding the origin of the world and its relation to the gods. In the New Testament, the word theology does not occur, and the idea seems alien to the simplicity of the primitive Christian faith. The Greek Christians originally designated any deep philosophical apprehension of the truths of religion by the term *Gnosis* (knowledge), which was opposed to *Pistis* (faith), the simple irreflective trust of the majority of humble believers. First during the 3d and 4th centuries the word theology came into use, especially in connection with such of the Fathers as defended the doctrine of the Deity of the Logos. In this sense, the Evangelist John and Gregory of Nazianzen were termed *Theologians*. During the same period, the word theology was applied to the doctrine of the Trinity.

In the century following, its application was widened by Theodoret, who used it to denote the whole circle of theoretical instruction in religion; and finally, Abelard, through his *Theologia Christiana*, gave the word that comprehensive signification it still bears, as expressive not only of a theoretical but also a practical exposition of religious truth. The word Divinity is sometimes used to denote the same thing as theology.

THEO'PHILUS, one of the most important precursors of Dr. Faust, was, according to the legend, coadjutor-bishop at Adana, in Cilicia. After the death of his bishop, being unanimously chosen successor, he declined the proffered honor, but was shortly afterwards, at the instigation of slanderers, deposed from his former office by the new bishop. He now had recourse to a Jew magician, who took him to a midnight meeting of devils, whose chief ordered him to deny Christ and Mary, and to give a bond, making over his soul. The result was, that next morning he was reinstated in his office and dignities by the bishop; and now, presuming on the support of his confederates, he began to assume a supercilious and domineering manner. But he was soon overtaken with remorse, and, through forty days' fasting and prayers, prevailed on Mary to intercede with her son for him, and to get

back the letter from the devil, which she laid upon the breast of the repentant sinner as he lay asleep in the church. T. then made a public confession of his crime, told of the goodness of the Virgin Mary, and died three days after. This legend, whose origin is traced back to an unknown Greek, of the name of Eutychianus, was brought, during the 10th c., through an equally unknown Neapolitan priest, named Paulus, to the West, where it very quickly spread far and wide. Before the end of the century, it was put into Latin verse by Roswitha, and still better, by the Bishop of Rennes, who died in 1123 (printed in the *Acta Sanctorum*, February 4; and in *Hildeberti Turonensis et Marbodi Opera*, published by Beaugendre, Par. 1708). Gauthier de Coinsy (died after 1236) turned it into a beautiful French poem (printed in *Œuvres de Rutebeuf*, published by Jubinal, 2 vols.); and the Rhenish compiler of the *Alte Passional* admitted it among his legends of Mary (*Marienlegenden*, published by Pfeiffer, Stuttg. 1846).

A Dutch metrical version, in the 14th c., was published by Blommaert (*Theophilus*, Ghent, 1836). The first dramatic handling of the subject was in French by Rutebeuf, a distinguished troubadour of the 13th c. (*Œuvres*, published by Jubinal, 2 vols., Par. 1839); then repeatedly during the 14th and 15th centuries in Low-German (*Romantische und andere Gedichte in altplattdeutscher Sprache*, published by Bruns, Berl. and Stettin, 1798; *Theophilus, in Icelandic, Low-German, and other Tongues*, by Dasent, Lond. 1845). The legend of T. is also not seldom to be found inserted in large works, and frequent allusions to it occur in Latin, German, Anglo-Saxon, Icelandic, Swedish, French, and even Spanish literature. It has even been pictorially represented in French churches. With the 16th c., it seems to have disappeared. However much the various versions differ from one another in the minor circumstances, the essential traits remain throughout unchanged: that T. made a compact with the devil in order to recover lost property; that he attained his object, but at the same time nothing more (nothing whatever of magic art), and that Mary rescued the repentant sinner. Through this legend of T., the oldest known instance of a compact with the devil, there runs a lenient spirit (derived from paganism, and which the Roman Catholic Church was able to sanction by interposing the Virgin Mary), which distinguishes it markedly and essentially from the stern Protestant shape of the devil's compact in the Faust-book, which, with rigorous consistency, requires the consignment of the contracting party to hell.

THEOPHRA'STUS, the Greek moralist and naturalist, was born at Eresus, in Lesbos, and studied philosophy at Athens, first under Plato, and subsequently under Aristotle. The latter took especial interest in him, and according to a rather incredible legend, altered his original name of Tyrtamus into that of Theophrastus (divine speaker), in compliment to the fluent and graceful speech of his pupil. To T., moreover, he bequeathed the presidency of the Lyceum, his library, and the original MSS. of his writings. T. proved a worthy successor of the Stagirite. Under his presidency, the Lyceum sustained its character, and attracted no fewer than 2000 disciples, among whom was the comic poet Menander. The kings Philippus, Cassander, and Ptolemy held him in high esteem; and such was the admiration of the people of Athens for him, that, when he was arraigned for impiety and triumphantly acquitted, they would have killed his accuser, had he not generously interceded. In compliance, however, with the law of Sophocles, which decreed the banishment of all philosophers from Athens, T., in 305 B.C., left the city, until the enactment was repealed the very next year by Philo, also a disciple of Aristotle. From that date, T. continued his lectures until his death in 287, at which time he had presided over the Academy for 35 years. His birth being unknown, we are ignorant of his age at the time of his death, and conjectures variously give it from 85 to 107 years. On the eve of dissolution he is said to have complained of the shortness of human life, which ended just when he was about to solve its enigmas. He was accompanied to the grave by the entire Athenian population. He bequeathed his library to Neleus of Scepsis. The great object of his philosophical labors was to develop the Aristotelian system, to explain the difficulties which obscured it, and to fill up the gaps which left it incomplete. Most of the works which he wrote with this object have perished; only the following remain: 1. *Characteres*, in 30 chapters, descriptive of vicious characters; 2. *Of Sensuous Perception and its Objects;* 3. A fragment on *Metaphysics;* 4. *Of the History of Plants*, in 10 books, one of the earliest of extant treatises on botany; 5. *Of the Causes of Plants*, in 8 books, of which, however, only 6 remain; 6. *Of Stones*. The best complete edition of T. is that of Schneider; there are numerous editions of the *Characteres* separately.

THE'ORY, a word expressing the scientific process of generalization under various aspects.

Theory is, in the first place, opposed to Fact, or matter of fact, and signifies that a certain class of facts have been generalized and brought into a single comprehensive statement. It thus corresponds to a Principle, general truth, or Law of Nature. That a half-inflated bladder hung before the fire is expanded till it bursts, is a matter of fact; that bodies generally are expanded by heat, is the theory or general principle, comprehending the whole class of facts. To give the theory of a fact, in this sense of the word, is to give its general law; this is also called its Explanation, and sometimes its Cause. See CAUSE.

Theory, in the next place, is opposed to Hypothesis (q. v.). A fact may, for a time, be referred to a hypothetical or assumed principle; endeavors being meanwhile made to remove the hypothetical character, by proving or disproving the principle. The vortices of Descartes was a hypothesis to account for planitary motions; while Newton's view, that gravity might be the cause of these motions, was, in the first instance, a hypothesis. The Cartesian doctrine was disproved and abandoned; the Newtonian was fully verified, and, ceasing to be a hypothesis, became a theory.

Lastly, Theory is opposed to Practice. The Theory of a subject is the knowledge or explanation of it; the Practice is making some use of it. Physiology is Theory; Physic, or Medicine, is practice. In practical matters, there are two modes of procedure which are still further illustrative of the distinction now in hand. The knowledge possessed by a worker in any art may be empirical, experimental, rule-of-thumb—that is, it may be gathered by actual experience in the particular operation. The seaman's knowledge of the prognostics of weather, and the cook's art in boiling and roasting, are usually of this kind. On the other hand, the worker's knowledge may be obtained from Theory, in other words, from general principles or laws scientifically ascertained; as when the theory of the winds and the law of storms are employed to predict the weather; when the cook roasts and boils according to the known temperature for coagulating albumen; and when a physician prescribes a dietary grounded on a chemical analysis of the food and of the tissues to be maintained.

Great caution is required in the employment of such theoretical knowledge in the arts and in practical affairs. It is not enough that the theories are fully established; we must also know all the conditions of the case, so as to allow for every agent operating to produce or to mar the effect. That a cannon-ball should describe a parabola, is a correct theoretical inference from gravity and the laws of motion; but the resistance of the air, a distinct agency, makes it untrue in fact, and therefore misguiding in practice. When this resistance is allowed for, the theory is complete, and its application will no longer disappoint the operator. See DEDUCTION.

THEO'SOPHY (Gr. *theosophia*, divine wisdom), the name given to a so-called sacred science, which holds a place distinct as well from that of philosophy as from that of theology, even in questions where these latter sciences have the same object with it, namely, the nature and attributes of God. In investigating the divine nature and attributes, philosophy proceeds entirely by the dialectic method, employing as the basis of its investigation the ideas derived from natural reason; theology, still employing the same method, superadds to the principles of natural reason those derived from authority and revelation. Theosophy, on the contrary, professes to exclude all dialectical process, and to derive its knowledge of God from direct and immediate intuition and contemplation, or from the immediate communications of God himself. Theosophy, therefore, so far as regards the science of God, is but another name for MYSTICISM (q. v.), although the latter name implies much more; and the direct and immediate knowledge or intuition of God, to which the Mystics laid claim, was, in fact, the foundation of that intimate union with God, and consequent abstraction from outer things, which they made the basis of their moral and ascetical system. The theosophic system dates from a very high antiquity; and within the Christian period we may number among Theosophs, the Neo-Platonists, especially Plotinus, Iamblichus, and Proclus; the Hesychasts of the Greek Church; all those of the medieval Mystics who laid claim to any dogmatical theory; and in later times, the Paracelsists, Bodenstein and Thalhauser, Weizel, Jacob Böhme, and above all, Immanuel Swedenborg. If we consider one particular view of the philosophic system of Schelling, he also may be assigned to the same school.

THERAPEU'TÆ, a pious 'Jewish' sect, mentioned in a book ascribed to Philo, as living chiefly on the Lake Mareotis, near Alexandria, but as having also numerous colonies in other parts of the world. They are described as in many respects like the Essenes (q. v.). Like them, they lived unmarried in a kind of monastery, were very moderate with regard to food and dress, the latter consisting in a white garment; prayed at sunrise, their face turned to the sun; studied much in the Scriptures—which they explained allegorically—and in other 'ancient books,' and were principally opposed to slavery. The chief differences between these two 'sects,' as they are described to us, consisted in the T. simply living a life of contemplation, while the Essenes followed many occupations, such as agriculture, arts, &c.; the latter lived

together, while the T. lived separately in their cells; the Essenes not only took an interest in other human beings, but actively assisted them; while the T., who also, before they entered the brotherhood, divided their property among their relatives, contrary to the 'common treasure' of the Essenes, kept in utter ignorance of the outer world. Again, the T. knew none of the divisions which marked the degrees of initiation among the Essenes, but they held the Temple at Jerusalem in much higher veneration than the latter; the T. brought up boys to the brotherhood, while the Essenes only recruited themselves from grown-up people. One of the chief characteristics of the T. was also the religious meals they used to hold in common on every seventh Sabbath; the Essenes having two such sacred meals daily. Many and striking are also the analogies offered by their mode of life and their doctrines to those of the Pythagoreans. Neither partook, e. g., of animal food or wine, and both admitted women to their assemblies, which were mostly concluded with hymns; and they both held the number seven sacred. Many theories have been broached regarding this mysterious sect. One of the most plausible notions is the one—now commonly accepted—of the whole book *De Vita Contemplativa*, which treats of this sect, being falsely attributed to Philo. It is rather believed to be the work of an early Christian, intended to idealize the life of Christian monasticism and asceticism of the first centuries. See ESSENES.

THERAPEU'TICS (Gr. *Therapeuo*, I heal) is that division of the science of medicine which treats of the various actions of remedies upon the diseased animal system, or the means by which nature may be aided in her return to health.

THERAPI'A, or TARAPIA, a small Turkish town of about 3000 inhabitants, is situated on the Bosporus, 21 miles north-north-east of Constantinople, at the head of a large and beautiful bay of the same name. It is one of the most charmingly picturesque spots in the neighborhood of the Turkish capital, and all summer has a climate deliciously cool. T. is the residence of the French and English embassies, and many of the Frankish merchants have villas here.

THERAPO'NIDÆ, a family of acanthopterous fishes, allied to *Percidæ*, from which they are distinguished by having 6 instead of 7 branchiostegal rays. The scales in some are ctenoid, in others cycloid. Some are fresh-water fishes. None are British. Some are found in the lakes and rivers of North America.

THERESIO'PEL, more commonly called MARIA-THERESIOPEL (Hung. *Szabadka*), an important town in the Hungarian county of Bacs, 24 miles west-south-west of Szegedin, on the Palitsch Lake. It is well built, but unpaved; contains numerous important buildings, as the churches, gymnasium, and the great barracks. Manufactures of leather and shoes, linen-weaving, dyeing, the cultivation of tobacco and fruits, together with the rearing of cattle, are the chief branches of industry. Pop. (1869) 56,323; (1880) 61,367.

THERI'ACA (Gr. *ther*, a wild or a venomous animal), a medicine in the form of an electuary, supposed to be an antidote to the poison of venomous animals. It was invented by Andromachus of Crete, physician to the Emperor Nero, and was described in a poem, preserved in Galen's work, *De Antidotis*. This theriac was a mishmash of about 70 ingredients, some of them quite inert, and others antagonistic to one another. Yet it continued in repute until recent times, and it is not long since in Venice, Holland, France, and other places, the druggists had to prepare the compound with certain solemnities in the presence of the magistrates. The term theriaca was applied to various compounds of a similar nature, and *theriac* and *theriacal* became synonymous with medicinal. The English word *treacle* is a corruption of *theriacal*, and originally meant an electuary, or compound syrupy medicine (e. g., Venice treacle = the theriac of Andromachus); and it was applied to molasses from the similarity in appearance.

THE'RMIDOR, i. e., the 'Hot Month,' formed, in the calendar of the first French Republic, the 11th month, and lasted from the 19th July to the 18th August. The 9th Thermidor of the Republican year 2 (July 27, 1795) is historically memorable as the date of Robespierre's fall, and the termination of the Reign of Terror. The name Thermidorians was given to all those who took part in this fortunate *coup d'état*, but more particularly to those who were desirous of restoring the monarchy.—See Duval's *Souvenirs Thermidoriens* (2 vols., Par. 1844).

THE'RMO-DYNA'MICS, or the DYNAMICAL THEORY OF HEAT, though literally merely the science of the relations of Heat and Work, is now very generally employed to denote the whole science of ENERGY. See FORCE. We propose in this place to give a general sketch of this grand modern generalization, supplementary to what will be found in the article just referred to; but, for the sake of continuity, we must repeat a little of what was there given, though in a somewhat different form.

Energy is strictly defined as the power of doing Work (q. v.), and is of one or other of two kinds—*Potential* or *Kinetic*. A raised weight, a wound-up spring, gunpowder, and the food of animals, are instances of stores of potential energy. A missile in motion, wind, heat, and electric currents are instances of kinetic energy. Sound, Light, and other forms of Wave-motion (see WAVE), are all instances of mixed potential and kinetic energy.

The modern theory of Energy contemplates its

CONSERVATION,
TRANSFORMATION, and
DISSIPATION.

The CONSERVATION OF ENERGY is the statement of the experimental fact, that Energy is, like Matter (q. v.), indestructible and uncreatable by any process at the command of man.

The TRANSFORMATION OF ENERGY is the statement of the experimental fact, that any one form of energy may in general be transformed wholly or partially into any other form. This used to be known as the CORRELATION OF FORCES. But it is subject to the condition derived from the first fact, that the portion transformed retains its amount unchanged. It is also subject to the law of DISSIPATION, or Degradation, which is a statement of the experimental fact, that Energy generally tends at every transformation to at least a partial transformation into heat; and that, once in that form, it tends to a state of uniform distribution, in which no further transformation is possible.

The original energy of the universe, therefore, though still of the same amount as at creation, being in a state of ceaseless transformation, has been in great part frittered down into heat, and will at length take wholly that final form.

The history of the grand discoveries which are briefly summarized in these few lines, has been much discussed of late—especially in the *Philosophical Magazine*—and is now pretty clearly ascertained.

Newton took the first great step. In a Scholium to his Third Law of Motion (q. v.), he lays down in a few clear words the Conservation of Energy as the embodiment of the experimental results known in his day with reference to forces and visible motions. Part of this statement of Newton's was afterwards reinvented under the name of Conservation of Vis-viva; but all that Newton really wanted to enable him to complete the Conservation of Energy was an experimental knowledge of the nature of Heat, Electricity, &c. That heat is motion of some kind, not matter, and that the laws of its communication are the same as those of the communication of visible motion, was experimentally proved at the very end of last century by Davy. Rumford had almost completed a proof a year or two before; but he had also made a very fair attempt to determine the 'Mechanical Equivalent' of heat—i. e., the quantity of heat which is equivalent to a given amount of mechanical work. That there is such an equivalent is at once evident by looking at Davy's discovery in the light of Newton's Scholium already referred to. But though the Dynamical Theory of Heat was thus really founded in 1799, it was not generally received. The first to recall attention to it was Séguin, nephew of the celebrated Montgolfier (from whom he states that he derived his views), who, in 1839, distinctly enunciated the equivalence of heat and mechanical work, and sought to prove by experiment that heat disappears, or is put out of existence, in the production of work from a steam-engine.

In 1842, Mayer published a short note, in which he enunciated the Conservation of Energy as a metaphysical deduction from the maxim, *Causa æquat effectum*. He made no experiments to prove this general statement, but he made a calculation of the mechanical equivalent of heat from the specific heats of air—assuming that when heat is produced by compression, its amount is the equivalent of the work spent in compressing. His result was erroneous, because his data were imperfect. But it appears that his assumption, quite unwarranted as it was, is really very nearly true for air.

In 1843, Colding, led also by some metaphysical speculations, propounded the doctrine, but endeavored to base it upon actual experiments.

Finally, Joule (q. v.), also in 1843, published an experimental determination of the mechanical equivalent of heat (770 foot pounds as the work required to heat a pound of water one degree F.), which is within half per cent. of the most trustworthy results since obtained. Joule had been, since 1840 at least, making quantitative determinations of equivalence between various forms of energy; and was led to propound the general law of Conservation of Energy by the only legitimate process—viz., experiment, as contrasted with metaphysical assertions of what ought to be. The complete foundation of the science on a proper basis is thus due to him; though, as we have seen, portions of it were established thoroughly by Newton and by Davy.

Before we consider what are the principal features of the theory as now developed, it is necessary to refer to the admirable investigations of Fourier and Carnot, which, though in some respects defective, must be considered as real advances. Fourier's great work, *Théorie de la Chaleur*, is devoted to the laws of conduction

and radiation, i. e., to the dissipation of heat, and is one of the most remarkable mathematical works ever written. Carnot's work, *Sur la Puissance Motrice du Feu*, is the first in which any attempt is made to explain the production of work from heat. It is unfortunately marred by his assumption, that heat is a material substance, though it is only fair to say that he expresses grave doubts as to the truth of this hypothesis.

(We borrow our notice of Carnot from a paper by Sir W. Thomson (q. v.) in the *Transactions of the Royal Society of Edinburgh*, 1849.)

He begins his investigation by premising the following correct principle, sadly neglected by many subsequent writers: 'If a body, after having experienced a certain number of transformations, be brought identically to its primitive physical state as to density, temperature, and molecular constitution, it must contain the same quantity of heat as that which it initially possessed.' Hence he concludes, that when heat produces work, it is in consequence of its being *let down* from a hot body to a cold one, as from the boiler to the condenser of a steam engine. His investigation, though based on an erroneous hypothesis, is extremely ingenious, and forms the foundation of the modern theory. We give a sketch of it preparatory to our account of the present state of the theory, and for this purpose we choose a somewhat hypothetical case, as simpler than the most common practical one. This is the case of a piston working air-tight in a cylinder closed at the bottom.

Suppose we have two bodies, A and B, whose temperatures, S and T, are maintained uniform, A being the warmer body, and suppose we have a stand, C, which is a non-conductor of heat. Let the sides of the cylinder and the piston be also non-conductors, but let the bottom of the cylinder be a perfect conductor; and let the cylinder contain a little water, nearly touching the piston when pushed down. Set the cylinder on A; then the water will at once acquire the temperature S., and steam at the same temperature will be formed, so that a certain pressure must be exerted to prevent the piston from rising. Let us take this condition as our starting-point for the cycle of operations. 1. Allow the piston to rise gradually; work is done by the pressure of the steam, which goes on increasing in quantity as the piston rises, so as always to be at the same temperature and pressure. And *heat is abstracted from A*, namely, the latent heat of the steam formed during the operation. 2. Place the cylinder on C, and allow the steam to raise the piston further. More work is done, more steam is formed, but the temperature sinks on account of the latent heat required for the formation of the new steam. Allow this process to go on till the temperature falls to T, the temperature of the body B. 3. Now, place the cylinder on B; there is of course no transfer of heat; because two bodies are said to have the same temperature when, if they be put in contact, neither parts with heat to the other. But if we now press down the piston, we do work upon the contents of the cylinder, steam is liquefied, and the latent heat developed is at once absorbed by B. Carry on this process *till the amount of heat given to B is exactly equal to that taken from A* in the first operation, and place the cylinder on the non-conductor C. The temperature of the contents is now T, and the amount of caloric in them is precisely the same as before the first operation. 4. Press down the piston further, till it occupies the same position as before the first operation; additional work is done on the contents of the cylinder, a further amount of steam is liquefied, and the temperature rises.

Moreover, *it rises to S exactly*, by the fundamental axiom, because the volume occupied by the water and steam is the same as before the first operation, and the quantity of caloric they contain is also the same—as much having been abstracted in the third operation as was communicated in the first—while in the second and fourth operations, the contents of the cylinder neither gain nor lose caloric, as they are surrounded by non-conductors.

Now, during the first two operations, work was done by the steam on the piston; during the last two, work was done against the steam; on the whole, the work done by the steam exceeds that done upon it, since evidently the temperature of the contents, for any position of the piston in its ascent, was greater than for the same position in the decent, except at the initial and final positions, where it is the same. Hence the pressure also was greater at each stage in the ascent than at the corresponding stage in the descent; from which the theorem is evident.

Hence, on the whole, a certain amount of work has been communicated by the motion of the piston to external bodies; and the contents of the cylinder having been exactly restored to their primitive condition, we are entitled to regard this work as due to the caloric employed in the process. This, we see, was taken from A, and wholly transferred to B. It thus appears ,that *caloric does work by being let down from a higher to a lower temperature*. And the reader may easily see that if we knew the laws which connect the pressure of saturated steam, and the amount of caloric it contains, with its volume and temperature, it would be possible to apply a rigorous calculation to the various processes of the cycle above explained, and to express by formulæ the amount of work gained on the whole in the series of operations, in terms of the temperatures (S and T) of the boiler and condenser of a steam-engine, and the whole amount of caloric which passes from one to the other.

Though the above process is exceedingly ingenious and important, it is to a considerable extent vitiated by the assumption of the materiality of heat which is made throughout. To show this, it is only necessary to consider the second operation, where *work is supposed to be done* by the contents of the cylinder expanding *without loss or gain of caloric*, a supposition which our present knowledge of the nature of heat shows to be incorrect. But it is quite easy, as seems to have been first remarked by J. Thomson in 1849, to put Carnot's statement in a form which is rigorously correct, whatever be the nature of heat. J. Thomson says: 'We should not say, in the third operation, "compress till the same amount of heat is given out as was taken in during the first." But we should say, "compress till we have let out so much heat that the further compression (during the fourth stage) to the original volume may give back the original temperature."' It is but bare justice, however, to acknowledge that Carnot himself was by no means satisfied with the caloric hypothesis, and that he insinuates, as we have already seen, more than a mere suspicion of its correctness.

If we carefully examine the above cycle of operations, we easily see that they are *reversible*, i. e., that the transference of the given amount of caloric back again from B to A, by performing the same operations in the opposite order, requires that we expend on the piston, on the whole, as much work as was gained during the direct operations. This most important idea is due to Carnot, and from it he duduces his test of a *perfect* engine, or one which yields from the transference of a given quantity of caloric from one body to another (each being at a given temperature) the greatest possible amount of work. And the test is simply that *the cycle of operations must be reversible*.

To prove it, we need only consider that,if a heat-engine, M, could be made to give more work by transferring a given amount of caloric from A to B, than a reversible engine, N, does, we may set M and N to work in combination, M driven by the transfer of heat, and in turn driving N, which is employed to restore the heat to the source. The compound system would thus in each cycle produce an amount of work equal to the excess of that done by M over that expended on N, without on the whole any transference of heat; which is of course absurd.

The application of the true theory of heat to these propositions was made in 1849, 1850, and 1851 respectively, by Rankine, Clausius, and Sir W. Thomson. Rankine employed a hypothesis as to the nature of the motion of which heat consists, from which he deduced a great many valuable results. Clausius supplied the defects of Carnot's beautiful reasoning; accommodating it to the dynamical theory by a very simple change, and evolving a great number of important consequences. But by far the simplest, though at the same time the most profound, writings on this subject, are those of Sir W. Thomson, to be found in the *Transactions of the Royal Society of Edinburgh;* and these must be consulted by any reader who desires to have a clear statement and proof of thermo-dynamical laws, not complicated by unnecessary hypotheses or formulæ, and yet perfectly general in its application. See also Tait's *Thermo-Dynamics* (2d ed. 1877).

In its new form, thermo-dynamics is based on the two following laws:

Law I. (Davy and Joule.) *When equal quantities of mechanical effect are produced by any means whatever from purely thermal sources, or lost in purely thermal effects, equal quantities of heat are put out of existence, or are generated.*

Law II. (Carnot and Clausius.) *If an engine be such that, when it is worked backwards, the physical and mechanical agencies in every part of its motions are all reversed, it produces as much mechanical effect as can be produced by any thermo-dynamic engine, with the same temperatures of source and refrigerator from a given quantity of heat.*

The proof of this second law differs from that of Carnot (already given as regards reversible engines) by being no longer based on the supposition of the materiality of heat, but on the following axiom, in some of its many possible forms—It is impossible, by means of inanimate material agency, to derive mechanical effect from any portion of matter by cooling it below the temperature of the coldest of the surrounding objects. It will be easily seen that the pair of engines (one reversible) before mentioned would, if worked in combination, form a perpetual motion; and, besides, would constantly transfer heat from a colder to a warmer body.

One of the immediate and most important deductions from these principles is—that only a fraction of the heat employed in any engine is converted into useful work (the remainder being irre-

coverably lost). This fraction was shown by Thomson to be capable of expression as $\frac{S - T}{S}$; where S and T are the temperatures of the source and condenser, *measured from the absolute zero* of temperature. See HEAT. Thus, an air engine, in which a far greater range of temperature can be safely used than in a steam-engine, employs effectively a much larger portion of the heat supplied to it; and there is no doubt that air-engines would supersede steam-engines, if we could get a material capable of enduring the great heat required.

THERMO-ELECTRI'CITY treats of the currents that arise from heating the junction of two heterogeneous conductors. Such currents can be obtained in many ways, but we shall here simply indicate the more important.

Thermal Currents with one Metal.—Take a copper wire, cut it in two, and fix each half in one of the binding screws of a galvanometer. Heat one of the free ends to redness, and press it against the other, and a current will be generated, passing at the junction from the hot to the cold end, as shown by the deflecting needle. In almost all cases where portions of the same metal at different temperatures are pressed together a current is produced, the direction of which depends on the metal, and even on the structure of the same metal.

Currents are also obtained when two portions of the same metal or piece of metal have different structures, and the point where the two structures meet is heated. If, for instance, one piece of wire be hard-drawn and the other part annealed, when the seat of change from the one to the other is heated, a current is produced. Or if the whole be annealed, and one part of it be hammered, the hammering makes the other part harder, and the current, when the junction is heated, passes from the soft to the hard part. The direction of the current differs with different metals in these circumstances. Even the difference of structure introduced by the twisting of a portion of a wire, causes a current to flow when the wire is heated in the vicinity of the twist. Thus, when a knot is tied on a platinum wire, or when part of it is coiled into a spiral, a current passes always towards the knot or coil when the flame of a spirit-lamp is directed on a portion of the wire near the knot or spiral. The twisting, in this case, acts as hardening or hammering would do.

By running the flame of a spirit-lamp along a metal, it frequently happens, more especially if it be of a crystalline structure, that currents are produced at certain points. These points are supposed to indicate a change in structure. If a bar of fused antimony have its ends connected with a galvanometer, and examined in this way, *neutral points* are generally found. The flame of a lamp generates a current near these points, always passing towards the point, and changing in direction with the change of the side on which the flame is applied. Bismuth shows neutral points, but the current always goes from the cold to the hot part across the neutral point. In bars of those metals which are crystallized regularly and slowly, no neutral points are found.

Thermal Currents with two Metals.—A current is always obtained when the point of junction of any two metals is heated. The two metals which show this property in the greatest degree are bismuth and antimony. When a bar of antimony, A (fig. 1), is soldered to a bar of bismuth, B, and their free extremities are connected with a galvanometer, G, on the junction being heated, a current passes from the bismuth to the antimony, as shown in the figure. When S is chilled by applying ice, or otherwise, a current is also produced, but in the opposite direction. Such a combination constitutes a thermo-electric pair. Applying the same mode of explanation to this pair that we apply to the galvanic pair (see GALVANISM), bismuth is positive within and negative without the pair, antimony negative within and positive without the pair. Bismuth thus forms the negative pole, but positive element; antimony the positive pole, but negative element of the pair. The metals may be classed in thermo-electric just as in electro-chemical order.

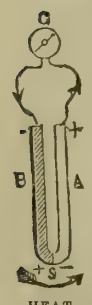
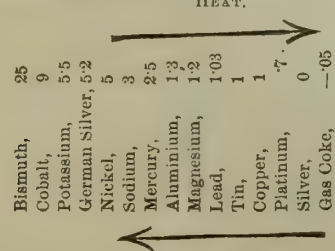


Fig. 1.

The following table gives them in this order, the direction of the arrow showing how the current goes within the pair :



The order and numbers in this table, which are for temperatures between 40° and 100° F., are those given by Dr. Mathiessen. For other temperatures, the table would be different for several of the metals.

It will be seen, that metals like bismuth and antimony, which have a crystalline structure, are best suited for a thermo-electric pair. Tourmaline, when heated, shows an opposite electricity at each end. If it had a low conducting power like the metals just named, we might expect from it a thermo-electric current instead of mere polarity. It is probable that the crystalline structure, however, accounts for the appearance of electricity in both cases.

Thermo-electric Pile or Battery.—One bismuth-antimony pair is of very little power. To increase this, several pairs are associated together, as shown in fig. 2, where the same tension-arrangement is adopted as in a galvanic battery. The heat in this case must be applied only to one row of soldered faces. The current depends on the difference of temperature of the two sides. When a strong current is required, the one series must be kept in ice, or in a freezing mixture, whilst the other is exposed to heat radiating from a red-hot plate of iron. As in the galvanic pair, the electro-motive force is proportionate to the number of pairs; the size of the bars, like the size of the galvanic plates, merely aiding to diminish the resistance. The electro-motive force of a thermo-electric battery is small; according to Dr. Mathiessen, that of 25 bismuth-tellurium pairs equals one cell of Daniell's battery, when the one series is kept at 32° F. and the other at 212° F. In consequence of the low electro-motive force of the thermo-electric battery, the galvanometer to be used with it must introduce as little resistance as is consistent with the best effect on the needle. Hence special galvanometers are used, in which the coil wire is short (200 turns) and thick ($\frac{1}{25}$ inch); these are called theremo-galvanometers.

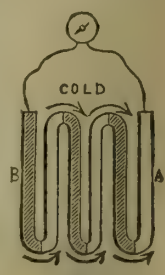


Fig. 2.

When a great number of pairs are formed into a battery, they may be conveniently arranged as in fig. 3, which shows one of 30 pairs. The odd faces, 1, 3, 5, &c., are exposed on the one side, and the even faces, 2, 4, 6, &c., on the other. The terminal bars are connected with the binding screws *n*, *p*. The interstices of the bars are filled with insulating matter (gypsum) to keep them separate, and the frame in which the whole is placed is of non-conducting matter. Such a pile in conjunction with a thermo-galvanometer (see GALVANISM) forms the most delicate thermometer for radiant heat, and is generally called a *thermo-multiplier*. When placed in a room, the temperature of which is equable all round, no current is produced; but if heat be radiated more on one side than another, a current ensues. If the hand, for instance, be brought near on the one side, a current indicates its radiant power; or if a piece of ice be brought near, a current is also shown, but moving in the opposite way.

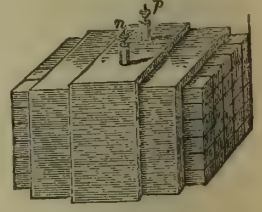


Fig. 3.

Thermal Effects produced by the Galvanic Current.—As heat or cold produces a current at the junction of two dissimilar conductors, we should expect that if a galvanic current be made to pass through the junction, heat or cold would follow, and such is found to be the fact. When a current from a voltaic cell passes, as shown in fig. 4, through a system of three rods of bismuth, antimony, and bismuth, at the junction where the current passes from bismuth to antimony, cold is produced; and at the other, from antimony to bismuth, heat. If, for instance, water be placed in a hollow at either junction, cooled to 32° F., it will become frozen when the current passes from the bismuth to the antimony. When the junction of these two metals is put into the bulb of an air thermometer, so that a current can be sent through it in either way, the air expands when the current goes from antimony to bismuth, but contracts when it goes in the opposite way. See THERMO-ELECTRICITY, where the theory of energy is applied to the explanation of the various phenomena.

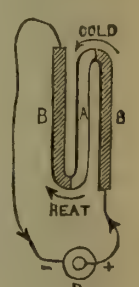


Fig. 4.

Seebeck was the discover (1821) of thermo-electricity; Nobili invented the thermo-electric pile (1834); Peltier (1834) first observed the thermal effects of galvanic currents at the junction of heterogeneous conductors.

THE'RMO-ELECTRI'CITY AND THERMO-MAGNETISM. If the ends of an iron wire be attached by twisting or soldering to the extremities of the copper wire of a galvanometer, and one

of these junctions be heated, the galvanometer indicates the passage of a current in the circuit in a direction from copper to iron through the heated junction. The first application of the theory of energy to this phenomenon is of course as follows: Since heating the junction produces the energy of the current, part of the heat must be expended in this process; though it is of course entirely recovered as heat in the circuit, if the current be not employed to do external work. The existence of the current from copper to iron is thus associated with the cooling of the junction; and it had been experimentally shown by Peltier, that if an electric current be passed through a circuit of iron and copper, originally at the same temperature throughout, it produced cold when passing from copper to iron, and heat when passing from iron to copper. If the two junctions be maintained each at a constant temperature, a constant current passes from the warmer to the colder junction through the iron wire; and by the conservation of energy, the heat developed in the circuit (together with the equivalent of the external work done, if the current be employed to drive an electro-magnetic engine) is equal to the excess of the heat absorbed at the warmer junction over that given out at the colder, precisely as in the case of a heat-engine. So far the process presents no difficulties. But it was discovered by Cumming in 1823, that not only is the strength of the current *not* generally proportional to the difference of temperatures of the junctions, but that if the difference be sufficiently great, the current may, in many cases, pass in the opposite direction. Thus, in the copper-iron circuit, at the temperature 300° C. of the hot junction, the current passes through it from iron to copper.

Thomson (Bakerian Lecture—*Phil. Trans.* 1855—'On the Electro-dynamic Properties of Metals') applied the principle of energy to this case, and derived from it the conclusion, that one of three things must happen, the most unexpected of which was found by experiment to be the actual one—viz., the startling result, that *a current passing in an iron bar or wire from a hot to a cold part produces a cooling, but in copper a heating, effect.* This very remarkable discovery, which, taken in connection with that of Peltier, gives the key to the whole subject of thermo-electricity, has been made the subject of a valuable experimental investigation by Le Roux (*Annales de Chimie*, 1867).

The theory of such phenomena (and of others far more complex, involving, for instance, crystalline arrangement), in complete accordance with the conservation of energy, has been given by Thomson (*Trans. Royal Soc. Edin.* 1854); but it would be inconsistent with the character of this work to enter into any details on so abstruse a subject. A similar remark must be made regarding his application of the principle to the subject of thermo-magnetism, or the relation of the magnetizability of various substances to their temperature; one or two of his results may, however, be mentioned. Thus, iron at a moderate or low red-heat experiences a heating effect when allowed to approach a magnet, and a cooling effect when slowly drawn away from it; while in cobalt, at ordinary temperatures, exactly the opposite effects are produced. Similar effects are in general produced when a doubly-refracting crystal is turned in the neighborhood of a magnet.

THERMO'METER (Gr. literally *heat-measurer*), a term which, in spite of its derivation, is usually restricted to instruments which measure temperature (see HEAT) by the *expansion* of bodies. Like that of the telescope and microscope, and many other valuable pieces of philosophical apparatus, its early history is very obscure. There are various claimants who seek to share at least a part in the credit of its invention; and they agree pretty well in referring it to somewhere in the beginning of the 17th century. We shall not waste space in endeavoring to settle such matters of history, but proceed at once to a description of the forms of the instrument now most commonly used; after which we shall say a few words about the actual value of their indications, and finish by a rapid sketch of a few other instruments also adapted for the measurement of temperature, but not usually known by the name of thermometer.

Let us commence with the ordinary spirit-thermometer, as it is called; where the indications are given by the expansion of a quantity of alcohol which fills entirely a glass bulb, and partially a narrow tube attached to it.

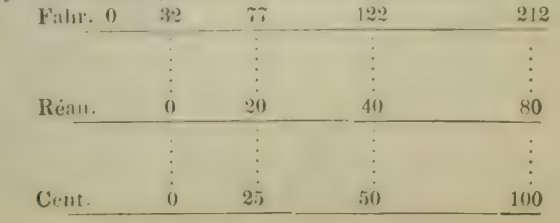
To construct such an instrument, a capillary tube is selected, of as uniform a bore as possible. The easiest method of testing its uniformity is to introduce a column of mercury, about an inch long, into the tube, and gradually move it along by inclining the tube, carefully measuring the length of the column in each of its successive positions. It is obvious that the column will be longer the smaller is the mean section of the portion of the tube occupied at any time by the drop of mercury. If considerable differences of length are found, the tube is rejected at once. The best tubes are those which, if showing any change, taper very slowly but nearly uniformly from one extremity to the other; a defect which can easily be allowed for in the subsequent graduation of the instrument. A bulb is blown on one end of the selected tube: large, if the instrument is meant to be very delicate; small, if a common instrument is to be made, or one which will work through a great range of temperature. The bulb is heated to expand the contained air, and then the open end of the tube is plunged into alcohol, usually tinged with coloring matter, for greater visibility. As the bulb cools, the atmospheric pressure on the alcohol in the vessel forces some of it into the stem, and perhaps a little into the bulb. The tube being then inverted, a few dexterous taps suffice to shake the greater part of the alcohol into the bulb. The lamp is again applied, with caution, until the alcohol boils, and the rapidly escaping vapor drives the air almost entirely from the tube, whose open end is immediately plunged again into the colored spirit.

Unless the stem be nearly 40 feet in length—and thermometers have been made by Forbes (q. v.) of a length approaching to this for the measurement of underground temperature—the alcohol fills the whole of the ball and stem as soon as the glass has cooled. The bulb is again cautiously heated so that, by the expansion of the spirit, such a portion may be expelled, that when the whole has again cooled, the level of the liquid in the tube may stand near some point previously determined on with reference to the particular employment for which the instrument is destined. Finally, the lamp being again applied to the tube, near the upper surface of the liquid, that portion of the spirit is again made to boil; and while the vapor keeps the free end of the tube clear of air, that end is hermetically sealed; and the glass-blower's part of the work is done. A somewhat similar, but more difficult process has to be gone through if other liquids, such as ether, sulphuric acid, mercury, &c., are employed to fill the bulb; each of these liquids having its own special use in certain philosophical inquiries, as we shall presently see. It only remains that the instrument be *graduated*, so that some definite information may be given by its indications.

In the older thermometers, the scale was arbitrary, so that no comparable readings could be taken by means of different instruments. In the finest modern instruments, also, the scale is usually quite arbitrary, being, in fact, engraved on the tube during the process of calibration above described. But then, by careful observation, certain definite temperatures are measured in terms of this arbitrary scale, so that the value of a degree and the position of some definite zero-point are determined for it, and the result engraved on the tube. These numbers enable us, by an easy calculation, to reduce the observed reading of the fine instrument to its equivalent in some of the standard scales.

At present, we assume, what is very nearly true for mercury at least, that equal increments of bulk correspond to equal increments of temperature. All, then, that is necessary is to fix two definite temperatures, and assign their positions on our scale. Water being one of the most common bodies in nature, and being everywhere easily obtainable in a state of great purity, is usually employed; and its *freezing* and *boiling* points are taken as the definite points. The temperature of freezing water or of melting ice is almost absolutely fixed, for (see HEAT) pressure alters it only very slightly. It is otherwise with the boiling-point of pure water, for this is considerably raised by increase of pressure; so much so, in fact, that if the barometer be not attended to, an error of several degrees is possible. Hence we must define the particular pressure, usually 30 inches, at which the boiling-point is to be determined.

The thermometer, constructed (so far) as above described is to have its bulb, and nearly the whole of the portion of the stem which contains liquid, immersed in pounded ice, from which the melted portion is freely trickling; and when the level of the spirit has become stationary, its position, the *freezing-point*, is marked on the tube. Similarly, the barometer, standing at 30 inches, the bulb is enclosed in the steam immediately above the surface of water freely boiling. We thus obtain the *boiling-point*. It only remains that we decide by what numbers these points shall be indicated, because (on account of the nearly uniform expansion of mercury) then the remaining divisions can be at once filled in by dividing the interval between them into equal parts, or, if necessary, allowing for a slight taper in the tube. The only scales which require mention are those of Fahrenheit, Réaumur, and Celsius. Of these, the first is commonly used in Britain, the second in Germany, and the third in France; but this last, under the name of the *Centigrade* scale, is almost exclusively used by scientific men of all nations. The relations of these scales will be easily understood by means of the following figure:



In the Fahrenheit scale, the freezing-point is 32°, and the boiling point 212°, so that the space between these is divided into 212 — 32, or 180, equal parts or degrees. In the others, the freezing-point is the zero, but the boiling-point is 80° and 100° respectively. It is of course perfectly easy to reduce from one of these scales to another. Thus—What is the Centigrade reading for 77° F.? (see the dotted line in the figure). The numbers in Fahrenheit's scale are all too great by 32°, because 32°, and not 0°, stands for the freezing-point. Subtract this from 77, and we have 45. Hence the required number of Centigrade degrees must bear the same ratio to the 100 from freezing to boiling in that scale that the 45 bears to the 180 degrees between the same limits in Fahrenheit's. The requisite number is therefore $\frac{45}{180}100 = 25°$C. In words—*To convert Fahrenheit to Centigrade, subtract* 32, *and multiply by* $\frac{100}{180}$, *or* $\frac{5}{9}$. Vice versâ—*To pass from Centigrade to Fahrenheit, multiply by* $\frac{9}{5}$, *and add* 32. Thus the Fahrenheit value of 50 C is $\frac{9}{5}$ 50+ 32=122, as in the figure. Of course the similar processes with Réaumur's scale present no difficulty.

It is supposed that Fahrenheit fixed his zero at the point of greatest cold that he had observed, possibly in Iceland, more probably by means of a freezing mixture, such as snow and salt, or salammoniac. It is much to be desired that the Centigrade scale alone were employed.

A mercurial thermometer ceases to be of use for temperatures only a little above the freezing-point of mercury; but it has a wide range upwards, as mercury does not boil till about 600° C. On the other hand, a spirit-thermometer, though of little use beyond about 50° or 60° C., as alcohol boils at 70° C., is useful for any degree of cold yet produced, as alcohol has never yet been frozen. When extreme sensitiveness is required, ether being considerably more expansible than alcohol, is sometimes employed; as by Thomson in detecting the effect of pressure on the freezing-point of water. Water, again, would be about the very worst substance with which a thermometer could be filled; for not to speak of its expanding in the act of freezing, and therefore necessarily bursting the instrument, if it were ever allowed to reach the freezing-point, its scale would read partly backwards and partly forwards; for as ice-cold water is gradually heated up to 4° C., it contracts, and begins to expand again after that limit has been passed.

To make thermometers self-recording, various schemes have been proposed, of which we shall notice only one or two. Those most commonly used indicate only the *maximum* and *minimum* temperature during each 24 hours; or during the interval which has elapsed since they were last set. The usual arrangement consists of two thermometers, a mercurial and a spirit one, fixed horizontally to the same frame, with their bulbs at opposite ends of the frame. Above the mercury is a small piece of steel or ivory, and *in* the spirit a small and light float of glass or enamel. Capillary forces prevent the steel from entering the mercury, and the enamel from leaving the spirit. As the mercury expands, it pushes the steel before it, and when it again contracts, it leaves it behind; the end nearest the mercury thus remaining at the highest or maximum indication which that thermometer has given. In the spirit-thermometer, the liquid, as it expands, freely passes the enamel, and leaves it undisturbed; but it can never contract so as to leave it dry. It therefore pulls the enamel back when it contracts, and thus the extremity furthest from the bulb marks the lowest point which the spirit has reached, or the minimum temperature. To set this instrument, incline it so that the steel falls back to the surface of the mercury—the enamel at the same time comes to the surface of the spirit.

The best mode of registration is undoubtedly the photographic. For this purpose, a mercurial thermometer is placed vertically before a narrow slit, in such a way that no light can pass through the slit save above the level of the mercury in the tube. A gas flame is kept burning at some distance in front of the slit, the bulb of the thermometer being protected from its radiation; and behind the slit, a sheet of prepared photographic paper is exposed to the narrow line of light which passes above the mercury. This paper is fixed on a cylinder with a vertical axis, which is made to revolve uniformly by clockwork. Lines are drawn by the clockwork on the paper, giving the position of the slit at each hour of the 24, or the gas-flame is mechanically reduced or eclipsed at intervals of an hour; so that the record, when photographically developed, gives the temperature for every minute of the day and night, in a form represented below; where the blackened space represents the portion of the paper which has been exposed to the light. To find from such a record what was the temperature at any hour, say, 5 hours 30 minutes A.M., draw a vertical (dotted) line, as in the figure, half-way between the V and VI lines, and from the point where it meets the dark space, draw a horizontal (dotted) line. This intersects the scale (to the left in the figure) at 36°, the temperature required.

Among ordinary meteorological instruments, the *wet-bulb* thermometer is deserving of notice. It is simply an ordinary thermometer, with the bulb covered with paper or cotton-wool, kept constantly moist by the capillary action of a few fibres connecting it with a small vessel of water. If the air be *saturated* with moisture (see DEW, EVAPORATION), there will be no evaporation, and the wet-bulb thermometer will give the same indication as the dry-bulb. But the drier and the warmer the air is, the faster does the water evaporate, and (the latent heat of vaporization being mainly taken from the moist bulb) the lower does the mercury sink in the moist-bulb instrument. The difference between the readings of the two instruments, compared with the actual temperature, as shown by the dry-bulb, thus leads to a determination of the hygrometric state of the air.

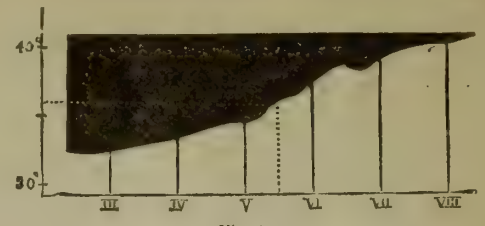


Fig. 1.

So far, we have spoken of the instruments now in common use. But the *air*-thermometer was probably the oldest form; and possesses a scientific superiority over those just described. Theoretical and experimental investigations, connected with the modern Dynamical Theory of Heat (see FORCE, HEAT), show that equal increments of heat produce almost exactly equal changes of bulk in a nearly perfect gas, such as air, if the pressure to which it is exposed be constant. Hence, temperature, as measured by an air-thermometer, gives a true indication of the quantity of energy present in the form of heat. As the comparison of an air-thermometer with a mercurial one shows that, for temperatures not greater than 300° C., or 572° F., the indications of the two agree very closely, the ordinary mercurial thermometer practically possesses within these limits the same advantage.

As the pressure of a gas depends on the amount of heat it contains, the *absolute zero* of temperature, or the temperature of a body wholly deprived of heat, may be determined by finding the temperature at which a perfect gas would cease to exert pressure. For ordinary temperatures, it is found (see HEAT) that air increases in bulk by ·3665, and hydrogen by ·3668 of its bulk, when heated under constant pressure from 0° to 100° C. Again, by Boyle's law, if the air be compressed again, at constant temperature 100° C., to the bulk it had at 0° C., its pressure is increased by ·3665 of its former amount. Thus, p_0 being the pressure at temperature 0° C., p^t that at $t°$ C., we have, when the volume is kept constant,

$$pt = p_0(1 + \cdot003665t).$$

If we assume this to hold for all temperatures, pt vanishes when

$$1 + \cdot003665t = 0;$$
$$\text{or } t° = -274° \text{ C. very nearly.}$$

That is to say, at 274° C. under the freezing-point of water, a perfect gas ceases to exert pressure on its containing vessel—i. e., is deprived of that thermal energy on which pressure depends.

The air-thermometers in common use are affected by the pressure, as well as the temperature, of the atmosphere. To avoid this inconvenience, Leslie and Rumford in the present century revived the *Differential Thermometer* of Sturmius. This instrument, in one of its many forms, is represented in fig. 2. Here a bulb is blown at *each* end of the tube (which is bent into a U-form), and the liquid in the stem is used merely as an index, both balls being full of air. The length of the column of fluid is usually adjusted so that it can just fill one of the vertical arms and the horizontal portion of the tube; and the quantities of air in the two balls are so adjusted, that the column will take this position *when the two balls are at the same temperature*. If the ball A be heated more than B, the liquid index will take a new position, such as CD, and this is read off by a scale applied to either of the vertical arms. The graduation of this instrument may be effected by calculation, but it is usually done experimentally. Leslie made good use of it in his investigations on heat; and, with various adjuncts, such as coloring the glass of the ball A, while that of B was left white; silvering or gilding one of the balls; covering one of them with

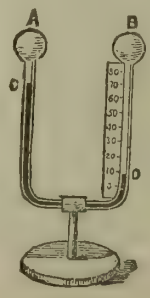


Fig. 2.

moist silk or linen, &c., this instrument became in his hands a *Photometer*, an *Æthrioscope*, a *Hygrometer*, &c.

To thermometers which depend for their action on the expansion of solids, the name PYROMETER (q. v.) is frequently given; but that of Bréguet, as delicate as a good ordinary mercurial thermometer, is not alluded to in that article. The principle of this very beautiful instrument may easily be explained thus. In bending a slip of wood, the fibres on the convex side are necessarily more extended than those towards the concave side. Conversely, if the fibres on one side of a slip of wood were to expand more than those on the other, the slip would bend. Bréguet solders together two thin strips of gold and platinum, or platinum and silver; for portability and concentration bends the compound strip into a helix, fixes its upper end, and attaches a horizontal index to the lower end. The least change of temperature in the surrounding air changes the length of one side of the compound slip more than the other, and the helix twists or untwists through an angle very nearly proportional to the change of temperature.

For measuring radiant heat, the most delicate instrument is the thermo-multiplier. See THERMO-ELECTRICITY.

THERMO'PYLÆ (literally, 'the hot gates'), a famous pass leading from Thessaly into Locris, and the only road by which an invading army can penetrate from northern into southern Greece. It lies south of the present course of the river Spercheius, between Mount Œta and what was anciently an impassable morass bordering on the Maliac Gulf. In the pass are several hot springs, from which T. probably received the first part of its name. T. has won an eternal celebrity as the scene of the heroic death of Leonidas (q. v.) and his 300 Spartans in their attempt to stem the tide of Persian invasion (480 B.C.). Again, in 279 B. C., Brennus, at the head of a Gallic host, succeeded, through the same treachery that had secured a victory to Xerxes, in forcing the united Greeks to withdraw from the pass.

THERSI'TÉS, son of Agrius, whom Homer, in the *Iliad*, makes the ugliest and most impudent talker among the Greeks before Troy. His name in antiquity was a synonym for dastardy and malevolent impudence. The later poets say that he was slain by Achilles for calumniating him.

THESAU'RUS. See DICTIONARY.

THE'SEUS, one of the most celebrated personages of the Greek heroic age. The legend of his career is differently told, but he is usually said to have been the son of Ægeus, king of Athens, by Æthra, daughter of Pittheus, king of Troezen. He was brought up at the court of his maternal grandfather, and, on reaching manhood, proceeded to his father's residence at Athens. On his way thither, he performed several famous exploits, such as the destruction of Periphetes, Sinis, Phæa, the Krommyonian sow, Skiron, Kerkyon, and the fell robber Prokrustes. See PROCRUSTES. After his arrival, Media sought to poison him, but her plot failed. Ægeus recognized his son, and Media and the sons of Pallas were banished. The next feats of T. were the capture of the Marathonian bull, and the deliverance of Athens from its dreadful tribute of youths and maidens to the Cretan Minotaur (q. v.), in which he was assisted by the Cretan princess, Ariadne (q. v.). On his return to Athens, his father Ægeus destroyed himself, and T. succeeded to the throne. In his new capacity of ruler, he displayed no less wisdom than he had formerly shown heroism. To him the legend ascribes the consolidation of the twelve petty commonwealths of Attica into one state, an event that certainly did occur at some period of Attic history, which was commemorated by the festival of the *Synœkia*. T. also reorganized the Athenaic festival, and re-named it the Pan-Athenaic, founded the Isthmian games, and many other institutions; but soon after, the craving for his old stirring life returned, and having laid down his authority, he set out along with Herakles in quest of new adventures. They fought the Amazons, and T. carried off their queen, Antiope or Hippolyte, by whom he had a son.

After the death of Antiope, he married Phædra. The legend makes him take part in the Argonautic expedition by a ludicrous anachronism, join in the Calydonian hunt, help Peirithous and the Lapithæ against the Centaurs, and assist in the attempt to rescue Persephone from the lower world (which led to a long imprisonment there, from which he was delivered by Herakles). Returning to Athens, he found that the minds of the people had been prejudiced against him during his absence, and as he could not re-establish his authority, he withdrew to Skyros, where he was treacherously destroyed by King Lykomedes. What grain of historical fact may lie in the myth of T. it is hard to say. One of the most brilliant figures of the heroic age, reminding us, by his valor, wisdom, and generous love of the fair sex, of a knight of chivalry, we are loath to yield him up as a victim to the ravenous maw of criticism; yet all that can be said for his historic reality is, that so finished and admirable a prince is more likely to have been a legendary tradition of some real hero of primeval times, than a mere creature of the poetic imagination.

THE'SIS, a Greek term, strictly signifies a 'placing' or 'setting'—e. g., Pindar's *epéon thesis* (Ode iii. 14—the 'arrangement of words' in verse; but subsequently was employed by the philosophers (Aristotle, &c.) to denote an intellectual position that had to be maintained. This is the sense in which the word was understood by the scholastics of the middle ages.

THESMOPHO'RIA, a famous festival anciently celebrated in different parts of Greece, but especially in Attica, in honor of Demeter, as the *Thesmophoros* or 'law-giving' goddess, inasmuch as, by the introduction of agriculture, she gave the first impulse to civil society, and more especially to the honorable bond of marriage. The Thesmophoria lasted three days, from the 11th of the month Pyanepsion (October). Only married women could take part in the ceremonies. After certain preliminary purifications (among which abstinence from sexual intercourse was prominent), the women inaugurated the solemnity by marching in procession from Athens to Eleusis, where the night was spent in celebrating the mysteries of the goddess. The next day, called *nesteia*, or the 'day of fasting,' was spent in mourning. The women sat for a while on the ground around the statue of Demeter, and ate nothing but cakes made of sesame and honey. They next proceeded barefooted to the Thesmophorion or temple of Demeter, where they deposited their mystical offerings to the goddess. On the third day, called *Kalligeneia* in honor of Demeter as the 'mother of beautiful offspring,' fasting was exchanged for merriment, jollity, and raillery.

THE'SPIS. See DRAMA.

THESSALO'NIANS, FIRST EPISTLE TO THE, one of the earliest epistles of St. Paul—perhaps the very earliest—was probably written at Corinth about the close of the year 52 A.D., and seems to have been occasioned by the 'good tidings' which Timothy brought him of the 'faith and charity' displayed by his Macedonian converts. It may be divided into two portions, a *narrative* and a *hortatory;* the former embracing the first three chapters, and terminating with a prayer for the Thessalonians, the latter the remaining two. From the narrative portion we derive much important and deeply interesting information regarding the 'Church of the Thessalonians;' but perhaps its great value consists in the picture it presents to us of the apostle himself—'bold in God,' yet 'gentle, even as a nurse cherisheth her children;' scorning to use 'flattering words,' or to 'seek glory' from an assertion of his apostolic dignity; nay, in the excess of a noble pride, 'laboring night and day because he would not be chargeable unto any.' The Epistle is conspicuous for the absence of the ordinary doctrinal element; even the word 'justification,' it has been remarked, does not once occur: on the other hand, it is penetrated with a deep conviction of the nearness of the second coming of Christ, and with an undefined fear lest, in spite of all his labors, the 'tempter' (probably, in this case, the Hellenistic Jews of Thessalonica) should seduce the Thessalonian Christians from the 'faith.' Schrader (*Apostel Paulus*) was the first to impugn the genuineness of the Epistle. He was followed in the same line by Baur; but their opinions have met with little favor among scholars of any party.—See Lünemann in Meyer's *Commentary*, Jowett's (2d ed. 1859) and Ellicott's (3d ed. 1866) *Commentaries*.

THESSALONIANS, SECOND EPISTLE TO THE, was likewise written at Corinth, and in all probability not long after the first. It is generally thought to have been occasioned by the misapprehension of the apostle's meaning on the subject of the coming of Christ to judgment, to which the previous letter had given rise, although Hug and others consider the expression, 'be not troubled. . . . by letter, *as from us*' (chap. ii. 2), as indicating that somebody had forged an epistle in Paul's name; and it is scarcely possible to interpret the passage at the close of the letter, 'The salutation of Paul with mine own hand, which is the token in every epistle: so I write' (chap. iii. 17), otherwise than as a precaution against forgery. From its contents, we gather that adversaries of the apostle had been at work among his Macedonian converts, and that they had not scrupled to misrepresent his teaching, particularly on the great topic above mentioned. Who they were, we cannot be sure, but it is probable that they were Jews or Judaizing Christians. They must have obtained a considerable measure of success in their nefarious enterprise, for we are distinctly aware of a sharper and more imperious tone in the language of Paul. He now teaches more precisely that Christ could not come until the antagonistic forces in human or diabolic society had made themselves more prominent, and done their worst. The genuineness of this Epistle is as certain as that of the first. See the commentaries previously mentioned.

THESSALONI'CA. See SALONIKI.

THE'SSALY, the largest division of ancient Greece, lay to the south of Macedonia and the east of Epirus, being separated from the latter by Mount Pindus, and from the former

by the Cambunian Mountains, the Ægean Sea bounding it on the east, and the Maliac Gulf and Mount Œta on the south. T. proper is a vast plain shut in on every side by mountains; on the N. and W. by those already named, on the S. by Mount Othrys, and on the E. by Mounts Pelion and Ossa, the only opening being the Vale of Tempe in the north-east, between Ossa and Olympus. The plain of T. is said at one time to have been a vast lake, the waters of which found an outlet by the Vale of Tempe. This plain is drained chiefly by the river Peneius (now *Salambria*), which traverses the country in a north-east direction, and its tributaries, and is the most fertile in all Greece, producing in ancient times abundance of corn and cattle, and a breed of horses considered the finest in Greece.

History.—T. was originally called Æolia, indicating that the country was at one time inhabited by Æolians, who, however, were either expelled (proceeding south, and taking up their residence in Bœotia, &c.) or reduced to slavery by immigrants from the more rugged region of Epirus about 1000 B.C. As in Laconia, the inhabitants of T. appear to have been divided into three classes —1. There were the Epirote conquerors, who became rich landed proprietors; 2. Those descendants of the original inhabitants, who, although dependent on the nobles, yet possessed a few privileges —corresponding to the Laconian Perioeci; and 3. The Penestæ, or those of the original inhabitants who had been reduced to serfdom, and who cultivated the lands of their conquerors, corresponding to the Helots, although, on the whole, their condition was better. These latter frequently rebelled against their masters, who were very frequently at war among themselves. Each of the four districts into which T. proper was divided was regulated by a council of its own, but they were occasionally united under a Tagus or president, whose power and time of office appear to have been indefinite. The government, from an early time, appears to have been oligarchical in the separate cities—of which Pharsalus, Larissa, Heracleum, and Pheræ were the chief—the principal power being in the hands of the two great families of the Aleuads and Scopads, famous for their hospitality and encouragement of poets and artists.

T., however, never played any important part in Grecian history, and it was only after the end of the Peloponnesian war that it exercised any influence on the affairs of Greece. About 374 B.C. Jason, tyrant of Pheræ, was elected Tagus of all T. The rule of Jason's successors became so unbearable, that aid was sought from Philip of Macedon, who in 344 subjected the country to Macedonia. T. remained subject to the Macedonian kings, till the victory of Cynoscephalæ, in 197 B.C., brought it under the protection of Rome. Under the emperors, T. was united with Macedonia, but after Constantine it was a separate province. In 1204 A.D., with other portions of the Eastern Empire it came under the dominion of the Venetians, and in 1355 was taken by the Turks. The restoration to Greece of T. south of the Salambria was recommended by the Berlin Congress in 1878; and subsequently various modifications of the Greco-Turkish frontiers were proposed, the Greeks endeavoring to secure the cession of the whole of T. War between Greece and Turkey seemed imminent; but in 1881 Turkey agreed to cede, and Greece to accept Thessaly south of the ridge of mountains forming the watershed of the Salambria (the ancient Peneus), by much the largest and most fertile section of the province.

THE'TFORD, a municipal and parliamentary borough and market-town of Norfolk, on the Little Ouse, 95 miles north-north-east of London by the Great Eastern. Malting is carried on to a considerable extent, and there is some trade on the Ouse, which is navigable up to this point. There are remains of a Cluniac priory, and of other religious edifices. Pop. (1881) 4034. The borough was disfranchised by the reform bill of 1867.

At T., which is a very ancient town, a synod was held in 669; and two centuries later, in 870, it was taken and sacked by the Danes.

THE'TIS, daugther of Nereus and Doris, was married against her will by the gods to Peleus, by whom she became the mother of Achilles. She dwelt in the depths of the sea with her father, and had, like Proteus, the power of changing her shape. Her hand is said to have been sought by Poseidon and Zeus, who gave up the pursuit on Themis declaring that the son of T. would be greater than his father.

THIAN-SHAN, or CELESTIAL MOUNTAINS, a great mountain-system, consisting of several ridges, mostly parallel, in Central Asia, are situated to the south and east of Lake Issykkul, in lat. about 42° N. They are said to extend in an east-north-east direction from the vicinity of Samarkand, to long. about 96° E.—a distance of 1500 miles. As this range, however, was never visited by any European till P. Semenof, commissioned by the Imperial Russian Geographical Society, explored a part of it in 1858, little has been actually ascertained regarding its character and dimensions. It is one of the four great ranges, trending in a general direction from west to east, which traverse Central Asia—and these respectively are the Altaï-Sayan, or Altaïan Mountains, in lat. about 50° N.; the T. Mountains, lat. about 42° N.; the Kuen-lun system, lat. about 36° N.; and the Himalaya Mountains (q. v.). In long. 76°—79° E., the T. Mountains are divided into two great, nearly parallel ridges, and enclose between them a deep valley, about 15 miles in average breadth, through which the river Narin—the chief head-water of the Sir-Daria—flows in a west-south-west direction. East of these ranges, the mountains are known as the Tengri-Tagh; and of this subdivision, the chief peak is the Tengri-Khan (i. e., Spectre-Prince), in lat. 42° 23′ N., long. 79° 40′ E., and which rises to the height of 21,000 feet. East from the Tengri-Tagh, the T. Mountains continue in a double chain, and at an average height of 11,330 feet. In long. 90° E. is the volcano Pe-shan, which is believed to have been in activity prior to the 7th century; and in the vicinity are several other volcanoes. These are remarkable as the only instances of volcanic fires at so great a distance—1500 miles—from the sea. In long. 88° E. is the huge mountain-mass of Bogdo-Oola, perhaps the culminating point of the whole system, and certainly the peak on which there is the greatest accumulation of snow. There are several passes of from 10,000 to 13,000 feet in height.

THICK-KNEE (*Oedicnemus*), a genus of birds of the family *Charadriadæ*, most nearly allied to the plovers, although, from their comparatively large size, they have often been ranked with bustards. They differ from the true plovers in having both mandibles inflated towards the tip, and not merely the upper mandible. There are about half a dozen species. Only one occurs in Britain, the COMMON T. (*O crepitans*), also known as the Thick-kneed Plover, Thick-kneed Bustard, Great Plover, Norfolk Plover, and Stone Curlew.

THIELT, a town of Belgium, in the province of West Flanders, 16 miles south-south-east of Bruges. It is a well-built town, containing several interesting edifices and institutions. An important linen market takes place here annually, and the principal manufactures are linen, woollen, and cotton goods, gloves, vinegar, beer, and tobacco. Pop. (1876) 10,209.

THIERRY, JACQUES NICHOLAS AUGUSTIN, an eminent French historian, was born at Blois on the 10th May 1795. He received his education in the normal school of his native town, and became a teacher in a provincial school. In 1814, he resigned this charge, came to Paris, and published his first work, entitled *De la Réorganisation de la Société Européenne*. In this treatise he considers the practicability of having one government for the whole of Europe, preserving at the same time the nationality of each people. Adopting the views of St. Simon, T. became the assistant of that philosopher, in which capacity he worked for three years. In 1817, he joined Comte and Dunoyer as editors of the *Censeur Européen*, in which he wrote many articles, literary, political, and historical. In 1820, he became engaged on the *Courrier Français*, in which he published his *Dix Lettres sur l'Histoire de France*. He now began to addict himself almost exclusively to historical writing. Having given up the *Courrier*, he published his masterpiece, *L'Histoire de la Conquête d'Angleterre par les Normands* in 1825, and his *Lettres sur l'Histoire* (1827), works which had great success; but this success was dearly bought, as the necessary labor seems to have ruined the eyesight of the author. Becoming quite blind in 1830, he went in that year to Hyéres for the benefit of his health. Here he met Julie de Quérengal, an authoress of considerable repute, whom he married in the following year.

He seems to have been able partially to resume work about this time, and in 1835 he published his *Dix Ans d'Etudes Historiques*, the introduction to which is one of the most eloquent of his works. In 1840 appeared his *Récits des Temps Mérovingiens*, which work gained the great Gobert prize. The preface gives an interesting and eloquent account of the history of his own literary labors. His last publication was the *Essai sur l'Histoire de la Formation et de Progrès du Tiers Etat*, in 1853. The author died 22d May 1856, his wife having predeceased him in 1844. During his life T. enjoyed the success and popularity due to his industry and talents. His careful research has thrown much light on the early ages of which he has written, and dispelled much popular error regarding them. He is second to no French historian of the present day.

THIERS, LOUIS ADOLPHE, French historian and statesman, was born April 16, 1797, at Marseille. His father is variously reported to have been a locksmith, a decayed cloth-merchant, or an advocate at the parliament of Marseille; his mother belonged to an old commercial family which had fallen into poverty. He was placed by his mother's relatives in the Lyceum, where he achieved many victories over his young competitors. In 1815 he was sent to Aix to pursue the study of the law. Here he formed his friendship with M. Mignet the historian, in company with whom, as soon as he had taken his degree as advocate, he set off to Paris to seek his fortune. He lived for a time in obscurity and indigence, but obtaining an introduction to Lafitte, he was enrolled among

the contributors to the *Constitutionnel*, then the leading Liberal organ.

He became distinguished for the vigor and hardihood of his articles, and as in France the occupation of a journalist was at that time, and for many years afterwards, regarded with an estimation proportioned to its influence over society, the young political writer was admitted into the most brilliant circles of the Opposition. In the crowded saloons of Lafitte, Casimir Perier, the Comte de Flahault, the Baron Louis (the great financier of the era), and of M. de Talleyrand, he enjoyed an intercourse with actors in the grand revolutionary drama, which was eminently useful to him in the great undertaking which he had long meditated. *L'Histoire de la Révolution Française* at once placed the briefless advocate and young political writer in the highest ranks of literary celebrity. Three editions were soon called for, and the profits upon the sale, and the gift of a share in the *Constitutionnel*, conferred upon him by an admirer, raised him to comparative affluence. Leaving his garret in the alley of Montesquieu, he emerged into fame, and became one of the most prominent men of France in the two paramount fields of literature and politics. In January 1830, he established a new paper of more democratic principles, the *National*. Assisted by Armand Carrel and some of the ablest men of the Liberal party, T., in this journal, waged unrelenting war against the Polignac administration, which at length, stung beyond endurance, took the desperate measure of issuing the ordinances of July. The revolution of 1830 was the result.

T. now devoted himself to a public career, and was appointed Secretary-General to the Minister of Finance, and elected deputy for the town of Aix. His first appearance in the Chamber of Deputies gave no promise of his subsequent distinction. His diminutive person, his small face, encumbered with a pair of huge spectacles, and his whole exterior presenting something of the ludicrous, the new deputy, full of the impassioned eloquence of the revolutionary orators, attempted to impart the thrilling emotions recorded of Mirabeau. The attempt provoked derision, but soon subsiding into the oratory natural to him—simple, easy, vigorous, rapid, anecdotic—he became one of the most formidable of parliamentary champions. From 1832, when the Soult cabinet was constructed, he continued a minister, with one short interval, until 1836. He was by turns Minister of the Interior, Minister of Commerce and Public Works, and Minister for Foreign Affairs under various chiefs—Soult, Gérard, Mortier, and Broglie. In February 1836, he was nominated President of the Council and Foreign Minister by Louis Philippe. He only held this office until August 1836, when he passed into Opposition. In 1840, he was again called by the king to the premiership. He refused Lord Palmerston's invitation to enter into an alliance with England, Austria, and Prussia for the preservation of the integrity of the Ottoman Empire, from some lingering sympathy with the principles which dictated the first Napoleon's invasion of Egypt and Syria, and a desire to accomplish by diplomatic relations with Mehemet Ali that which Bonaparte had sought to effect by force of arms—a controlling power on the part of France in Syrian and Egyptian affairs.

Lord Palmerston entered into the treaty without France, Acre was taken by the English fleet, and Mehemet Ali was driven out of Syria. The popular irritation in France fostered by T. was excessive, and nothing but the peaceful character of Louis Philippe prevented the French nation from rushing into a war of defiance to all the powers of Europe. T. alarmed the continent by his threats of setting aside the treatise of 1815, and extending the French frontier to the Rhine. It was computed that he spent not less than £8,000,000 in military and naval demonstrations. The effect of the ill blood thus generated was felt shortly afterwards in the seizure of the Society Islands, and in the remonstrances which the British government saw reason to address to that of France respecting the ill treatment of Mr. Pritchard, their consul at Tahiti. Louis Philippe dismissed his bellicose prime minister, and Europe again tasted the sweets of repose. He employed his leisure in historical pursuits. His *Histoire du Consulat et de l'Empire*, begun in 1845 and completed in 1860, is one of the greatest historical works of the age. At the revolution of 1848, he accepted the Republic, but was banished after the *coup d'etât* of 1851 (see LOUIS NAPOLEON). After a short residence in Switzerland, he was permitted to return to Paris, where he published a continuation of his *History*. He re-entered the Chamber in 1863, having been elected deputy for the department of the Seine by the Liberal opposition.

In his speeches, T. constantly taunted the empire with the loss of foreign *prestige;* and these taunts are not to be left out of record when the disastrous war of 1870 is to be rightly accounted for. When that conflict became inevitable, he predicted the certain defeat to France it would lead to. The early disasters of the war brought him into a particularly prominent position. It was T. who suggested the laying waste of the country around Paris. He declined to become a member of the government of national defence, formed on the downfall of the empire; but voluntarily undertook diplomatic journeys to England, Russia, Austria, and Italy, on behalf of France—a self-appointed mission, in which he was unsuccessful, but by which he acquired the unfeigned gratitude of his countrymen. According to the suggestions of these four neutral powers, T. opened negotiations for peace with the King of Prussia at Versailles; which, however, were for the time unavailing. After the capitulation of Paris, T. was elected to the National Assembly by the vote of a third of the French nation, and was chosen by the Assembly to be head of the Provisional Government. Owing to his good sense, the French accepted the terms of peace offered by Prussia. In 1871, after having crushed the Commune and restored order, he ceased to be 'Chief of the Executive Power' of France, to become 'President of the French Republic;' and this office he held till May 1873, when, failing in his effort to make the republic permanent by definitive legislation, he made way for Marshal MacMahon. His death (5th September 1877) was a severe blow to the republicans of France, whose leaders had latterly come to regard T., though a 'Conservative Republican,' as head of the whole republican party. T. had been a member of the *Académie Française* since 1836.

THIERS, a manufacturing town of France, in the dep. of Puy-de-Dôme. It stands in a pleasant valley, on the right bank of the Durole, 23 miles E.N.E. of Clermont. Its manufactures of cutlery, paper, and playing-cards gave to the town a certain importance in the 17th century. Pop. (1876) 11,182.

THIRD, the name popularly given to a musical interval, or rather to two different musical intervals, which are distinguished as the *major* and *minor* third. The major third is the interval between a note and its mediant, as between C and E; its ratio is 4 to 5, and it comprises four semitones. The minor third has for ratio 5 to 6, as from A to C, and comprises but three semitones.

THIRDS, in Scotch Law, means the share which a widow, on surviving her husband, has in his personal property. During the marriage, his personal property, as well as her own, form one common fund called the goods in communion; and on the death of either, there is a division between the survivor and the children or next of kin. If there are children, they take two-thirds, and the widow takes the remaining third. But if there are no children or descendants of children, she takes one-half.

THI'RLAGE is, in the law of Scotland, a peculiar right or servitude enjoyed by the proprietor of a mill over the neighboring lands, whereby the owner or possessor of such lands is bound to carry the corn grown thereon to be ground at his mill. The miler or owner of the mill is entitled to certain duties from the suckeners, i. e., the possessors of the lands within the thirl or sucken, and these duties are called multures, being a proportion of the grain or flour. Such multures are called insucken multures; while outsucken multures are similar payments made by strangers, who are not bound to send their corn to the mill, but choose to do so. Many nice questions have been raised between proprietors on this subject; but these are technicalities which must sooner or later be abolished, and the whole system is unsuited to the present times. Thirlage is extinguished by the ruin of the mill or by forty years' exemption. In England, there is no similar right, except in some ancient manors where an immemorial custom to a like effect exists.

THIRSK, a parliamentary borough in the North Riding of Yorkshire, on both banks of the Codbeck, an affluent of the Swale, 23 miles north-west of York. It contains an old, large, and handsome Gothic church, and carries on manufactures of leather and saddlery. Pop. (1881) of borough, which returns a member to parliament, 6306.

THIRST is a well-known sensation, resulting from a peculiar state of the mucous membrane of the digestive canal, but especially of the mucous membrane and the fauces, usually caused by an insufficient supply of liquid. In cases of extreme thirst, there is a peculiar sense of clamminess in the mouth and pharynx; which, with the other disagreeable feelings, is almost immediately relieved by the introduction of liquid into the stomach, where it is absorbed by the veins. That the thirst is relieved by the absorption of the fluid, and not by its action as it passes over the mucous membrane, which seems to suffer most, is proved by the facts—(1) that injection of liquids into the stomach through a tube (in cases of wounded œsophagus), and (2) the injection of thin fluids, as water, into the blood, remove the sensation of thirst. An excessive thirst is often an important morbid symptom. It may arise from two very opposite conditions—one a condition of excitement, and the other of depression. Whenever the blood is in a state requiring dilution, and is too stimulating, as in fevers and inflammations, there is thirst; and, again, in cases of excessive secretion and exhaustion, as for example in cholera and in the two forms of diabetes, there is great thirst, which sometimes also attends the lowest stages of prostration in malignant diseases.

When there is a great loss of the watery portion of the blood

by profuse perspiration, caused not by disease, but by hard bodily exercise in a hot atmosphere, as in the case of coal-whippers, mowers and reapers, &c., there is always great thirst and from two to four gallons of beer or cider a day may, in these cases, be taken with impunity, if not with advantage. Cold tea, without milk or sugar, is the most satisfying drink under these circumstances. Independently of disease, great thirst may be induced by the use of salted meat or fish, highly-peppered curries, and other stimulating dishes, the ingestion of malt liquors drugged with salt and more pernicious matters, or of gin strengthened by sulphuric acid, &c. In all these cases, the symptoms point to the natural remedy.

THIRTY TYRANTS, at Athens, were a body of rulers invested with sovereign power after the close of the Peloponnesian war. They were all native Athenians, but members of the aristocratical party, and chosen by the Spartan conquerors, who, knowing the animosity existing between the democracy and oligarchy of Athens, hoped to rule the city through the agency of the latter. Their government was a positive 'reign of terror,' marked by the most infamous cruelties. Even Mitford, with all his hatred of democracy, speaks of the 'shamelessness of crime' as surpassing all that had previously occurred in Grecian history. It lasted only one year, when it was overthrown by the return of the Athenian exiles under Thrasybulus.

THIRTY TYRANTS of the Roman Empire, is the collective title given to a set of military usurpers who sprung up in different parts of the empire during the 15 years (253—268 A.D.) occupied by the reigns of Valerian and Gallienus, and amid the wretched confusions of the time, endeavored to establish themselves as independent princes. The name is borrowed from the Thirty Tyrants at Athens, but, in reality, historians can only reckon nineteen—Cyriades, Macrianus, Balista, Odenathus, and Zenobia, *in the East;* Postumus, Lollianus, Victorinus and his mother Victoria, Marius, and Tetricus, *in the West;* Ingenuus, Regillianus, and Aureolus, in Illyricum and the countries about the Danube; Saturninus, in Pontus; Trebellianus, in Isauria; Piso, in Thessaly; Valens, in Achaia; Æmilianus, in Egypt; and Celsus, in Africa.—See Niebuhr's *Lectures on Roman History*, and Gibbon's *Decline and Fall of the Roman Empire.*

THIRTY YEARS' WAR was not properly one war, but rather an uninterrupted succession of wars (1618—1648) in Germany, in which Austria, the most of the Catholic princes of Germany, and Spain, were engaged on one side throughout, but against different antagonists. This long-continued strife had its origin in the quarrels between the Catholics and Protestants of Germany, and the attempts of the former, who were the more powerful body, to deprive the latter of what liberty of worship they had obtained. The severe measures taken by the emperor, the head of the Catholic party, against the Protestant religion, led also to strictures on their civil rights; and it was to protect their political as well as their religious liberties, that the Protestants formed a union, 4th May 1608, with Frederick IV., the Elector Palatine, at its head. The rival union of the Catholic powers, under the leadership of the Duke of Bavaria, followed 11th July 1609.

In Bohemia, the immense preponderance in numbers (two out of three) and influence of the Protestants, had forced from their Austrian king an edict of toleration (11th July 1609), which was at first faithfully observed; but during the reign of Matthias, sundry violations of it were made with impunity; and as the influence of Ferdinand of Styria (see FERDINAND II), his successor, began to be felt in more flagrant partiality to the Catholics, the kingdom became a scene of wild excitement; three of the Catholic party were thrown from the window of the Bohemian council chamber at Prague, and ultimately Ferdinand was deposed, and Frederick V., the Elector Palatine, chosen in his stead (1619); and Count Thurn, at the head of an insurgent army, repeatedly routed the imperial troops, and actually besieged the emperor in Vienna. The Catholic princes, though as apprehensive as their opponents of the encroaching policy of Austria, crowded to the emperor's aid; and while the Protestant union and James I. of Great Britain held aloof from Frederick, whose sole allies were Bohemians (under Thurn), Moravians, Hungarians, and a Piedmontese contingent of 3000 (under Count Mansfeld), a well-appointed army of 30,000, under Duke Maximilian, advanced to support the Austrians, and totally routed Frederick's motley array at Weissenberg (8th November 1620, near Prague, afterwards reducing the Upper, while an army of Spaniards under Spinola ravaged the Lower Palatinate, and the Saxons (in alliance with the emperor) occupied Lusatia. The Bohemians were now subjected to the most frightful tyranny and persecution; a similar policy, though of a more moderate character, was adopted towards the people of the Palatinate—the Protestant union standing aloof, and subsequently dissolving, through sheer terror. But the indomitable pertinacity and excellent leadership of Count Mansfeld and Christian of Brunswick, two famous partisan leaders who ravaged the territories of the Catholic league, and the forced cession to Bethlem Gabor of large portions of Hungary and Transylvania, did much to equalize the success of the antagonistic parties.

Here the war might have ended; but the fearful tyranny of Ferdinand over all the Protestants in his dominions (Hungary excepted), drove them to despair, and the war advanced to its second phase. Christian IV. of Denmark, smarting under some injuries inflicted on him by the emperor, and aided by a British subsidy, came to the aid of his German co-religionists in 1624, and being joined by Mansfeld and Christian of Brunswick, advanced into Lower Saxony, while the emperor, hampered by the political jealousy of the Catholic league, was unable to oppose him. But when, by the aid of Wallenstein (q. v.), a powerful and effective army had been obtained, and the leaguers under Tilly, in co-operation with it, had marched northwards, the rout of the Danes by Tilly at Lutter (17th August 1626), and of Mansfeld by Wallenstein at Dessau (1st, 11th, and 25th April 1626) again prostrated the Protestants' hopes in the dust; yet a gleam of comfort was obtained from the victorious raid of Mansfeld through Silecia, Moravia, and Hungary, though his scheme for an insurrection in Hungary failed, and his death soon after, at Zara, freed the emperor from a formidable and irreconcilable enemy. The combined imperialists and leaguers meantime had overrun North Germany and continental Denmark, and ultimately compelled King Christian to conclude the humiliating peace of Lübeck (12th May 1629). This second great success seems to have turned Ferdinand's head, for not content with a still more rigorous treatment of the Protestants, and the promulgation of the *Restitution Edict*, which seriously offended even the Catholics, he stirred up Poland against Sweden, and insulted Gustavus Adolphus, both personally and in the persons of his ambassadors—insolent impertinences which he soon saw bitter reasons to regret. The Catholic league now forced him to reduce his army, and supplant Wallenstein by Tilly; while France was inciting Gustavus to the willing task of aiding the Protestants in Germany.

The war entered its third phase by the landing of the Swedes at Usedom (June 1630), and their conquest of Pomerania and Mecklenburg. Gustavus, by the exercise of a little wholesome pressure, induced the elector of Brandenburg to aid him; and though unable to save Magdeburg (q. v.), he marched to join the Saxons, completely routed Tilly at Breitenfeld (17th September 1631); victoriously traversed the Main and Rhine valleys; again routed Tilly on the Lech (5th April 1632), and entered Munich. By the judicious strategy of Wallenstein, he was, however, compelled to return to Saxony, where he gained the great victory of Lützen (q. v.); but his death, depriving the Protestants of the only man who could force the confederate powers to preserve unity of action, was a severe blow to their cause; though the genius and indefatigable zeal of his chancellor, Oxenstierna, and the brilliant talents of the Swedish generals, preserved the advantages they had gained, till the crushing defeat of Bernard of Weimar at Nordlingen (6th September 1634), again restored to the emperor a preponderating influence in Germany. Saxony now made peace at Prague (30th May 1635), obtaining such satisfactory terms for the Lutherans, that the treaty was within three months adhered to by all the German princes of that sect, and the Calvinists were left to their fate.

Final success now appeared to demand only one more strenuous effort on the part of Austria; but Oxenstierna, resolved to preserve to Sweden her German acquisitions, propitiated Richelieu (q. v.), by resigning to him the direction of the war; and the conflict advanced into its final and most extended phase. The emperor, allied for offence and defence with the Lutherans, was now also assailed through his ally, Spain, who was attacked on her own frontier, in the Netherlands, and in Italy; Bernard of Weimar fighting independently, with the view of obtaining Alsace for himself, opposed the leaguers; while the Swedes, under Baner, held North Germany, and by frequent flying marches into Silesia and Bohemia, distracted their opponents, and prevented them, after their successes over Duke Bernard, from proceeding with the invasion of France. The great victory of Baner over the Austrians and Saxons at Wittstock (4th October 1636), restored to Sweden the victor's wreath she had lost two years before; and from this time, especially under Torstensohn (q. v.) and Konigsmark, the Swedes were always successful, adding a second victory of Breitenfeld (2d November 1642), one at Yankowitz (14th February 1645), and numberless ones of less note, to their already long list of successes, carrying devastation and ruin into the hereditary territories, even to the gates of Vienna, defeating the best generals of the empire, till, from a profound feeling of inability to check them, the Austrians hardly dared appear to the north of the Danube. On the Rhine, the leaguers at first had great success—the Weimar troops, now in French pay, were almost exterminated at Duttlingen (24th November 1643); but after the Spanish power had been thoroughly broken in the Netherlands by Condé, the French were reinforced on the Rhine, and under

Condé and Turenne (q. v.), rolled back the leaguers through the Palatinate and Bavaria, and revenged at Nordlingen (3d August 1645) the former defeat of the Swedes. The emperor was now deserted by all his allies except the Duke of Bavaria, whose territories were already mostly in the hands of Turenne and Wrangel; and a combined invasion of Austria from the west and north was on the point of being executed, when, after seven years of diplomatic shuffling with an eye to the changing fortunes of the contest, the Peace of Westphalia (q. v.) put an end to this terrible struggle.

THISTLE (*Carduus*), a genus of plants of the natural order *Compositæ*, sub-order *Cynarocephalæ*, with spinous leaves, imbricated involucres, and heads of flowers, consisting of tubular hermaphrodite florets alone, very rarely dicœcious, stamens free, pappus deciduous, the receptacle having chaffy bristles. The flowers are sometimes large, generally purple, rarely white or yellowish. Recent botanists have divided this genus into two genera—the true T. (*Carduus*), in which the pappus is composed of simple hairs, and the Plume T. (*Cirsium* or *Cnicus*), in which the pappus is feathery.—The species of both genera are numerous, and are found in most of the temperate and cold parts of the northern hemisphere, annual, biennial, and perennial herbaceous plants of considerable size.—The MILK T. (*Carduus Marianus*), a biennial, native of Britain, and other parts of Europe, attains a height of 4—6 feet, and is remarkable for the milky veins of its large waved leaves. The bracteæ of the involucre are subfoliaceous and recurved. The young leaves are sometimes used as a spring salad. Blanched leaves are used in winter salads. They are also used as a boiled vegetable, along with the young stalks, after these have been peeled and soaked in water to extract part of their bitterness. The root is used as salsafy. In former times, the plant was frequently cultivated.—The creeping Plume T. (*Cirsium arvense*, or *Cnicus arvensis*), a species about 1—3 feet high, with creeping roots, pinnatifid leaves and numerous dicœcious flowers, is a very troublesome weed in fields, very common in Britain, and now too common, not only in Europe, where it is indigenous, but in America and other countries to which it has found its way. *Cirsium lanceolatum* and *C. palustre*, both common British plants, are also regarded as troublesome weeds. The former has larger flowers than any of the other species common in Britain. *Cirsium oleraceum* is a native of the north of Europe, but not of Britain, distinguished by its yellowish flowers, which are surrounded with large yellowish involucral bracteæ. The young leaves are used as a culinary esculent.—The BLESSED T. (*Carduus benedictus* of the pharmacopœias, *Cnicus benedictus* or *Cirsium benedictum* of modern botanists) is a native of the Levant and of Persia, resembling in appearance a *Centaurea*, with yellow flowers enveloped in leaves, and abounding in a gossamer-like down. The whole plant has a very bitter and disagreeable taste, and, besides a bitter extractive, contains much sulphate and muriate of potash and sulphate of lime. It is a powerful laxative-tonic medicine, and a strong decoction of it readily induces vomiting.—The COTTON T. (*Onopordon*) is a distinct genus, known by its receptacles being destitute of bristles, and coarsely and deeply honey-combed. The common Cotton T. (*O. acanthium*), a native of Europe, and found in England, but rarely wild in Scotland, if, indeed, it is a true native of that country, is, nevertheless, very generally called by gardeners and others the SCOTCH THISTLE. The national emblem of Scotland is not, in all probablity, any one species of thistle in particular, as botanically distinguished; though the Stemless T. (*Cnicus acaulis*, or *Cirsium acaule*) is in many districts of Scotland so designated.

Stemless Thistle (*Cnicus acaulis*).

According to the common tradition, the Danes (or Norsemen?) came upon the Scots unperceived in the dead of night; and, halting while their spies were trying to discover the undefended points of their opponent's camp, one of the spies chanced to tread upon a thistle of this species, and the loud imprecation which the sudden pain evoked aroused the unsuspecting Scots, who at once attacked the invaders, gained a complete victory, and dubbed the plant which had been the means of their success, the Scotch Thistle. The Cotton T. has large elliptic leaves, and a broadly winged stem. The young fleshy root and the stem, whilst still tender, are in many places boiled and eaten. The expressed juice of the plant was formerly reckoned good for cancerous sores and cutaneous eruptions.—Plants of the genus *Silybum*, distinguished by its monadelphous stamens, and of the genus *Echinops*, which has a very different manner of growth, and belongs to a very different section of the *Compositæ*, are often to be seen in flower-gardens, where they are known as Thistles. The name is also, generally with some addition, very often bestowed upon many plants which have little resemblance to any of these, except in their spinous character. *Centaurea Calcitrapa* is commonly known as the STAR T. (see CENTAUREA).—The CARLINE T. (*Carlina vulgaris*) is pretty common in dry hilly pastures in some parts of Britain.

THISTLE, ORDER OF THE, called also the Order of St. Andrew (q. v.). The following is a more complete account of the institution of the order than is given in the article referred to: The order is of no very ancient date. The earliest-known mention of the thistle as the national badge of Scotland is in the inventory of the effects of James III., who probably adopted it as an appropriate illustration of the royal motto, *In defence*. Thistles occur on the coins of James IV., Mary, James V., and James VI.; and on those of James VI. they are for the first time accompanied by the motto, *Nemo me impune lacesset*. A collar of thistles appears on the gold bonnet-pieces of James V. of 1539; and the royal ensigns, as depicted in Sir David Lindsay's armorial register of 1542,

Star, Collar, and Badge of the Order of the Thistle.

are surrounded by a collar formed entirely of gold thistles, with an oval badge attached. This collar, however, was a mere device until the institution, or, as it is generally but inaccurately called, the revival of the order of the Thistle by James VII. (II. of England), which took place on May 29, 1687. Statutes were issued, and eight knights nominated by James; but the patent for the institution of the order never passed the Great Seal. After falling entirely into abeyance during the reign of William and Mary, the order was revived by Queen Anne, December 31, 1703.

THISTLEWOOD CONSPIRACY, a conspiracy formed in 1820 by Arthur Thistlewood, a man of profligate habits, and a few other adventurers of desperate fortunes, to overturn the government of Britain, and assassinate the ministers of the crown. The opportunity was to be taken of the funeral of George III., when all the military would have left London for Windsor, to take possession of London, and plunder the shops. The ministers were to be massacred when assembled at a cabinet dinner, and the pieces of cannon in Gray's Inn Lane and the Artillery Ground were at the same time to be seized. A provisional government was to be established, and means taken to intercept communication with Windsor and Woolwich, and prevent any one from leaving England by sea. The conspirators were surprised, and most of them apprehended by the police in the garret in Cato Street, where their meetings were held, on February 23, the same day which had been fixed for the massacre of the ministers. A few turned king's evidence against the rest; and Thistlewood and four others suffered the penalty which the law annexed to treason.

THO'LEN, an island in the Netherlands, province of Zeeland, bounded on the S. by the Easter Scheldt, contains about 34,000 acres of rich land, and is defended from floods by strong dykes, the borders of which are planted with trees. Pop. 14,078. Wheat, rye, barley, oats, beans, and potatoes are extensively

grown. The annual produce of madder reaches a million of pounds-weight, and of flax, 400.000. Horses, cattle, sheep, and swine are kept in large numbers. Tholen, the chief town, with a pop. of 2540, is situated in the south-east corner of the island.

THOLUCK, Friedr. Aug. Gottreu, a German Protestant theologian, whose reputation is perhaps greater in England and America than at home, was born at Breslau, March 30, 1799, and studied, first, at the university of his native city, and afterwards at Berlin, where oriental studies claimed his special regard, the first-fruits of which was his *Suffismus sive Theosophia Persarum Pantheistica* (Berl. 1821). The state of his religious opinions may be conceived from his own confession, that when he left Breslau, he thought nearly as much of Mohammedanism as of Christianity. The influence of Neander, however, and still more of Baron von Kottwitz, a philanthropic Christian nobleman of Silesia, produced a radical change in his convictions and modes of thought, and as early as 1823, he appeared as a champion of evangelical doctrines in his *Wahre Weihe des Zweiflers* (True Consecration of the Sceptic; 7th ed. published at Hamb. 1851, under the title of *The Doctrine of Sin and the Propitiator*, and translated into English, French, Danish, Swedish, and Dutch). Next year he published his *Auslegung des Briefs an die Römer* (Exposition of the Epistle to the Romans; Berl. 1824; 4th ed. 1842; also translated into English and other languages). About the same time he was appointed Extraordinary Professor of Theology at Berlin; and in 1825, he paid a visit to England. On his return, in 1826, he succeeded Knapp as Ordinary Professor of Theology at Halle, where, with the exception of a brief official sojourn at Rome, he has ever since remained. T.'s position at Halle was far from pleasant at first, for the majority of the theological faculty, among whom was Gesenius, were very decided rationalists, and did all in their power to make the new professor miserable; but the latter, though not a man of very powerful intellect, was filled with a quiet, earnest, resolute *faith*, and he continued his evangelical labors in spite of all opposition, until they were crowned with success. The university of Halle is at present, mainly owing to T., as thoroughly Christian, though not, perhaps, so strictly orthodox as it was in the days of Francke. His kindness (and that of his wife) towards students, especially *poor* students, is proverbial, and has contributed not a little to his fame abroad. In 1843 he was chosen a member of the Consistory of Magdeburg, where he became Superior Councillor in 1867.

Besides the works already mentioned, we may specify among his exegetical writings his *Praktischer Commentar zu den Psalmen* (Practical Commentary on the Psalms; Hamb. 1843); *Commentar zum Evangelium Johannis* (Commentary on the Gospel of John; 6th ed., Hamb. 1844); *Commentar zum Briefe an die Hebräer* (Commentary on the Epistle to the Hebrews; 3d ed. Hamb. 1850; and *Philosophisch theologische Auslegung der Bergpredigte* (Philosophico-theological Exposition of the Sermon on the Mount; 3d ed. Hamb 1845). Of his dogmatic writings, the principal are contained in the *Literarischer Anzeiger für Christliche Theologie und Wissenschaft*, a journal now discontinued; and in his *Glaubwürdigkeit der Evang. Geschichte* (Credibility of the Gospel History; Hamb. 1837), a treatise directed against Strauss's *Leben Jesu*. Among his contributions to history of theology, are to be reckoned his *Vermischte Schriften grösstentheils apologetischen Inhalts* (2 vols., Hamb. 1839); *Der Geist der Luth. Theologen Wittenbergs im* 17 *Jahr* (The Spirit of the Lutheran Theologians of Wittenberg in the 17th Century; Hamb. 1852); *Das Academische Leben des* 17 *Jahrh.* (The Academic Life of the 17th Century; Halle, 1853—1854); and his *Geschichte des Rationalismus* (History of Rationalism), of which several parts—notably a *Vorgeschichte des Rationalismus*—have already appeared, but which is still unfinished. Besides these may be mentioned several volumes of sermons. T. died at Halle, 9th June 1877.

THO'MAS, St., one of the most westerly of the group of Virgin Islands, is situated in lat. 18° 20′ N. long. 65° W.; area (*Almanach de Gotha*, 1879), 33 square miles; population about 14,000. It belongs to Denmark.

The interior of the island is mountainous, and not very fertile. Since the emancipation of slaves in 1847, the cultivation of sugar has been entirely abandoned. Cotton is planted, but only in small quantity. The climate is hot, dry, and unhealthy; yellow fever is endemic, and preys much upon Europeans, the natives being seldom affected by it.

The principal town, Charlotte Amalie, is situated on the side of the mountain, and descends nearly to the margin of the harbor. The houses, which appear from the harbor tier above tier, and have a beautiful and picturesque effect, are built of a bright cream-colored limestone, surrounded with balconies, verandahs, and jalousies, fancifully painted, and the roof covered with galvanized iron or shingles (the latter gaily colored when brightened up with the rays of a tropical sun), and presenting at night, when lighted up with lamps, a very striking effect. The town itself is laid out with rather narrow streets, but there are some good stores and hotels in the place. The governor's house, to the east of the town, is a large and imposing building; and an ancient ruin, 'Blue Beard's Castle,' crowns an elevation. The harbor is land-locked on three sides; the entrance to it, fortified on both sides, is rather narrow. The harbor is spacious, and has deep water, is much occupied with shipping of many nations, and has been much improved since 1864 by dredging. The Royal Mail Steam-packet Company have made it a central station for their large steamers, from whence the intercolonial steamers diverge on their different routes through the adjoining seas. About 750 British vessels of all kinds, exclusive of ships of war and mail-packets, enter the harbor annually. The average annual value of the imports, exclusive of coal, is about £1,000,000.

THOMAS, Christians of St., a remarkable religious community settled from a very early date on the Malabar coast of the Indian peninsula. They take their name from the apostle St. Thomas, who, according to a very ancient tradition, for which, however, no very positive evidence or satisfactory authority can be alleged, preached in India, and is regarded as the apostle of that country. As early as the 6th c., the well-known voyager, Cosmas Indicopleustes, reports of numerous Christian communities settled in India, under the pastoral care of bishops sent from Persia. To this circumstance it may be attributed that the Indian Christians, like those of what may be called the mother church of the Persian kingdom, lapsed into the Nestorian heresy, which, after the decrees of Ephesus and Chalcedon, having been suppressed by the civil laws of the Roman Empire, was driven beyond the limits of Roman authority, and found its most favored seat among the hostile Persians. Once established among the people, these opinions continued to be professed by the Christians who survived in those regions the vicissitudes of the revolutions of which India in medieval times was the scene. Their seat was almost entirely along the Malabar coast, and extended from the south cape, Comorin, as far as Calicut; and they are found scattered throughout this length over the whole space from the western declivity of the Ghauts to the sea. From the time of their lapsing into Nestorianism, their bishops were ordained by the Nestorian patriarch of Babylon, and they possessed certain civil rights under the successive dynasties which ruled in the south of India. On the whole, however, they were much oppressed; and on the arrival of the Portuguese in 1598, the Christians of St. T., although Nestorians, regarded them as their deliverers.

Nevertheless, the diversity of creed was at once recognized by the western missionaries, and attempts were made by the successive bodies of missionaries, Franciscans, Dominicans, and finally Jesuits, to reconcile them to the Roman Church. A union, more or less real, was effected by a synod held at Diamper in 1599; and one of the Jesuit Fathers, Padre Roz, was named bishop in 1601. This union, however, was not lasting; they fell away once again from the Roman communion, and the expulsion of the Portuguese from Cochin by the Dutch completed the disruption. A considerable number of them, however, were again united to Rome through the missionaries of the Carmelite order; and towards the close of the 17th c., the Emperor Leopold I. obtained the leave of the Dutch to send a bishop and twelve priests of that order to the Malabar coast. One of the most serious impediments to the influence of those missionaries, as well with the schismatics as with the heathen, was found in the intrigues and jealousies of the Portuguese. In later times, the Christians of St. T. have for the most part been absorbed in the native Christian population. Their tenets were in the main those of the Nestorians of Chaldea and Mesopotamia, about the precise details of which much controversy has prevailed, and many conflicting statements have been made, according to the religious views of the various travelers or missionaries who have reported regarding them. Much of this conflict of testimony arises from a confusion of names rather than of things. See Nestorians.

THOMASIUS, Christian, a German philosopher and jurist, was born at Leipzig, 1st January 1655, studied at Frankfurt-on-the-Oder (1675—1679), and returning to his native town, commenced to lecture on law in a style perfectly free from the pedantry of the schools. In 1687, to the astonishment of his Latin-speaking colleagues, he adopted the German language as the vehicle of his expositions, published his programme for the following year in the same tongue, and commenced a monthly journal under the very German title of *Freimüthige, lustige und ernsthafte, jedoch vernunft- und gesetzmässige Gedanken oder Monatsgespräche über allerhand vornehmlich aber neue Bücher* (Honest, Merry, Sincere, yet Rational and Moderate Thoughts, or Monthly Talk concerning all Sorts of Books, but especially New Ones). This work, however, excited so much opposition that he was forced to leave Leipzig, and went first to Berlin, and afterwards (1690) to Halle, where, under the patronage of the Brandenburg court, his lectures were the means of establishing a university, since famous. In this university T. became Professor of Jurisprudence, and here he died, 23d September 1728. The great aim of T. was to harmonize and blend science and life;

hence his contempt for hair-splitting subtleties of which nothing could be made; his preference for the use of German rather than Latin in his academic lectures; his disinclination to all philosophical terminology, his depreciation of the school-men, &c. But more particularly he was among the first who insisted on dissociating natural right from morality, and in connection therewith, honorably signalized himself as a courageous opponent of trial for witchcraft and punishment by torture. The characteristic features of his mode of thought are contained in his *Vernünftige und Christliche aber nicht scheinheilige Gedanke und Erinnerungen über allerhand auserlesene, gemischte, philosophische und juristische Händel* (Rational and Christian, but not pretendedly Pious Thoughts and Recollections concerning sundry Choice, Mixed, Philosophical, and Juristic Transactions, 3 vols., Halle, 1723—1726; and in his *Geschichte der Weisheit und Thorheit* (History of Wisdom and Folly).—See Luden, *Christian Thomasius nach seinen Schicksalen und Schriften* (Berl. 1805).

THO'MASTON, a town and port of Maine, U. S., on the St. George River, 15 miles from the coast, and 80 miles east-north-east from Portland. Its extensive granite quarries are worked by the convicts of the state prison; 300,000 casks of lime are exported annually; registered shipping, 60,000 tons; 5 churches, 2 public libraries. Pop. (1870) 3092.

THO'MISTS. See AQUINAS.

THOMSON, JAMES, author of *The Seasons*, was born on the 11th September 1700, at Ednam, in Roxburghshire, of which parish his father was minister. He was put to school at Jedburgh, and afterwards sent to complete his education at Edinburgh. His intention was to enter the church, and he went through a full course of study with that object in view. His views, however, changed. From a very early age, he had been wont to express himself in verse; and in 1725 he betook himself to London, to seek fame and fortune as a poet. Almost his sole capital for the enterprise seems to have been his manuscript poem of *Winter*. This, with some little delay and difficulty, he disposed of to a publisher for three guineas; and as its success was not instant, his outlook was by no means brilliant. Gradually, however, the merits of the poem were recognized; successive editions were called for; friends and patrons were not wanting to the young author; and in no long time T. found himself as good as a made man and poet. The *Winter* was followed in 1727 by the poem *Summer; Spring* was published the year after; and *Autumn*, completing *The Seasons*, appeared in 1730, with a reissue of the previous portions. In 1729, T. produced the tragedy of *Sophonisba;* but though great expectations were formed of it, its success on the stage was but indifferent. A weak line which occurred in it—

O Sophonisba, Sophonisba, O,

as parodied by a wag in the pit into

O Jemmy Thomson, Jemmy Thomson, O,

afforded much merriment to the town, and somewhat killed the pathos of the author, otherwise with not much vitality in it.

During 1730—1733, T. was abroad in Paris and elsewhere with the son of Sir Charles Talbot, the Chancellor; and on his return, at the death of his pupil, the comfortable place was bestowed upon him of Secretary of the Briefs. This he held till it lapsed on the death of the Chancellor in 1737, which left him once more in considerable straits, which were, however, a little alleviated by a pension of £100 a year given him by the Prince of Wales. His tragedy of *Agamemnon*, produced in 1738, was, in Johnson's phrase, 'only endured, but not favored;' and his poem on *Liberty*, by himself considered his greatest work, was little relished by the public. His *Tancred and Sigismunda*, produced in 1745, was the only one of his tragedies which had any success, and its success was not of a signal kind. About this time, the accession to power of his friend Mr. Lyttleton secured him the office of Surveyor-general of the Leeward Islands, which, however, he did not long live to enjoy. He died of a neglected cold in August 1748, and was buried in the church of Richmond, without an inscription; but a monument was afterwards erected to his memory in Westminster Abbey. In the spring before his death he had published his finest poem, *The Castle of Indolence*. This piece, which is written in the Spenserian stanza, has all the descriptive power and opulence of imagination which distinguish his more popular *Seasons*, while in tone and diction it is much more chastened and harmonious. Together, they continue to maintain for T. a somewhat high place in the roll of British poets. Of his other works, with the exception of the song of *Rule Britannia*, nothing but the names is now remembered. As a man, T. was singularly amiable, and his careless, indolent generosity of disposition seems to have endeared him to all who knew him.

THOMSON, SIR WILLIAM, one of the few very great living mathematicians and natural philosophers, was born in June 1824. His father was Professor of Mathematics in the university of Glasgow. T. graduated in 1845, as second wrangler and first Smith's Prizeman at Cambridge, where he was shortly afterwards elected to a fellowship in St. Peter's College; and became Professor of Natural Philosophy in the university of Glasgow in 1846. This appointment he still holds. While still an undergraduate, he published several valuable papers. He was for some time editor of the *Cambridge Mathematical Journal*, and some of his most brilliant discoveries have appeared in its pages. He has also contributed to the *Comptes Rendus*, the Transactions and Proceedings of the Royal Societies of London and Edinburgh, and various other journals. All his numerous writings have the stamp of originality in a marked degree. In the mathematical theories of Elasticity, Vortex-Motion, Heat, Electricity, and Magnetism, he has made remarkable discoveries; among which we need merely mention the Dissipation of Energy, the beautiful idea of Electric Images, and the complete solution of the problem of telegraphing through a submarine cable. Popularly, he is best known by his association with the Atlantic cable, a gigantic idea, which, but for his investigations, might, perhaps, not have been realized, or even attempted. On its successful completion, in 1866, he was knighted. He has invented several excellent and useful instruments for various electrical purposes—such as electrometers and galvanometers; instruments for the determination of electric units in absolute measure, &c. He is a remarkable instance of the combination of the very highest powers of reasoning with the practical skill of the mechanician and engineer. In conjunction with Professor Tait, he published in 1867 the first volume of an extensive *Treatise on Natural Philosophy;* and his *Papers on Electro-statics and Magnetism* (a splendid monument of his genius) were collected and reprinted in 1872.

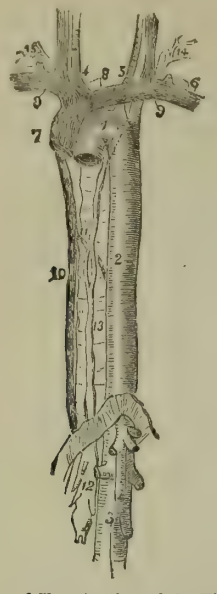
His elder brother, JAMES, Professor of Civil Engineering in Glasgow, has made various improvements in the construction of turbines; and other engines (see WATER-POWER); but is best known by his splendid discovery that the freezing-point of water is lowered by pressure; and the glacier-theory he has founded upon it. See HEAT, ICE, REGELATION.

THOR, the god of thunder, was the son of Odin and Earth (Yörd); his wife was Sif (= *sib*, friendship, love, and thus of the same import with Freyja). His palace, supported on 540 pillars, was called Thrudwanger; here he received the warriors that had fallen in battle. Thunder was caused by the rolling of his chariot, which was drawn by he-goats. He was in the vigor of youth, had a red beard, and was the strongest of all gods and men; the gods even called in his assistance when they were in straits. He was, in particular, a terror to the Giants (q. v.), with whom he was perpetually at strife, and whom he struck down with his hammer Miolnir (i. e., the smasher or mauler), which had the property of returning to his hand after being hurled; it had been made by cunning dwarfs. The sign of the hammer was among the heathen Teutons analogous to that of the cross among Christians. In the contest at the twilight of the gods, T. slew the serpent of Midgard, but fell at the same time poisoned by the venom exhaled from its mouth. The name of T. was widespread. The Saxons worshiped him as Thunar (High-German, *Donar*). Torden, the wrathful deity dreaded by the Lapps, who in his rage hurled down huge blocks from rocks, tore up trees, destroyed cattle and men, is evidently the Scandinavian Thor. The Gallic god Taranis—in an old inscription Tanarus—mentioned by Lucan, appears also to be identical, especially as *torrunn* in the Celtic languages still signifies thunder. The attribute of thunder is intimately associated with the Latin Jupiter and the Greek Zeus (see also INDRA). Of all the Asa-gods, T. had unquestionably the most worshipers. IN Upsala, according to Adam of Bremen, he occupied the place of honor in the temple between Odin and Frikke.

In Norway, T. was the national god, and here, as in Iceland, temples were almost exclusively erected to him. Offerings were made to him, particularly in times of pestilence. On the ground of the superior respect enjoyed by T., and of his being called 'Old Thor,' some place him in opposition to Odin, and consider him historically as an older divinity, only partly supplanted by the Odin doctrine. As rude force is the predominating element in T., the humorous element of the Scandinavian belief attaches to him. Thus, the giants often blinded him by magic, and made fun of him; yet he always shows his extraordinary strength in these cases, and in the long-run his opponents are invariably overcome by the hammer. Thursday is so called from T.; and the name survives in numerous names of places (Thuneresberg, in Westphalia; Thunderhill, in Surrey; Thurso), and also in personal names (Thorburn, in Scand. Thorbiörn).—Compare Uhland, *Der Mythus von Thor* (Stutt. 1836); Grimm, *Deutsche Mythologie*.

THORA'CIC DUCT, a canal equal in diameter to a goose-quill, proceeding from the *Receptaculum Chyli* (into which the contents of the lacteals are collected, and which is situated in the front of the body of the second lumbar vertebra), ascends along the front of the vertebral column, between the aorta and ascending vena cava, as high as the fourth dorsal vertebra; it then inclines to the

left, and passing behind the arch of the aorta, ascends as high as the seventh cervical vertebra, when it bends forwards and downwards, and terminates at the point of union of the subclavian and internal jugular veins of the left side, where it is provided with a



The Course and Termination of the Thoracic Duct.

1, the arch of the aorta; 2, the thoracic aorta; 3, the abdominal aorta; 4, arterior innominata; 5, the left carotid; 6, the left subclavian; 7, the superior vena cava, formed by the union of 8, the two venæ innominatæ; and these by the junction 9, of the internal jugular and subclavian vein at each side; 10, the vena azygos; 12, the receptaculum chyli; 13, the thoracic duct, often dividing in the middle of the thorax into two branches, which soon reunite (the course of the duct behind the great vessels is shown by a dotted line); 14, the duct making its turn downwards before terminating in the veins of the left side; 15, the termination of the trunk of the duct on the right side.—From Wilson's *Anatomist's Vade-mecum.*

pair of semilunar valves, which prevent the admission of venous blood into it. It is also provided with other valves on its upward course. This duct is not liable to any special diseases; but if its function of conveying chyle from its source into the general circulation be interfered with, as, for example, by the pressure of a tumor, the due nutrition of the system must be checked.

THO'RAX. See CHEST.

THORI'NUM, or THO'RIUM (symb. Th; equivalent, in the old system, 57·8; new system, 115·6), is a rare metal, much resembling aluminium, but taking fire considerably below a red heat, and burning with great brilliancy. *Thorina*, or *Thoria*, is supposed to be the protoxide, and is remarkable for its high specific gravity, 9·4. Thorinum was discovered in 1829 by Berzelius in an earth to which he had given the name *Thorina*, and which occurs in a rare black Norwegian mineral termed *Thorite*. None of the compounds of this metal are of any practical importance.

THORN. See CRATÆGUS, HAWTHORN, and SPINE.

THORN (Pol. *Torún*), a strongly-fortified town of Prussia, in the south of the province of West Prussia, on the right bank of the Vistula, 31 miles east-south-east of Bromberg by railway. The town was founded in 1232, was a member of the Hanseatic League, and contains many houses—as the town-hall—remarkable for their beautiful gables and interiors. It is the birthplace of Copernicus, whose monument is to be seen in the *Johannis-Kirche*, and a bronze statue to whom was erected in the market-place in 1853. An active trade in corn and timber is carried on. Pop. (1875) 18,667.

THORN, CONFERENCE OF, one of those efforts to explain away the differences between the several bodies of Christians, with a view to religious reunion, of which the 17th c. furnishes more than one example. The originator of this movement was the king of Poland, Ladislaus IV., who proposed his project for the consideration of a synod of the bishops of his kingdom held at Warsaw in 1643, and letters were addressed in consequence to all the several religious bodies in Poland, inviting them to send delegates to an assembly to be held at Thorn, for the purpose of the mutual explanation of their doctrines, with a view to the removal of all differences of belief. The conference met in October 1645, and was opened in a spirit of moderation; but it soon lapsed into disputation and controversy, and at length broke up without any result, November 21, 1645. The official account of the proceedings of the conference are printed in Calvi's *Historia Syncretistica.*—See also Schröckh's *Kirchengeschichte seit der Reformation*, iv. p. 509.

THORN-APPLE (*Datura*), a genus of plants of the natural order *Solanaceæ*, having a tubular 5-cleft calyx, a large funnel-shaped 5-lobed flower, a 2-laminated stigma, and an imperfectly 4-celled, prickly, or unarmed capsule. The species of this genus are annual herbaceous plants, rarely shrubs or trees; and are in general very narcotic, and productive of excitement or delirium. The common THORN-APPLE, or STRAMONIUM (*D. stramonium*), is an annual plant, with smooth stem and leaves, white flowers, and erect prickly capsules, a native of the East Indies, brought by the gipsies to Europe, where it is now very generaly to be met with, as also in Asia, the north of Africa, and North America. It is by some stated to be the plant from which the poisonous 'dri' of the gipsies is obtained. It contains a peculiar narcotic alkaloid, *Daturine*, and is one of the most powerful narcotic acrid poisons; but its leaves and seeds are employed, although rarely, in medicine. The leaves have an extremely nauseous over-powering smell, and a loathsome bitter taste; the seeds, which are of a dark-brown color, are still more poisonous. A variety with pale violet flowers and purplish violet stem is frequently cultivated in gardens as an ornamental plant.—Still more narcotic is the Soft-haired Thorn-apple (*D. metel*), a native of the south of Asia and of Africa. Robbers in India employ it in order to stupefy those whom they would rob, or rather to throw them into the condition of a waking dream. From its seeds, along with opium, hemp, and certain spices, a strong intoxicating substance is prepared, which the Mohammedans of India use in order to produce in themselves an indescribable joyfulness and extremely pleasurable feeling for a short time; but the use of it destroys the constitution. *D. Tatula*, another Indian species, has similar properties, and is very energetic; as is also *D. sanguinea*, the FLORIPONDIO of Peru, which is used by the Indians to prepare a very powerful narcotic drink, which stupifies when very diluted, and when strong, brings on maniacal excitement.—The beautiful *D. fastuosa*

Common Thorn-apple (*Datura stramonium*).

has flowers externally of a violet color, and white within, and is cultivated as an ornamental plant, especially a variety with what are called double flowers, which consist rather of two corollas, one within the other.—*D. arborea*, a native of Peru and Columbia, has begun to be also very generally cultivated in flower-gardens in Europe. It has very splendid pendulous white flowers, 9—12 inches long, which diffuse a sweet smell in the evening and at night.

THORNBACK (*Raia clavata*), a species of ray or skate, com-

Thornback (*Raia clavata*).

mon on most parts of the British coast. It attains a large size; the muzzle is little produced, and the form is nearly rhombic; the

tail has two small membranous fins near the tip, on the upper central ridge, and a small dilatation at the tip. The upper surface is brown, with lighter spots; the under surface white. The upper surface is rough with small points, and has numerous nail-like crooked spines, each with an oval bony base. The T. is much esteemed for food, particularly in autumn and winter, but is most abundantly captured in spring and summer, when it approaches the shore to deposit its eggs.

THOROUGH BASS. See FIGURED BASS.

THORVALDSEN, BERTEL, one of the greatest of modern sculptors, was born, it is supposed, at Copenhagen, on the 19th November 1770. Neither the place nor the day of his birth, however, can be fixed with absolute certainty; and he himself, when casually questioned as to the last, replied with a certain *brusque* felicity: 'I don't know; but I arrived at Rome on the 8th March 1797;' dating his birth, as it were, from the commencement of his career as an artist. He was the son of a poor ship-carpenter, and his first essays in art were made in the carving of figure-heads in the yard where his father worked. His education was otherwise neglected, so that through life he could but indifferently write or spell; but the genius for art was born with him, and in 1793 he gained the first gold medal for design at the Academy of Copenhagen; and along with it the privilege of three year's residence abroad for the purpose of study. Accordingly, in 1796, he sailed for Rome, arriving there as stated above. After long obscure and patient labor, his talent became conspicuous. From the celebrated Canova, in particular, he had early and generous recognition; and shortly, by the model for his great work, 'Jason,' he secured general admiration. No purchaser could, however, be found for it till, in 1803, just as in hopeless disgust the artist was about to return to Copenhagen, he received from the well-known Thomas Hope an order for its production in marble at a price which might be called munificent. From this time forward, prosperity and fame flowed upon him in full tide. In 1819, he returned to Denmark, taking the overland route, and everywhere on his journey special honor was paid him. His reception in Copenhagen was triumphal, and apartments were assigned him in the palace of Charlottenburg. He remained at home but a year, and at the end of it returned to Rome, where he continued to prosecute his art assiduously, up to 1838, when he left it, intending to pass his remaining years in his native country. Its climate, however, proved no longer suitable to him, and the year 1841 found him once more at Rome.

In 1844, having revisited Copenhagen, he died suddenly there in the theater, of disease of the heart, on the 24th March. All the works remaining in his possession he bequeathed to his country, to be preserved in a museum bearing his name, for the maintenance of which he also left the bulk of his fortune, reserving a sufficient provision for Madame Poulsen, his natural daughter. This magnificent and unique collection is now one of the chief glories of the metropolis of his native country. By his countrymen, he is naturally held in special honor; and their proud verdict, which ranks him the greatest of sculptors since Michael Angelo, is elsewhere more generally acquiesced in than is often the case in such instances of national enthusiasm. Anything like a catalogue of his chief works need not be here attempted. He addicted himself by preference to classical and mythological subjects; but his great works in the cathedral of Copenhagen, 'Christ and the Twelve Apostles,' 'St. John preaching in the Wilderness,' and the 'Procession to Golgotha,' sufficiently prove that he was determined to this preference by no incapacity to appreciate and grandly fulfil the demands of the Christian ideal. Of the many busts from his hand of eminent contemporaries, those of Byron and the great Danish poet Œhlenschläger are perhaps the most notable. The life of T. has been written by Hans Christian Andersen, by J. M. Thiele, and by Eugene Plon. English readers may consult a careful abridgment of M. Thiele's work, by the Rev. M. R. Barnard, published in 1865 by Messrs. Chapman and Hall, London; and a translation of M. Plon's *Life* by Mrs. Cashel Hoey, which appeared in 1874.

THOTH, also called TAUT or THEUTH, the Egyptian Hermes or Mercury, the mythical inventor of the arts and sciences, music and astronomy, and especially of speech and hieroglyphs or letters, over which he was supposed to preside. His name, indeed, meant 'speech,' or 'word,' and he personified the divine Logos, or intellectual power. See HERMES, EGYPT.

THOU, JACQUES AUGUSTE DE, or, as his name is frequently written, Jacobus Augustus Thuanus, son of Christophe de Thou, first president of the Parlément de Paris, was born in that city on the 8th October 1553. He was originally designed for the church, but when old enough to judge for himself, he gave up all thoughts of an ecclesiastical career. In spite of the difficulty presented by a sickly constitution, he pursued both literary and scientific studies with vigor and success. Taking a liking for the writings of Cujacius, he took up his residence at Valence in Dauphiné, where he attended the lectures of the celebrated jurist. At Valence, he made the acquaintance of Scaliger, with whom he maintained an unbroken friendship for the rest of his life. In 1578, he accepted, with reluctance, the office of ecclesiastical councillor of the Parlément of Paris. A firm adherent of royalty, in 1588, he was made councillor of state to Henry III.; and during the rest of the reign of that king, he took a leading part in all public affairs. On the accession of Henry IV., he was made keeper of the royal library. In 1593, he began his great work, the *Historia sui Temporis*, which principally occupied him during the remainder of his life. He took an important part in the arrangement of the Edict of Nantes; but, with this exception, he seems to have given but little attention to public affairs during the reign of Henry IV.; and the death of that monarch, in 1610, may be said completely to have ended his political existence. From 1604, when the first 18 books of the history appeared, the author held the position of first historian of his age. Eighty books appeared during his life; and the remainder, forming in all 138 books, were published in 1620, after the author's death, which took place on the 7th May 1617.

As a historian T. is eminently impartial; so devoid, indeed, did his work show him to be of religious prejudice, that he incurred the imputation of having no religion about which to feel; the consequence being that, in 1609, his work was put into the *Index Expurgatorius*—a fact which appears to have distressed him more than one would have expected. Written in Latin, the author has spared no pains to make it severely classical. It is generally held valuable rather from its workmanship than its material. The best English edition is that by Samuel Buckley, 7 vols. 1733. T. also wrote a number of Latin poems.—See *Autobiography*, ending 1601; also Colinson, *Life of Thuanus* (Lond. 1807).

THOUROUT, a town of Belgium, in the province of West Flanders, 11 miles west-south-west of Bruges. There are manufactures of starch, mustard, hats, and wooden shoes. T. was a place of great commercial importance in the middle ages. Pop. (1880) above 8000.

THRACE, anciently the name of an extensive country bounded on the N. by the Danube, on the E. by the Euxine, on the S. by the Ægean and Macedonia, and on the W. by Macedonia and Illyria. In pre-historical times, however, the name appears to have denoted the whole of eastern Europe north of Greece, including both Macedonia and Scythia; so, at least, one is disposed to understand the fable, that Oceanus had four daughters—Asia, Libya, Europa, and Thracia. It is, on the whole, very mountainous—whence, perhaps, its name T., from *tracheia*, rugged (?)—the principal range being Hæmus (mod. *Balkan*, q. v.), from which three lesser chains branch off in a south-easterly direction, the loftiest being Rhodope, the summits of which reach an elevation of more than 8000 feet. The three most important rivers of T. are the Strymon (mod. *Struma*), which, during the Greek period, formed the boundary between it and Macedonia; the Nestus (mod. *Carasu*); and the Hebrus (mod. *Maritza*, q. v.), the largest—all of which flow southward from Hæmus into the Ægean Sea.

Roughly speaking, ancient T., before the rise of the Macedonian power, comprised the territory now divided by the Turks into the provinces of Rumili and Bulgaria; but subsequently the Romans made the range of Hæmus the northern limit of T., and gave the region between Hæmus and the Danube the name of Mœsia (mod. *Bulgaria*). The climate was considered by the Greeks very severe—even that of Ænos, on the shores of the Ægean, being described by Athenæus as 'eight months of cold and four months of winter;' but it is believed that the ancient accounts are much exaggerated, or are only applied to T. poetically as the *North*, though it is not to be denied that, in the mountainous districts, the frost was often intense—as is still the case. The country was marshy, undrained, and overspread with dense damp forests (of fir, oak, chestnut, &c.), which must have considerably lowered the temperature; but large portions, especially in the south and east, 'such as the great plain of Adrianople and the land towards the lower course of the rivers Nestus and Hebrus,' were very fertile. The chief products were corn, millet, wine, and hemp. Cattle, sheep, horses, and swine were reared in great numbers. The region betwen the Nestus and the Strymon appears to have been infested by lions. Herodotus states that they attacked the baggage-camels of Xerxes on his march; but if this was anciently the case, these formidable animals have long since disappeared. Gold and silver mines were numerous and productive in the same locality, and the acquisition of these was the principal motive for Philip of Macedon's aggressions.

The question has been much discussed, to what race the Thracians belonged, and it cannot be said that it has as yet been satisfactorily settled. It is certain, however, that two different peoples went by this name in early times. It is repeatedly asserted by those writers who treat of the confused medley of tradition and myth which fills up the pre-historical annals of Greece, that a race of 'Thracians' inhabited part of the Hellenic peninsula,

and had even at one time extended themselves as far as Attica. To these pre-historic Thracians belonged, says Strabo, the Muses, and the cultivators of ancient music, Orpheus, Musæus, Thamyris, and Eumolpus; and the grand argument against confounding them with the Thracians of history, is the impossibility of a race so notoriously barbarous as the latter in language and manners, having sprung from the authors of Hellenic literature and art (see Müller's *Hist. of Greek Lit.*, p. 26, *et seq.*). But whether the pre-historic Thracians were properly Hellenes, or 'Pelasgians'—whatever *that* may mean—is indeterminable.

Passing now to the historic Thracians, whom we find settled in the regions north and east of Macedonia, we are again at fault. Of their manners and customs, of their character, and of their later history, we indeed know something; but of their origin and ethnological relations, we cannot be said to know anything. They were not Greeks, for they spoke a language which the latter called barbarous; but if (as Strabo asserts) the Getæ and Daci were branches of the Thracian family, and spoke the same tongue, we may conjecture that, ethnologically, the term 'Thracians' denotes a mixed Illyrico-Scythian race; though it is quite impossible, from want of evidence, to substantiate the conjecture. Herodotus, Xenophon, and Strabo are our chief authorities regarding the habits and practices of the people. From them we learn that they bought their wives, and sold their children. Polygamy was general, and when a husband died, his favorite spouse was slain over his grave. Before marriage the Thracian women enjoyed the utmost liberty; after it, they were guarded with Turkish rigor. War and robbery were the only honorable occupations of the men. They lived to steal, either from each other or from neighboring peoples. When not fighting or plundering, they spent their days in savage idleness, or in quarreling over their cups. Courageous, or rather ferocious, after the fashion of barbarous peoples, they yet lacked the steady valor and endurance of disciplined troops; at all times, their warfare displayed more fierceness and impetuosity than fortitude. Their treachery was probably no greater than that of other barbarians.

The history of T. may be sketched in a few words. The Greeks first became acquainted with the inhabitants when they began to plant colonies on the coasts. Of these, the principal were Byzantium (675 B.C.), Selymbria, Abdera (560 B.C.), Mesembria, Dicæa, Maronea Ænus, Cardia, Sestus, Amphipolisi, &c.; but their want of union—the fatal weakness of Hellenic civilization—hindered them from acquiring that measure of power to which they might have otherwise aspired, and enabled the Thracian chiefs of the interior to preserve their independence. In 513 B.C., Darius, king of Persia, marched through T., on his way to punish the Eupean Scythians, and on his return, left Megabazus, with 80,000 men to subdue the country. In this he partially succeeded, but new disturbances and complications arose between the Persians and Greeks, which resulted (480 B.C.) in the famous expedition of Xerxes, the details of which do not belong to Thracian history. We have only to mention that a consequence of the expulsion of the Persians from Europe was the resumption of liberty and the revival of prosperity among the Greek colonies in Thrace. Shortly before the Peloponnesian War, a native Thracian state—the Odrysian—had attained to great power and eminence under a ruler named Sitalces, who joined the Athenian alliance, but could not, in spite of his resources, prevent the triumph of Sparta in the north as well as in the south. The rise of the Macedonian kingdom, under Philip II. (359 B.C.), destroyed the independence of great part of Thrace. All the region between the Strymon and Nestus was incorporated with Macedonia, and Macedonian garrisons were established further east. Under the government of Lysimachus, the subjugation of T. became complete. On the fall of the Macedonian kingdom (168 B.C.) it passed into the hands of the Romans, and subsequently shared the vicissitudes of the Roman Empire. In 334 A.D., a colony of Sarmatians was planted in T. by Constantine, and in 376, another of Goths by permission of Valens. In 395, it was overrun by Alaric, and in 447, by Attila. In 1353, Amurath obtained possession of all its fortresses, except Constantinople, and it has ever since remained subject to Turkey. But see BULGARIA and ROUMELIA, EASTERN.

THRASHING is the separating of the grain or seeds of plants from the straw or haulm, a process which has been accomplished in different ages and countries by means less or more effective. The first method known to have been practiced was the beating out of the grain from the ears with a stick. An improvement on this method was the practice of the ancient Egyptians and Israelites to spread out the loosened sheaves of grain on a circular piece of hard ground 50—100 feet in diameter, and to drive oxen backwards and forwards over it, so as to tread the grain out; but as this mode was found to damage a portion of the grain, it was partially superseded in later times by the thrashing-sledge (Egypt, *noreg*, cf. Heb. *moreg*), a heavy frame mounted on three rollers, which was dragged over the heaps of sheaves. The use of the stick was, however, retained for thrashing the lighter kinds of grain. Similar methods of thrashing were employed by the Greeks and Romans, the stick (*fustis*, *baculum*, *pertica*), the treading by men or horses, and the thrashing-sledge (*tribulum*) being found in common use among them; but their thrashing-sledge, which is still to be seen in operation in Greece, Asia Minor, Georgia, and Syria, differed from the eastern one by having pieces of iron or sharp flints fastened to the lower side, in place of rollers. The primitive implement in Northern Europe was the stick, and an improved modification of it, the *flail*, has not yet been completely superseded. The flail consists of two sticks loosely fastened together at one end by stout thongs (*caplins*), one stick (the *hand-staff*) is used as a handle by the workman, and by a circular swing round his head he brings down the other stick (the *swiple*) horizontally on the heads of the loosened sheaves spread out on the barn-floor. In the hands of a good workman, this implement is found to perform its work pretty effectively, although slowly.

Various attempts were made to supersede the flail by a machine, but with little success, till 1787, when Andrew Meikle, an ingenious Scotch mechanic, produced a thrashing-mill so perfect, that even after having run the gantlet of nearly a century of improvers, it is essentially the machine of its original inventor. In Meikle's mill, the mode of operation is as follows: The sheaves are loosened and spread out one by one on the feeding-board A (fig. 1), with the ears towards the machine; they are then pushed

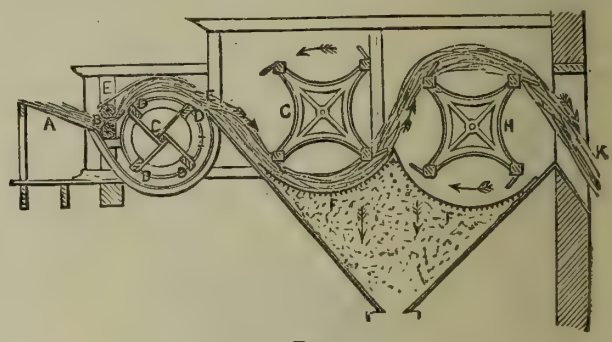


Fig. 1.

forwards till caught between two revolving fluted rollers of cast-iron B, B; and as soon as one sheaf disappears between the rollers, another is presented to them. Behind the rollers is a rapidly revolving *drum* or cylinder C, having four *beaters* D, D, D, D, or spars of wood armed with iron placed along its surface parallel to its axle; and these beaters striking the heads as they are protruded from between the rollers, detach the seeds and husks. Grain and straw then pass together over the cylinder, the former falling through the wire-work F, F, while the straw is carried forward by the circular rakes G, H, and, being by them thoroughly tossed and separated from the grain and chaff, is ejected at K. The grain which has fallen through the wire-work is received into a winnowing-machine, where it is cleansed from chaff, &c., and is then either discharged upon the barn-floor, or, as is the case with the most improved machines, is raised by a series of buckets fixed on an endless web, and again winnowed, to separate the perfect grains from the light and small seeds. Barley is, previous to the second winnowing, subjected to the process of 'hummelling,' by which the awns are removed; but the rest of the process is the same as above.

Since Meikle's invention, the improvements attempted on his mill have been chiefly confined to modifications of the drum; such as diminishing the distance between the drum and its cover, E, E, increasing the number of the beaters, and accelerating the speed of the drum.

The portable thrashing machine, now so generally employed in England and Scotland, has not the two grooved rollers, the loosened sheaf being at once submitted to the action of the thrashing-machinery; the drum, which is a *high-speed drum*, is provided with six beaters, and its cover is capable of being set at any required distance from it by means of screws. A modification of this machine has the drum wide enough to allow of the straw being fed in sideways; the cover encloses the machine for about three-fifths of its circumference; and the straw, after separation from the grain, is delivered by the rakes almost unbroken, and in a condition fit for being at once put up in *bolts*, or bundles, whence this species of drum is called a *bolting-drum*. In another form, the drum is armed with rows of spikes projecting outwards for about 2½ inches, which revolve between similar rows of spikes on the interior of the cover; this kind thrashes effectually, but breaks and chops the straw much more than the other forms of drum.

The attention of inventors and manufacturers of thrashing-machines has not only been turned of late to the question of securing increased speed, but also of providing against the risk of acci-

dents to those employed about the mills. The feeding of those high-speed drums which were getting so common was attended with considerable danger. Within the last few years, however, mills have been constructed, and are working well, with patent self-feeding apparatus. Considerable protection to life seems to have thus been afforded. The self-feeding apparatus consists of a covered hopper containing a shaking-board on which the sheaves are thrown sideways. Through this board, iron spikes curved like a fork or rake move forward and seize the unthrashed grain. A second row of spikes regulates to a nicety the quantity of stuff reaching the drum at a time; and while the shaking-board is falling to let the grain come in contact with the drum, the first row of spikes progresses to catch a fresh supply. Some of the English thrashing-machines fitted up in this way within the last few years thrash from 8 to 10 quarters of grain per hour, and perform their work in every respect satisfactorily.

The driving-power is wind, water, horse-power, or steam; the first of which is so very uncertain and unequal in its operation, that it has nowadays been mostly superseded by the others. Water-power is always desirable, and when it can be had in sufficient quantity or regularly, it is much to be preferred in point of economy, its mode of application to thrashing being either by the ordinary machinery of the Water-wheel (q. v.) or by *Barker's Mill* (q. v.). Horse-power was the agent in most common use in the

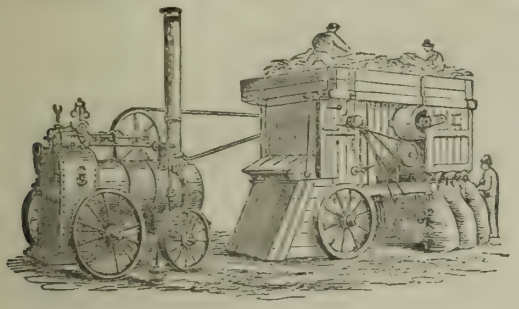


Fig. 2.

earlier days of thrashing-mills, the horses being yoked to beams attached to a vertical revolving shaft which communicated motion by means of bevelled gear to the thrashing-machine. But it was found that this kind of work was very trying for the horses, and interfered considerably with the other work of the farm; and accordingly steam-power, as being more economical, has extensively superseded horse-labor, engines of 4—10 horse-power being generally employed. Portable thrashing mills and engines are very generally employed in England, and to some extent in Scotland, being thought by many to be more economical, from their saving the labor of transporting the crop from the stack to the barn; and from their adaptibility to the requirements of a farmer who may rent more than one holding in a district. On the other hand, however, some prefer the fixed machine on account of cheapness and diminished liability to derangement.

THRA'SIMENE, Lake. See Trasimenus Lacus.

THREAD is an exceedingly small twine made by doubling and twisting several thicknesses of yarn so as to produce a strong and well-rounded line for sewing with, either of cotton, flax, or silk.

THREAD-WORMS. This term is employed by some zoologists to the whole order *Nematoda*—a word derived from the Greek, and signifying a thread-like form. Most writers, however, restrict it to the *Oxyuridæ*, which, in the early part of this work, have been included in the *Ascarides* (q. v.), but have been arranged in a separate family by Cobbold, who divides them into ten genera. Only one species, *Oxyuris vermicularis* (formerly known as *Ascaris vermicularis*) (q. v.), the small thread-worm, infests man, and is the commonest of the intestinal parasites.

THREATS, in a legal sense, are that kind of intimidation which has for its object to influence a person in abandoning or surrendering some legal right, or what is equivalent, paying money, to prevent some injury being done to him. When the threats are made by more than two persons, the offence usually assumes the form of Conspiracy (q. v.). In other cases, the usual form of the offence is the sending of a threatening letter—i. e., a letter either anonymous or otherwise—demanding money from the party addressed; otherwise, that he will be murdered, or his house will be burned, or he will be charged with some infamous crime. Whoever sends, or in directly or directly, with knowledge of the contents, causes to be received, any letter or writing demanding, with menaces, or without any reasonable or probable cause, any property, chattel, money, valuable security, or other valuable thing, is held guilty of felony, and liable to penal servitude for life, or imprisonment for three years. And whoever demands such things with intent to steal the same, is also guilty of felony, with like punishment. So, whoever sends a letter threatening to accuse a person of any crime, with a view or intent to extort money or gain any valuable security or property, is guilty of felony. Whoever threatens to accuse one of an infamous crime, with intent to extort money, or gain some valuable property, is guilty of felony. Whoever sends a letter threatening to burn or destroy any house, barn, building, stack of grain or hay, or to kill or wound cattle, is guilty of felony.

THREE KINGS, Feast of the, a famous medieval festival, identical with Epiphany (q. v.), or Twelfth Night, and designed to commemorate the visit of the three magi or wise men of the East (transformed by the mingled ignorance and reverence of the middle ages into great kings) to the infant Saviour. But the name is more particularly given to a kind of dramatic or spectacular representation of the incidents recorded in the 2d chapter of Matthew—as, the appearance of the wise men in splendid pomp at the court of Herod, the miraculous star, the manger at Bethlehem, the solemn and costly worship of the Babe—which was long very popular. In 1336, a peculiarly gorgeous representation was got up at Milan by the Preaching Friars. See Chambers's *Book of Days*, vol. i., page 62.

THRESHER. See Fox Shark.

THRIFT (*Armeria*), a genus of plants of the natural order *Plumbagineæ*, having the flowers collected into a rounded head, a funnel-shaped dry and membranous calyx, five petals united at the base, five distinct styles, and five stamens attached to the base of the petals. By many botanists it has been regarded as a subdivision of the genus *Statice*, from which it is distinguished chiefly by having the flowers in heads.—The Common Thrift (*A. maritima* or *vulgaris*) is a plant which grows in turf-like tufts, with linear leaves, scapes a few inches high, and beautiful rose-colored flowers, an ornament of the sea-coasts of Britain and of Europe generally, and also frequently found on high mountains. It is often planted in gardens as an edging, for which it is very suitable, being of a fresh green all the year, and exhibiting its fine flowers in profusion in July and August; but it requires to be renewed every two or three years, the smallest rootless sets growing, however, with great readiness in the moist weather of

Common Thrift (*A. maritima*).

spring. The flowers are an active and useful diuretic. From two drachms to an ounce of the flowers freshly gathered and quickly dried, should be gently boiled, and the patient allowed to drink as much of the decoction as he pleases. Some aromatic, as anise or cinnamon, is added.

THRIPS, a genus of small insects of the order *Hemiptera*, suborder *Homoptera*, allied to *Aphis* (q. v.), and included in the family *Amphidii* of some entomologists. The species are numerous and widely distributed. They are very active, and some of them very troublesome, by the injury which they do to cultivated plants, upon the juices of which they live. When disturbed, although they use their wings, their motion resembles leaping rather than flying. The wings are much fringed. A common British species is *T. cerealium*, an insect not a line in length or in extent of wing, which resides in the spathes and husks of cereal grasses, particularly wheat and rye, in the beginning of summer, causing the grain to shrivel; and which at an earlier season of the year, causes the abortion of the ear by puncturing the stems above the joints. It is most injurious to late-sown wheat, probably because

1, *Thrips cerealium* (female); *a*, natural size. 2, do. with wings extended; *b*, natural size.

the plants are weak, and therefore easily injured, at the time when the *Thrips* abounds. The larva is deep yellow, part of the head and two spots on the thorax dusky. The pupa is pale yellow and active. The perfect insect is flat, smooth, and pitch-color. The male is wingless, the female winged.

THROAT, AFFECTIONS OF THE. Common inflammatory sore throat has been already described in the article QUINSY; and other important throat-diseases, Aphthæ or Thrush, and Diphtheria, have also been discussed in special articles. The *malignant sore throat* of the older nosologists is now recognized as a modification of scarlatina. Another important variety of sore throat occurs as one of the forms of secondary syphilis. *Bronchocele* or *Goitre*, which, to a certain degree, is an affection of the throat, is specially described under the latter name.

The disease popularly known as *Clergyman's Sore Throat*, or *Dysphonia Clericorum*, and which is recognized in medicine under the name of *Follicular Inflammation of the Pharynx*, first shows itself by huskiness of the voice, with more or less coughing, hawking, and expectorating, from an uneasy sensation in the throat; there is, moreover, a constant inclination to swallow. On examining the back of the throat, its mucous membrane is seen covered with granulations, caused by an accumulation of secretion in the follicles, which sometimes burst and discharge their contents, which are of an elastic consistent nature. This discharge is occasionally followed by ulceration. The disease commonly arises from too prolonged or powerful exercise of the voice by persons in whom the mucous membrane of the throat is in a relaxed condition. Perfect rest from public speaking, preaching, acting, &c., is of more importance than anything else in the way of treatment, and a residence during the winter and spring in a mild and equable climate is expedient. Torquay, Ventnor, Nice, Mentone, Algiers, and Egypt, afford a choice of suitable residences. Tonics, such as iron, quinia, and strychnia (in small doses not exceeding $\frac{1}{20}$th of a grain, three times a day), should be tried; but the local application of a strong solution of nitrate of silver (from 20 to 80 grains in one ounce of distilled water), applied by a probang to the affected mucous membrane, is usually of far more service than internal remedies. The best work on this subject is that of Dr. Horace Green, an American physician.

Passing over several throat-affections of minor importance, we proceed to the consideration of wounds in the throat. These wounds are comparatively seldom the result of accident; they are more often made with a murderous intent, and most frequently they are made with the view of committing suicide.

The first duty of the surgeon, in treating a case of cut throat, is to arrest the flow of blood. Ligatures should be applied to wounded arteries, and steady pressure with the finger (beneath which a small pad of lint is placed) to wounded veins, such as the external jugular. If the internal jugular is wounded, fatal hæmorrhage will very rapidly ensue, unless the wound is immediately plugged with small pieces of sponge, or pressure with the finger is maintained as long as necessary. With a knowledge of these means of checking hæmorrhage by pressure, an intelligent non-professional person may be the means of saving life. When the bleeding has completely ceased, but not till then, means may be taken for bringing together the edges of the wound. In most cases, sutures, or even adhesive plaster, are inexpedient and even dangerous, and it is best to keep the parts in simple apposition. 'The patient,' says Mr. Gray, 'should be placed in bed in a moderately warm room, the shoulders well raised by pillows, and the head bent forward and retained in that position by a bandage, and the wound should be covered with a strip of wet lint or linen.'

THROMBO'SIS (derived from the Greek *thrombos*, a clot of blood) is a term originally suggested by Virchow, and was generally employed to designate an affection of the blood-vessels (either veins or arteries), which essentially consists in a coagulation of blood (forming a true clot) at a certain fixed spot. Under certain morbid conditions, the blood has a tendency to coagulate in its vessels during life, on the least provocation. Thus, slight pressure on the side of a vein will sometimes induce this coagulation, while in other cases it is due to inflammation of the tissues which surround a vein, or laceration of a vein (as when the placenta is expelled from the uterus). A clot thus formed in a vessel increases and extends from one to another, till it reaches and finally fills a large vessel. Clots of this kind occurring in veins have been noticed from the times of Ambrose Paré and Petit, who seem to have been the first to apply the term *thrombos* to them.

THRO'NDHJEM, or TRONDHJEM (Ger. *Drontheim*), the ancient Nidaros, and former capital of Norway, is situated in the Fjord of T., at the mouth of the little river Nid, 240 miles north of Christiania; pop. (1875) 22,597. T., which consists of the old town, founded in 997, and the suburbs of Blakland and Ilen, is built on the picturesque and undulating slopes of the Nid-Elv, and has regular and broad streets. The fortified islands of Munkholm and Christiansteen defend the capacious harbor, which is never closed by frost on the seaward side. Among the public buildings the most noteworthy are the Kongens-Gaard, or old palace, and St. Olaf's Church, the remains of the old cathedral, now partially restored, built in the 12th century, by Archbishop Oeysteen, who erected this noble Gothic pile on the site of the two early Christian churches which had been founded by Harald Haardrade and Olaf II. The fine western extremity of the nave was not completed till 1248. The body of the murdered St. Olaf was preserved within a costly shrine in the chancel of Christ Church, which ranked as the metropolitan church of Norway, where the kings of Norway have been crowned since the time of Magnus V. (1164). T. is the seat of government for the province and of a bishopric, and has a public exchange, the principal national bank, a public library, museum, various literary and scientific institutions, an institution for the deaf and dumb, an insane asylum, &c. The chief articles of trade are fish, tar, deal, and copper, which is obtained from the neighboring mines of Röros. Salted cod and herrings, which are found in large quantities at the entrance of T. Fjord, are important articles of export. Besides its shipping and coasting trade, T. is the center of considerable manufacturing activity, and has good sugar-refineries, distilleries, &c. The environs of T. are picturesque, and its position is one of considerable attraction, notwithstanding the high northern latitude (63° 25′); while the numerous historical events with which it is associated render it one of the most interesting towns in the Scandinavian kingdoms. The preponderance of wooden houses has somewhat diminished of late years, and the local authorities are endeavoring to enforce the use of stone for building purposes, in consequence of the frequent occurrence of great fires.

THRONE (Gr. *thronos*), the chair of royalty, an ornamented seat raised above the level of the floor on which it stands, often covered with a canopy, and intended for the use of a sovereign or other potentate. From an early period the Asiatic monarchs are represented as enthroned: the same usage of a dignified chair set apart for the sovereign was adopted in Greece, where also it was customary to represent all the greater gods as enthroned. In the middle ages and modern times, the throne has been in all monarchical countries the chair occupied by the sovereign on state occasions. The name of throne was also given, in the early centuries of the Christian church, to the raised seat in the middle of the tribune behind the altar, where the bishop sat surrounded by his clergy. The throne is now a common metaphorical expression for sovereign power and dignity.

THROSTLE. See SPINNING.

THROW, the term applied in Mining to the amount of Dislocation (q. v.) in a vertical direction, produced by a fault in the strata.

THRUSH (*Turdus* or *Merula*), a genus of birds of the family *Merulidæ* or *Turdidæ*, having a bill of moderate size, straight, the upper mandible convex, its point compressed, notched, and slightly curved downwards, the gape furnished with a few hairs; the nostrils near the base of the bill, oval, partly closed by a naked membrane; the first feather of the wing very short, the third and fourth longest; the tarsus longer than the middle toe, the outer toe connected with the middle toe at the base. The species are numerous and widely distributed, some of them inhabiting temperate and even cold countries, and some found only in tropical regions. Some of them are birds of passage, as the fieldfare and redwing. Some are gregarious, particularly in winter, as the species just named; others live solitary or in pairs.

The common British species are the Black-bird (q. v.), Fieldfare (q. v.), Redwing (q. v.), Ring Ouzel (q. v.), Song T., and Missel Thrush.—The SONG T., or THROSTLE (*T. musicus* or *M. musica*),

Song Thrush (*Turdus musicus*).

the mavis of the Scotch, is smaller than the black-bird, its whole length being not quite nine inches. Its plumage is brown, of various finely-mingled shades; the throat, sides of the neck, breast, and flanks yellowish, spotted with dark brown; the belly nearly white, with a few spots of dark brown; a dark brown streak, with a lighter brown streak over it, passing from the bill to the eye. It is found in all parts of Europe, but deserts some of the north-

ern parts in winter, being thus partially a bird of passage. It remains all the year in Britain. It feeds on insects, worms, slugs, snails, berries, and seeds. It often makes its nest in the center of a thick bush or shrub, and sometimes in an open shed. The eggs are usually four or five in number. The male takes part in the work of incubation, and is very attentive in feeding his mate whilst so occupied. The throstle is well known as one of the sweetest songsters of the groves. In captivity, it has been taught simple airs.—The MISSEL T. (*T. viscivorus* or *M. viscivora*) is about 11

Missel Thrush (*Turdus viscivorus*).

inches in entire length, and is the largest and strongest European species of the genus. The plumage is very similar to that of the Song Thrush. The tail is slightly forked, which is not the case in that species. The spots on the belly are more numerous, and black. The song is loud and clear, but not equal to that of the Song T. or of the black-bird. The bird delights in pouring forth its song from the very top of a tall tree. It also very often sings before or during wind and rain, whence it has received the name of Storm-cock. Its nest is generally fixed in the fork of a tree. It is found in almost all parts of Britain where there are woods. Its range extends through great part of Asia; it is found in India. —The WOOD T. (*T. mustelinus* or *M. mustelina*) is abundant in North America in summer, as far north as Hudson's Bay, retiring to tropical and subtropical regions in winter. It is rather smaller than the Song T., and very similar to it. It is of a very shy and retiring disposition. It has a clear but very simple song, which is to be heard in the depths of the forest, far from the haunts of men. Several other species are found in North America. India has some.—A common West Indian species (*T.* or *M. leucogenys*) is familiarly known by the name of Hopping Dick, and is a general favorite from its bold, lively manners, and its sweet song. All the species are in esteem for the table, and the Song T. is much sought for this use in Italy in the season of ripe grapes, when it becomes very fat. Gardeners in Britain well know how troublesome thrushes are where numerous, from their avidity for cherries and small fruit.

THRUSH, known also as *Infantile Sore Mouth*, is essentially a disease of early infancy, although it may occur at any age. Its characteristic symptom is the presence of small roundish white specks or patches on the lining membrane of the cavity of the mouth and throat, on the surface of the tongue, the angles of the lips, &c. These patches, which are termed *aphthæ*, look like minute drops of tallow or fragments of curd, and are formed by elevated portions of epithelium covering a drop of serous fluid; and as the dead epithelium falls off, a raw surface, or a dirty ash-colored spot, is left exposed. In thrush, crops of these little patches commonly succeed one another. These spots render the mouth hot and tender, in consequence of which the act of sucking is accompanied by difficulty and pain. In association with these local symptoms are indications of general constitutional disturbance, such as feverishness, drowsiness, sickness, flatulence, colicky pains, diarrhœa, &c. The stools are green and slimy, and not unfrequently acrid, as may be inferred from redness of the anus being a common symptom. The vomited matters are also green, and have a strongly acid smell, as also has the breath. The complaint sometimes seem to be the result of improper diet, if the child is being brought up by hand, or of unwholesome milk from a diseased or intemperate nurse; of bad ventilation, &c.; but in some cases the cause of the disease is not evident. The disorder usually lasts eight or ten days, and is only attended with danger when the local affection runs into a low form of gangrenous ulceration.' As undue acidity of the stomach seems to be an almost general symptom, the diet should be carefully regulated, and mild *antacids* prescribed. Dr. (now Sir Thomas) Watson specially recommends a mixture of 2 parts of dried carbonate of soda and 1 of gray powder (mercury with chalk), of which from three to five grains may be given thrice daily. As a local application to the patches, honey of borax may be applied with a camel-hair pencil; or a pinch of a mixture of powdered borax and loaf-sugar (1 to 8 or 10) may be placed occasionally on the tongue, and the infant allowed to spread it over the mouth.

THRUSH, or TRUSH, in the horse, consists in inflammation and ulceration of the sensitive surfaces within the frog, giving rise to a fœtid discharge, constituting unsoundness, and usually causing lameness. Want of cleanliness is the chief cause. Daily, when the horse returns to his stable, the foot should be washed out with soap and water, carefully dried, and the fissures filled with mineral tar. If amendment does not speedily ensue, a dressing of calomel should be substituted for the tar several times a week. Ragged or loose portions of the frog may be removed by the knife or scissors.

THUCY'DIDĒS, the great historian of the Peloponnesian War, born of the demus Halimus most probably in 471 B.C., is said to have been the son of Olorus and Hegesipyle, and connected with the family of Cimon. It is stated—on authority equally conjectural, however—that he was instructed in oratory by Antiphon, and in philosophy by Anaxagoras. Certain it is that, Athenian as he was, of good family, and resident in the most cultivated community in Greece, he must have enjoyed a most liberal education. He was further possessed, either by inheritance or by acquisition through marriage, of gold-mines in that part of Thrace lying opposite the island of Thasos. He left a son called Timotheus, and perhaps also a daughter, who is said by some scholars to have written the eighth book of his history. We know from himself that he was one of the sufferers from the terrible plague of Athens, and also one of the few who recovered. We have no direct evidence as to his having displayed in public the oratorical talent which he reveals in his history; but it is certain that he held military command, and that he had under him an Athenian squadron of seven ships at Thasus, 424 B C., when Eucles, who commanded in Amphipolis, solicited his assistance against Brasidas. The expected arrival of a superior force induced Brasidas to offer Amphipolis favorable terms, which were accepted.

T. arrived on the evening of the same day on which Amphipolis had surrendered; and though he prevented Eion, at the mouth of the Strymon, from falling into the enemy's hands, still his failure to save Amphipolis caused him to be sent into exile, probably to avoid the severer punishment which his enemy Cleon, then so popular with the Athenians, was designing for him. Where his exile was spent, is not known. Probably he lived a good deal in the Peloponnesus, if not also in Sicily, as has been inferred from his minute descriptions of Syracuse and its neighborhood. According to his own account, he lived in exile twenty years, and probably returned to Athens about the time when Thrasybulus liberated it, in the beginning of 403. Ancient authorities are all agreed that his end was a violent one, though whether it occurred at Athens or in Thrace, we have no means of ascertaining. The year of his death is generally fixed at 401. Uncertainty also prevails as to the time when he wrote his history. He is supposed, from hints supplied by himself, to have kept a register of the events of the war, from its outbreak to its close. His great work, chronologically divided into winters and summers—each summer and winter making a year—was subsequently re-arranged, probably by Alexandrine critics, into the books and chapters as we now have it; and of these books the eighth (and last) is supposed either to have not been written by him, or to have not received the same careful revision which he bestowed on the previous seven. There is hardly a literary production of which posterity has entertained a more uniformly favorable estimate than the history of Thucydides. This high distinction he owes to his undeviating fidelity and impartiality as a narrator; to the masterly brevity of his style, in which he is content to give in a few simple yet vivid expressions the facts which it must have often taken him weeks or even months to collect, sift, and decide upon; to the sagacity of his political and moral observations, in which he shows the keenest insight into the springs of human action, and the mental nature of man; and to the unrivalled descriptive power exemplified in his account of the plague of Athens, and of the Athenian expedition to Sicily.

Often, indeed, does the modern student of Greek history share the wish of Grote, that the great writer had been a little more communicative on collateral topics, and that some of his sentences had been expanded into paragraphs, and some of his paragraphs into chapters. But this want cannot have been felt by the contemporaries of T., while the fate of other ancient historians warns us that had his work, like theirs, been loser in texture, or less severely perfect, it would not have survived, as it has done, the wearing influence of time, or remained, in its own language, the *ktema es aei*—the 'possession for ever'—it has proved to the world. The best editions are those of Poppo (11 vols., Lps. 1821—1840), of Krüger (2 vols. Berl., 1846—1847), and—at least for historical illustration—of Arnold (3 vols., Oxford, 1830—1835). The best English translation is by Richard Crawley (1874); that of the Rev. Thomas Dale is also good.

THUG (from the Hindustani *thaga*, deceive; hence, literally, a deceiver, a cheat) is the name of a religious fraternity in India, which, professedly in honor of the goddess Kâlî, the wife of S'iva, is addicted to the committal of murders, and chiefly lives upon the plunder obtained from its victims. The name of Thugs is that by which this fraternity is generally known among Europeans in the more northern parts of India. In some provinces to the southward, they are called *Phansigars*, or 'stranglers,' (from the Hindustani *phansi*, a 'noose'). In the Tamil language, their name is *Ari Tulukar*, or 'noosers'; in the Canarese, *Tanti Kalleru*, or 'thieves who use a cat-gut noose;' and in Telugu, *Varla Vandla*, or 'people who use the noose.' In the south of India, they used to live under the protection of the native chieftains, who, on the consideration of a settled contribution, and probably also of a share in the result of their depredations, connived at their practices, which, to the uninitiated, were generally concealed under the guise of an honest industry, especially that of the culture of land.

The proceedings of the Thugs are generally these: Banding together in gangs of from ten to fifty, but sometimes also of a much greater number, they assume the appearance of ordinary traders, traveling, if enabled to do so by their wealth, on horseback, with tents, and all the comforts of opulent merchants; but if this be not possible, also in more humble characters. Each gang has its *Jemadar*, or leader; its *Guru*, or teacher; its *Sothas*, or entrappers; its *Bhuttotes*, or stranglers; and its *Lughaees*, or gravediggers. On arriving at towns or villages, they pretend to meet by accident, and to have no previous acquaintance with one another. Some of the gang are then employed as emissaries to collect information; and when learning that any persons of property are about to undertake a journey, they endeavor to insinuate themselves into their confidence, and usually propose to them, under the plea of safety, or for the sake of society, to travel in their company; or else, they follow them, waiting for the proper opportunity of carrying out their murderous work. The latter is generally perpetrated by throwing round the neck of the victim a rope or cloth, which one of the gang holds at one end, while the other end is seized by an accomplice; and while the two Thugs draw the noose tight, and press the head of their victim forwards, a third seizes him by the leg, thus causing him to fall to the ground. The fatal injury is then easily inflicted. Travelers staying in the same choultry, or public resting-place, are sometimes murdered in the night. In attacking a traveler on horseback, generally one of the gang goes in front of the horse, while another keeps himself in the rear; a third, walking by his side, when finding him off his guard, suddenly seizes him by the arm, and drags him to the ground: the sufferer is then strangled in the usual manner.

Three Thugs are therefore generally required to murder one man; two, at the least, are thought necessary; for to strangle a man single-handed is a rare occurrence, and a feat of this kind is esteemed by the fraternity a most honorable distinction, which goes far to ennoble, in the eyes of his fellows, the Thug who has acomplished it, and even his family, for many generations. After the murder is perpetrated, the body of the victim is generally mutilated, in order, it seems, to expedite its decomposition, and thus to guard against discovery. For the same reason, care is taken to inter the body at a spot where it is not likely to be found; and thus it could happen that entire parties of travelers were destroyed, and not a vestige of them was discoverable. The indiscriminate slaughter in which the Thugs seem to indulge, is to a certain extent restrained by superstition; thus, it is deemed unlucky to kill certain classes and castes; and, as a rule, the female sex is exempt altogether.

The mode of dividing the plunder is probably various. According to one account, 'a portion of it is usually appropriated to defraying the expenses of religious ceremonies; and sometimes a part was also allotted for the benefit of widows and families of deceased members of the gang. The residue of the booty being divided into several parts, was generally shared as follows: To the leader, two shares; to the men actually concerned in perpetrating the murder, and to the person who cut the dead body, each one share and a half; and to the remainder of the gang, each one share.'

The practice of Thugs is not restricted to adventures on land. The rivers of India also are infested by bands of these robbers, who have similar habits to those of the land Thugs. They generally go in considerable parties—the one assuming the dress of travelers of respectability, the others acting as boatmen. When going up the river, they always pretend to be men going on pilgrimage to Benares, Allahabad, or some other sacred place; when going down, they pretend to be on their way home from such places. The travelers intended for their victims are inveigled on the high-roads, and murdered inside the boat, while some of the gang above sing and play. At a signal given by these that all is clear, the bodies of the murdered men are thrown into the river.

The patron goddess of the Thugs is Devî or Kâlî, the wife of the god S'iva, and the deity of destruction. In her name they exercise their profession, and to her they ascribe its origin. Formerly, they believe, Kâlî co-operated with the Thugs, and assisted them in the disposing of the bodies of their victims by devouring them. But through an indiscretion of one of the fraternity, who, out of curiosity, pried into the proceedings of the goddess, she became displeased, and condemned them in future to bury their victims. But though she now refused her future assistance, she presented her worshipers with one of her teeth for a pickaxe, a rib for a knife, and the hem of her lower garment for a noose. Whether on the faith of this legend, or otherwise, it is certain that the pickaxe is the instrument which, by all the Thugs, is held in the highest estimation. Its fabrication is superintended with the greatest care, and it is consecrated to its duties under many and minutely regulated ceremonies; and after it has thus been prepared, it is only intrusted to a Thug selected for this dignity on account of his shrewdness, caution, and sobriety. The place where, and the manner in which, it is then deposited are likewise the subject of the strictest rules; and it is submitted to special purifications after each time that it has been used for the preparation of a grave. The pickaxe is, in short, looked upon with the highest reverence by a Thug; it is the symbol of his faith, and the chief object of his superstitions. That these superstitions are gross and numerous, may be easily anticipated. The belief in omens especially, plays a great part in a Thug's career. All his movements are regulated by it, and the learning of the Thugs consists in a thorough acquaintance with them.

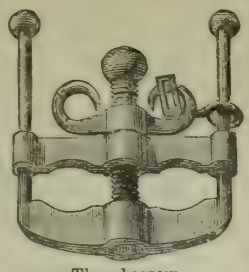
To a neglect of the warnings given by omens, or to an imperfect acquaintance with them, the Thugs invariably ascribe a failure of their undertakings, if it happens. When preparing for an expedition, the auspices are always solemnly taken; and only if favorable it is carried out. Among the bad omens, they count the meeting the corpse of any one belonging to the village, the meeting of an oil-vender, a carpenter, a potter, a dancing-master, a lame or blind man, a fakeer with a brown-waistband, or a Hindu devotee with long traced hair. To sneeze is a bad thing at setting out on an expedition; to meet a woman with an empty pitcher, or an ass braying from the front, a pair of jackals crossing the road in front of the gang, to see a wolf cross the path from left to right. On the other hand, it is a lucky omen to meet a woman with a pitcher full of water, or a pregnant woman, or to hear an ass braying on the left while halting at a stage, or to see a single jackal passing from right to left, or an antelope from left to right. Superstitions like these—and it is not necessary to give more instances of them—sufficiently show that the Thugs consider their murderous practices as countenanced and regulated by higher powers; and it is for the same reason that after every murder they perform a special solemnity called *Tapunî*. It is celebrated in honor of the terrific Kâlî, and its principal feature consists in addressing a prayer to the goddess, and in making the practical stranglers, those who formed part of the expedition, and committed the murders, partake of *gaur*, or consecrated sugar, the effect of which is believed to be irresistible. Other ceremonies are, of course, likewise performed on the occasion; but it is from the eating of the gaur that the strength and prosperity of the Thug are supposed necessarily to be derived. Another feast observed by the Thugs throughout India is called *Kurhae Karna* or *Kote*. It likewise takes place in honor of Kâlî, and the requisites for its celebration are goats, rice, ghee (butter), spices, and spirits. The superstitions of the Thugs are all of Hindu origin; but they are adopted also by the Mohammedans, who, while stout adherents to the tenets of the Koran, yet pay divine honors to the Hindu goddess of destruction. This inconsistency they sometimes reconcile by identifying Kâlî, whose other name is also Bhavânî, with Fatima, the daughter of Mohammed, and wife of Alî, and by saying that Fatima invented the use of the noose to strangle the great demon Rukutbeejdana.

At various periods, steps were taken by the native and English governments to suppress Thuggee—the practice of the Thugs—but it is only since 1831 that energetic measures were adopted by the British authorities to counteract the evil; and though it has not yet altogether disappeared, it may be safely assumed that it is fast dying out.—For a fuller account of the Thugs, the reader is referred to the *Illustrations of the History and Practices of the Thugs* (by E. Thornton, Lond. 1837)—whence the foregoing outline is taken; to the authentic reports of special cases, contained in the same work; and to Col. Meadows Taylor's *Confessions of a Thug* (1840).

THU'JA. See ARBOR VITÆ.

THU'LÉ, the name generally given by the ancients to the most northerly part of Europe known to them, and in the description of which fancy played a conspicuous part. According to Pliny, it was an island in the northern ocean, discovered by the navigator Pytheas, who reached it after six days' sail from the Orcades. The name T. appears to be merely a classic form of the Gothic

Tiel or *Tiule*, 'remotest land' (comp. Gr. *telos*, a goal); and most modern geographers identify T. with Iceland. Some, however, prefer to seek for it in that part of Norway called *Thile* or *Thilemark*, or in Jutland, the extremity of which is known as *Thy* or *Thyland*. Ptolemy considers that Mainland, the principal member of the Shetland group, has the best claim to being regarded as the T. of Pytheas.



Thumbscrew.
(From an instrument in the Antiquarian Museum, Edinburgh.)

THU'MBIKINS, or **THUMBSCREW**, an instrument of torture for compressing the thumb, largely made use of by the Inquisition in Spain, and also occasionally used in England, when examination by torture was practised there. The last instance of its application in Britain was in the case of Principal Carstairs, on whom this mode of torture was inflicted for an hour and a half at Holyrood by the Scottish Privy Council, with the view of obtaining from him confession of the secrets of the Argyll and Monmouth parties, but without effect in producing any disclosures.

THUN, a picturesque and ancient town of Switzerland, in the canton of Bern, 17 miles south-south-east of the city of that name. It stands on the Aar, one mile from the Lake of Thun, out of which the river rushes past the town in a stream of crystal clearness. The old castle of the 12th c. with its corner towers, and the venerable church, are the chief buildings. T. is the starting-place for those who visit the Bernese Oberland, and is consequently visited by crowds every season. Pop. (1880) 5124.

THUN, LAKE OF, in the canton of Bern, Switzerland, between the town of Interlaken on the east, and that of Thun on the north-west; is 12 miles long, 2 miles broad, about 1800 feet above sea-level, and in some places between 600 and 700 feet deep. The scenery is very attractive. Steamers ply on the lake, and there is a good post-road along the south shore.

THUNDER. See **LIGHTNING**.

THU'NDERBOLT, in Heraldry, a bearing borrowed from classical mythology, which may be described as a twisted bar in pale inflamed at each end, surmounting two jagged darts in saltire between two wings displayed with streams of fire.

Thunderbolt.

THU'RGAU (i. e., valley of the Thur), a frontier canton in the north-east of Switzerland, bounded on the N.-E. by the Lake of Constance, and on the W. and S. by the cantons of Zürich and St. Gall. Area, 384 sq. m.; pop. (1880) 99,552. The surface, unlike that of the other cantons of the country, is undulating or hilly, but nowhere mountainous, the chief height being the Hörnli in the extreme south, 3690 feet. The principal river is the Thur, from which the canton derives its name, and which, flowing west-north-west through a broad valley, joins the Rhine in the canton of Zürich. The soil is fertile in the ordinary crops, and remarkably so in fruits—large tracts of open country being laid out in orchards, as well as vineyards. Three-fourths of the inhabitants are Protestants. Capital, Frauenfeld.

THU'RIFER (Lat. *thur*, incense, and *fer-*, to carry), the ministering attendant in the Roman Catholic Church, at solemn mass, vespers, and other solemn ceremonies, whose duty it is to carry the *thurible*, or incense-vessel, and either to minister incense (q. v.) himself, or to present the thurible to be used for that purpose by the officiating priest. The office of thurifer is one of those which belong to the so-called 'Minor Order' of *Acolyte*. See **ORDERS**. The thurible now in use consists of a metallic vessel for holding burning charcoal, commonly of silver or silver-plated, but occasionally also of gold, with a movable cap, and suspended from four chains, so as to be capable of being freely waved about in the air for the readier dispersion of the smoke of the incense which is thrown upon the live charcoal.

THÜ'RINGER-WALD (Forest of Thuringia) is a considerable mountain-range of Central Germany, which extends from the junction of the rivers Werra and Horsel, near Eisenach (q. v.), in a south-east direction to the north of Bavaria, where it joins the Frankenwald, a ramification of the Fichtel-Gebirge. Its total length is about 50 miles, and its highest summits (Gross-Beerberg, Schneekopf, Inselsberg, and Finsterberg) range from a height of close on 3000 feet to about 3200 feet. The range is composed mostly of granite, porphyry, and argillaceous schists, abounding in metallic veins, among which iron ore is most conspicuous, though many others are found more or less plentiful; and auriferous sands occur in some of the rivers which have their source here. The T. is parcelled out among the states of Weimar, Meiningen, Coburg-Gotha, Prussia, Schwarzburg, Reuss, and Altenburg.

THURI'NGIA (Ger. *Thüringen*), the name still borne by that part of Upper Saxony which is generally bounded by the Werra, the Saale, and the Harz Mountains, though it has no longer any distinct terminal significance. The country was so called from the people Thuringii (probably the descendants of the Hermunduri), who were found inhabiting it in the 5th c.

THURLES, a market-town and seat of a poor-law union, in the county of Tipperary, province of Munster, Ireland. It is a place of great antiquity, and is celebrated not only in the bardic history, but also as the scene of a great battle with the Danes. It is situated on the river Suir, 52° 42′ N. lat., 7° 47′ W. long., 86 miles south-west from Dublin, with which city, as well as with Cork, it is connected by the Great Southern and Western Railway. Pop. of township (1881) 4850, with few exceptions Roman Catholics. T. being the seat of the Roman Catholic archbishop, has two convents of nuns, a monastery of Christian Brothers, and a college for ecclesiastical and general education, numerously attended.

THURLOW, EDWARD, LORD, an English lawyer, was born, in 1732, at Little Bracon-Ash, in Norfolk. His father, a clergyman, sent him to school at Canterbury, where he obtained a sound knowledge of the Latin and Greek classics. Thence he proceeded to Cambridge, but in his zeal, it is said, to affect the character of an idle clever boy, he committed breaches of discipline which compelled him to leave the university. He became a student of the Inner Temple, and was called to the bar in 1754. He was a fellow-pupil, in a solicitors's office, with the poet Cowper, and still affected idleness, although, in reality, he worked hard to make himself a good lawyer. His lofty stature, strongly marked features, dark eyes, bushy eyebrows, and look of self-possession and wisdom, led, it appears, every one with whom he came in contact to attribute to him qualifications he really did not possess. His gifts, however, were those which are most likely to insure early success at the bar. An accidental meeting, at a coffee-house, with the Scotch solicitors in the great Douglas case, led to his employment in it as junior counsel, and to his acquaintance with the members of the Douglas family. It was one of them, the Duchess of Queensberry, who, by her influence with Lord Bute, obtained for him, in 1761, the rank of King's Counsel. After this period, he acquired a still higher reputation by his speech in the Douglas case—the greatest effort of his life. In 1768, he was returned for Tamworth, and became a zealous supporter of Lord North.

When, in 1771, he was appointed Solicitor-general, he attracted the special notice of George III. by the zeal he displayed in supporting the American policy of the government. In 1778, he was raised to the woolsack; and such was his influence with the king, that he was allowed, contrary to all precedent, to retain the office under the Rockingham administration. He caused great embarrassment by opposing all the measures brought in by that government. Under the coalition ministry, he was compelled to retire; but he was restored as Chancellor on Mr. Pitt coming to power. For a time he supported the government; but relying again on the support of the king, he once more began to give trouble, and ventured to oppose the measures his colleagues brought forward. Pitt then intimated that he or T. must retire, and the king, without any hesitation, consented to his removal (1792). T. sank into comparative obscurity. He amused himself in reading the Latin and Greek classics with his nephews, and spent much of his time in visiting and receiving visits. He died at Brighton on September 12, 1806. Lord Campbell, in his excellent life of T., says he can find nothing recorded of him to justify the great reputation for ability he had among his contemporaries, and ascribes it chiefly to his assuming manner; but it must be recollected that he had no Boswell to record his talk, and that it was his conversation which was admired. Johnson would not have said of an ordinary person as he did of him: 'I would prepare myself for no man in England but Lord Thurlow. When I am to meet him, I should wish to know a day before.'

THU'RSDAY (Swed. *Thorsdag*, Ger. *Donnerstag*), the fifth day of the week, is so called from Donar or Thor (q. v.), who, as god of the air, had much in common with the Roman Jupiter, to whom the same day was dedicated (Lat. *Jovis dies*, Fr. *Jeudi*).

THU'RSO, a burgh of barony, seaport, and market-town on the north coast of Caithness, 20 miles north-west of Wick. It is irregularly built, but contains some handsome freestone houses, and two handsome churches. Thurso Castle, to the east of the town, is a fine venerable structure. The harbor is a safe one for vessels not over 150 tons burden. At Scrabster, on the west side of the bay, steamers call regularly, and there is a good roadstead with a pier. Ropes are manufactured; and cattle, grain, sheep, and paving-stones exported. A railway connecting Wick and T. with the south was completed in 1874. Pop. (1881) 4055.

THWARTS, in a boat, are the cross-benches on which the rowers sit.

THY'LACINE (*Thylacinus*), a genus of carnivorous marsupial quadrupeds, nearly allied to opossums and dasyures. The muzzle is elongated, and somewhat dog-like. The tail is long and tapering. Only one species is known (*T. cynocephalus* or *Harrisii*), a native of the mountainous parts of Van Diemen's Land, where it inhabits the wildest glens, but issues from them to prey upon the sheep of the colonists, by whom it is commonly called the wolf, or tiger-wolf, and is destroyed by all possible means. Kangaroos, echidnæ, &c., seem to have been its ordinary prey before sheep were introduced. It is of the size of a large dog, and is the most powerful of Australian carnivorous quadrupeds. It is very active and fierce. It is not known to exist except in Van Diemen's Land.

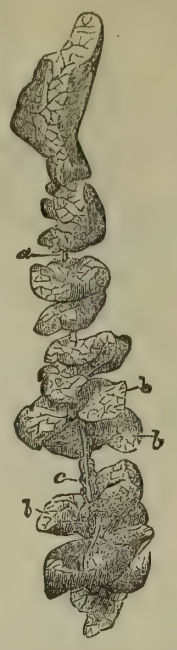
THYME (*Thymus*), a genus of humble half-shrubby plants, of the natural order *Labiatæ*, having a two-lipped calyx, and four diverging stamens. GARDEN T. (*T. vulgaris*) is 6—10 inches high, with narrow almost linear leaves, and whitish or reddish flowers, which grow in separate whorls, six in a whorl. It is common upon dry hills in the south of Europe, and is very commonly cultivated in gardens on account of its fragrance.—WILD T. (*T. Serpyllum*) has a procumbent stem with many branches, 2—3 feet long, oval leaves and purplish flowers arranged in whorls, which are united in a head. It is abundant on hills and mountains in Britain, and in all parts of Europe, and the north of Asia. It is less fragrant than Garden T., but both species contain an aromatic essential oil. The flowering branches (*Herba Thymi* and *Herba Serpylli*) are used in medicine as a powerful stimulant, and those of Garden T. are also used in cookery for flavoring.—The LEMON T., or Lemon-scented T. of our gardens, is regarded as a variety of *T. Serpyllum*. It is generally of still lower growth than the common Garden Thyme.—No species of T. is indigenous in America.

THYMELEA'CEÆ, a natural order of exogenous plants, of which the Mezereon and Spurge Laurel (see DAPHNE) are familiar examples. This order consists chiefly of shrubs, with a few herbaceous plants, and contains about 300 species, natives chiefly of the warmer temperate countries. The leaves are undivided. The perianth is inferior, tubular, colored, 4-cleft, or rarely 5-cleft, sometimes with scales in the orifice. The stamens are perigynous, often eight, sometimes four, and less frequently two. The ovary is one-celled, and the fruit one-seeded, either nut-like or a drupe. The bark is generally fibrous and tough. That of *Gnidia daphnoides* is used in Madagascar for ropes, and that of *Lagetta lintearia*, or Lace-bark, in the West Indies for whips. The bark of some species of *Daphne* and nearly allied genera is made into paper in the East. See DAPHNE. Poisonous properties prevail in the order. The bark is in general very caustic, and that of some species is used as a vesicatory, and for other medicinal purposes.

THY'MIC ASTHMA. See THYMUS GLAND.

THY'MUS GLAND, or simply the Thymus (Gr. *thymos*, sweet thyme, because the gland was compared to the flower of this plant by Galen), one of those structures which, like the spleen, suprarenal capsules, and thyroid gland, are placed amongst the ductless glands. It is a temporary organ, and is commonly stated to attain its greatest development in relation to the rest of the body during the latter part of fœtal life. 'But this,' says Dr. Carpenter, 'is a mistake, for the greatest activity in the growth of this organ manifests itself in the human infant soon after birth; and it is then, too, that its functional energy seems the highest. This rapid state of growth, however, soon subsides into one of less activity, which merely serves to keep up its proportion to the rest of the body; but its increase is continued till the age of puberty is attained.'—*Principles of Human Physiology*, 6th ed., p. 143. After remaining stationary for some years, it gradually assumes, in well-nourished persons, the characters of a mass of fat.

On examining the gland when its growth is most active, it is found to consist of two lateral lobes placed in contact along the middle line, extending from the lower border of the thyroid gland to the cartilage of the fourth rib, and covered by the sternum and by the margins of the muscles passing upwards from the top of that bone. The gland is of a pinkish gray color, soft and lobulated on its surfaces; and by careful manipulation it may be shown to consist of an assemblage of hollow glandular lobules, united together by connective tissue, all their cavities communicating with a central reservoir or main canal, from which there is no outlet. This arrangement is well seen in the accompanying diagram of a portion of the thymus gland of a calf. The thymus is about two inches in length, one and a half in breadth, and four lines thick, and at birth it weighs about half an ounce; its chemical constituents are water, albumen, gelatine, sugar (?), fats, leucine, sarkine, xanthine, and formic, acetic, succinic, and lactic acids, besides the ordinary inorganic salts—the number of the ingredients, many of them of rare occurrence elsewhere in the body, indicating that important chemical changes take place in their structure. Its exact uses are unknown, but like the other ductless or vascular glands, it doubtless plays some important part in the preparation and maintenance of the blood. The albuminous nature of the juice of this gland, and the finely granular appearance it presents, indicate that a material is here being prepared which is to be rendered subservient to nutrition; and various facts which have been noticed in regard to its changes of bulk (especially its rapid diminution in over-driven lambs, and its subsequent gradual redistension during rest, if plenty of food is given) strongly confirm these views.



Portion of Thymus of Calf, unfolded:
a, main canal; *b*, glandular lobules; *c*, isolated gland-granules seen in the main canal.

The anatomy, physiology, and development of this gland have occupied the attention of three of the most celebrated writers of the present century: see Sir Astley Cooper's beautiful monograph, *On the Anatomy of the Thymus Gland*, 1832; Mr. Simon's *Physiological Essay on the Thymus Gland*, 1843; and Professor Goodsir's Memoir 'On the Development of the Thymus Gland,' in the *Philosophical Transactions* for 1844.

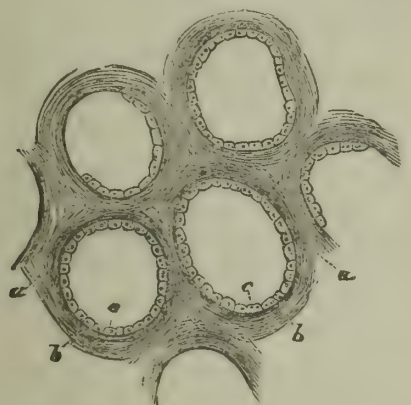
The only disease of this structure requiring notice is hypertrophy—a condition which was supposed occasionally to induce suddenly fatal dyspnœa (breathlessness) in children. There are, however, sound reasons for believing that there is no essential connection between the glandular enlargement and the suffocative paroxysms; because (1) the affection termed *thymic asthma* may occur with an abnormally *small* thymus; and (2) when a thymus, enlarged by malignant disease (encephaloid, for example) does occasion dyspnœa, it is not sudden and paroxysmal, but constant in its nature. The disease is known under various other names, as *Laryngismus stridulus*, *spasmodic croup*, and *child-crowing*. This *bastard croup*, as Dr. Watson calls it, is far more common than true croup, and is very liable to be confounded with it. 'In their most obvious symptoms, the two affections are much alike. The broad and essential difference between them is the absence in the spurious disorder of inflammation and of fever, and consequently of any concrete or other effusion from the mucous membrane of the air-passages. The child is seized all of a sudden, roused perhaps from its sleep, or checked in the act of sucking, by a catch, or interruption of its breathing, more or less complete. It strives and struggles to inspire, but is apparently unable to do so; at length, the effort is successful, and the breath is drawn in with a shrill whistling or crowing sound, like that which characterizes the inspirations of croup or of whooping-cough, and depending, no doubt, upon the same cause—a narrowing (in this complaint, temporary) of the fissure of the glottis.'—*Lectures on the Principles and Practice of Physic*, 4th ed. vol. i. p. 866. The more complete the closure of the chink of the glottis is, the more intense will be the symptoms.

In severe cases, the countenance becomes livid, the eyes fixed, and there is an entire suspension of the respiratory function for a while. The child makes vehement struggles to recover its breath, and at varied intervals, from a few seconds up to a minute or longer, air is admitted through the glottis, now partially open; and this rush of air produces the characteristic sound. A fit of coughing or crying then often supervenes, and the attack terminates with some exhaustion. If, however, the glottis does not partially open, the child will die suffocated (or in popular language, *in a fit*) at the end of two, or at most, three minutes, falling back pallid and exhausted in its nurse's arms. In association with these symptoms, is often a contracted state of the flexor muscles of the thumb, fingers, toes, wrist, and ankle, giving to the foot an appearance like that of club-foot. It has been observed by Dr. Ley, who has written a volume on this disorder, and other observers, that there is a frequent connection between child-crowing and certain other affections, as (1) tumefaction of the glands in the neck and chest, and entanglement of the pneumogastric nerve or its branches among these glands; (2) painful dentition, which is apt to produce glandular swellings of the neck; and (3) excoriations behind the ears, and inflamed and irritable scalp, which also occasion enlargement of the glands. The nerves passing from the enlarged gland to the nervous center convey the sensation of irritation; and the inferior laryngeal nerve, which supplies nearly all the muscles of the larynx, acts on the efferent or motor nerve, and excites spasmodic contraction of the muscles closing the aperture of the glottis. Hence the phenomena are those of Reflex Action.

During the paroxysm, the warm bath may be tried, if it can be

got ready at once. The application of hot fomentations to the throat by means of a large sponge, is often very serviceable, and is usually more accessible than the bath. The muscles sometimes relax when cold water is freely sprinkled over the chest and face, and these simultaneous applications of hot and cold water are by no means incompatible. The subsequent general treatment must depend upon the exciting cause, on the painful dentition, the eruption of the head, &c. The state of the bowels and of the skin must always be carefully regulated, and change of air is always advisable. Phosphate of lime, in doses of from five to ten grains, three times a day, administered in chalk mixture, has been strongly recommended by Dr. W. Budd in this disease, and is well deserving of a trial.

THY'ROID BODY or GLAND (Gr. *thyreos*, a shield, and *eidos*, like), one of the ductless or vascular glands, lying at the upper part of the trachea, and consisting of two lateral lobes, placed one on each side of this canal, and connected together by a narrow transverse portion at the lower third, called the isthmus. It is of a brownish red color, and its normal weight is about an ounce, but it occasionally becomes enormously enlarged, constituting the disease called bronchocele or goitre. Each lobe is somewhat conical, and is about two inches long and three-quarters of an inch broad. The thyroid body differs from the other vascular glands in structure, for it 'consists of an aggregation of closed vesicles (*b*, *b* in the figure), which seem to be furnished with a



Group of Gland-vesicles from the Thyroid Gland of a Child : *a*, connective tissue ; *b*, membrane of the vesicles ; *c*, epithelial cells.

true limitary membrane, and therefore to be real gland vesicles embedded in a stroma (*aa*) of connective tissue, and not communicating with any common reservoir. These bodies vary in diameter in the human subject from $\frac{1}{200}$th to $\frac{1}{18}$th of an inch; and they contain an albuminoid plasma, which is either faintly granular or of a somewhat oily aspect, amidst which are seen a number of corpuscles, the greater part of them in the condition of nuclei, while some have advanced to that of cells.'—Carpenter's *Principles of Human Physiology*, 6th ed. p. 143. The thyroid body is abundantly supplied with blood by the superior and inferior thyroid arteries, which continue subdividing, till they ultimately form a very minute capillary plexus upon the limitary membrane of the vesicles. This body, like the thymus and supra-renal capsules, is relatively larger in the fœtus and during infancy than in after-life.

From the investigations of Mr. Simon (see his Memoir on the 'Comparative Anatomy of the Thyroid,' in the *Philosophical Transactions* for 1844), it appears that a thyroid is present in all mammals, birds, reptiles, and amphibians, and that he has discovered it in many fishes. Its presence in some of the fishes in which Mr. Simon observed it, has, however, been called in question by Dr. Handfield Jones (see his article 'Thyroid Gland' in the *Cyclopædia of Anatomy and Physiology*).

Mr. Simon has propounded a theory regarding the function of this gland which is certainly ingenious, and probably correct. Basing his theory on the circumstance, that the thyroid arteries arise in close proximity to the cerebral, he considers that the thyroid gland acts as a diverticulum to the cerebral circulation, exercising at the same time its secreting function in an alternating manner with the brain.

Little need be said here regarding the diseases of this organ, as the most important of them, bronchocele or goitre, has been already described under the latter title.

THY'RSUS, in Botany, a Panicle (q. v.), in which the flower-stalks are short, and the flowers are thus close together, so that the panicle is dense. It is a very common form of inflorescence. The use of the term is, however, somewhat vague.

THYSANU'RA, an order of wingless insects of small size, and which undergo no metamorphoses. They are furnished with peculiar organs, either along their sides or at the extremity of the abdomen, which, as well as the legs, are used for locomotion. The whole order is comprised in two families—*Poduridæ*, or Spring-tails (see PODURA), and *Lepismidæ*. The *Lepismidæ* have an elongated body, covered with small shining silvery scales. The abdomen is furnished on each side with a series of movable appendages; it has also at its extremity a compressed appendage of two pieces, and three jointed bristles, which are used in leaping. The *Lepismidæ* inhabit dark and moist places, as behind window-shutters, beneath planks, &c.; many of them often in the interior of houses.

TI (*Cordyline Ti*, formerly *Dracæna terminalis*), a plant of the natural order *Liliaceæ*, and nearly allied to the Dragon Tree. See DRAGON'S BLOOD. It is found in the south-east of Asia, the Eastern Archipelago, the Sandwich Islands, and many other island groups of the Pacific Ocean. It attains a height of ten or twelve feet, sometimes more, with a tree-like form, lanceolate leaves of a reddish hue, and branching panicles. The fruit is a three-celled and three-seeded berry. The leaves afford food for cattle. They also form durable thatch for houses. Their fibres are sometimes made into cloth. It is most valuable, however, for its root, which is very large, and when raw, is hard, fibrous, and almost insipid; but becomes soft and sweet when baked—is very nutritious, and much used as an article of food. Good sugar is also made by evaporating its juice; the fermented juice is used as an intoxicating beverage, and a kind of ardent spirit is distilled from it.

Tiara.

TIA'RA, the triple crown of the pope, which is considered to be symbolical of his temporal, as the keys are of his spiritual authority. It is composed of a high cap of gold cloth, encircled by three coronets with a mound and cross of gold on the top. From the cap hang two pendants, embroidered and fringed at the ends, and semée of crosses of gold. The original papal crown consisted of the cap alone, and was first used by Pope Damacus II., 1048 A.D. The cap was surrounded with a high coronet by Boniface VIII. in 1295; the second coronet was added in 1335 by Benedict XII.; and the third by John XXIII. in 1411.

TI'BER, the chief river of Central Italy, and the most famous in the peninsula, rises from two springs in a wood of beech trees in a dell of the Tuscan Apennines (province Arezzo), about six miles north of the village of Pieve-San-Stefana, and in lat. about 43° 45′ N. Its course until it reaches Perugia is south-south-east; thence, as far as Rome, it pursues, along an irregular zigzag line, a southern direction; but when it enters the plain of the Campagna, it curves to the south-south-west, and enters the Mediterranean by two branches, which enclose the Isola Sacra. The entire course of the river is about 212 miles. The most celebrated towns on or near its banks are Perugia, Todi, Orvieto, Rome, and Ostia; and its chief affluents are the Nera (anc. *Nar*), and Teverone or Aniene (anc. *Anio*) from the left, and the Chiana from the right. In the upper portion of its course, from its source to the city of Orvieto, it is rapid and turbid, and of difficult navigation. It is regularly navigable for boats of 50 tons to the confluence of the Nera, 100 miles from its mouth, and small steamers ascend to within 7 miles of that point. Wine, corn, charcoal, wood, and other produce from the interior are conveyed by the T. to Rome. Within the walls of Rome (q. v.), the width of the river is 300 feet, and the depth from 12 to 18 feet. Of its two mouths, the northern, the Fiumicino, is the channel of commerce; the southern, the Fiumara, is useless for commercial purposes, owing to the accumulation of sand at its mouth. The T. is supplied mostly by turbid mountain torrents, whence its liability to sudden overflowings of its banks; even the oldest Roman myth, that of Romulus, being inseparably associated with an inundation. Its waters, too, are still discolored with yellow mud, as when Virgil described it—

Vorticibus rapidis et multa flavus arena.

TIBE'RIAS. See GALILEE.

TIBE'RIUS (TIBERIUS CLAUDIUS NERO CÆSAR), the second emperor of Rome, was the son of Tiberius Claudius Nero, one of the active partisans of Pompey and Antony in the war of the second triumvirate, and of Livia, a descendant of Appius Claudius Cæcus, and was born 16th November 42 B.C. The triumvir, Octavianus Cæsar (afterwards the Emperor Augustus) having become enamoured of Livia, the complaisant husband divorced her, and, though then pregnant with Drusus, she was immediately espoused by Octavianus (38 B.C.). T. being now one of the imperial household, received a careful education, was allowed by Augustus the same public honors as were paid to his nephew and grandsons, and as well as his brother Drusus, was employed in active service at the head of the legions on the outposts of the

empire. T. was at this time in favor with the emperor and the Roman people, chiefly because his retired mode of life and subordinate position restrained his evil propensities; and his praises as a military leader were loudly sounded, though the character of his opponents was not such as called for the display of very great warlike ability. At the command of Augustus, he unwillingly divorced his wife, Vipsania Agrippina, to marry the emperor's daughter Julia (11 B.C.); but disgusted at her open profligacy, he gladly accepted a command on the German frontier, and afterwards (6 B.C.) retired to Rhodes, where he lived for seven years, returning after Julia's banishment to Pandataria. The death of two of Augustus's three grandsons paved the way for the adoption of T., and of the third grandson, Agrippa Postumus, by the emperor, and for the appointment of T. as heir to the throne, Agrippa being, apart from his youth, wholly unfitted for the exercise of uncontrolled authority. Accordingly, T. ascended the throne (14 A.D.), and by his manly and graceful demeanor, prudence and moderation, gave promise of a happy reign. His mild and benignant sway at first, was doubtless due in part to the necessity of outbidding his popular nephew Germanicus (who was of Octavian blood by his mother's side) for public favor; but after his kinsman's death (19 A.D.), and the removal of all who were likely to put forth claims to the throne, T.'s true character became better known. He had always shown himself reserved, jealous, timid, and irresolute, though not cowardly, and almost devoid of sympathy and affection; and with the scepter firmly in his grasp, the development of these qualities produced the most suspicious and cruel of tyrants.

During the life of his mother, however, T., who held her somewhat in dread, took little share in the government, but led a retired life, attempting to ape the virtues he had not. The chief events of this part of his reign were the increase in number and amount of the taxes, the removal of all power from the people and the senate, and the institution of prosecutions for *læsa majestas*, the latter being nothing else but a convenient mode of removing all who incurred the displeasure of the emperor. But after Livia's death (29 A.D.), he resigned the whole real authority into the hands of Ælius Sejanus, a Roman knight, and a commander of the prætorian guards, and gave himself up to the unrestrained indulgence of his sensual appetites. The empire did not suffer by the change, for Sejanus was a man of great ability and resolution, and well knew how to maintain his ascendency over the emperor by pouring into his suspicious ear tales of conspiracy, and then allaying the imperial fears, and satisfying his own private enmities by the condemnation for *læsa majestas* of eminent Roman citizens. In 27 A.D., T. retired to the island of Capri, there to wallow in his brutish enjoyments with more freedom, leaving Sejanus, whom he made his coadjutor in government, and equal in position, at the head of the government; and from this period till the discovery of the ambitious aspirations of Sejanus, and his downfall (31 A.D.), the Roman annals are crowded with proscriptions at Rome, and infamous excesses at Capri. Sejanus's successor, Macro, had all his vices, and few or none of his talents, and so the state of affairs was even worse than before, the senate exhibiting a rare degree of sycophancy, by endorsing with the most accommodating promptitude every order, however tyrannical, of the emperor or his confidant. It may seem strange that this frightful misgovernment by an aged debauchee and his ignoble favorite should have been so quietly submitted to by the Romans, but in reality their tyranny was confined exclusively to those of rank, the common people being treated with forbearance and occasional liberality, as there was nothing to fear from them. T.'s powerful constitution was at last completely destroyed by his excesses, and falling sick at Astura, he traveled to Misenum, where, in the villa of Lucullus, he ended his infamous life, 16th March 37 A.D., his death being hastened a few days either by poison or suffocation.

TIBE'T, THIBET, or TUBET, is the European name of a country in Central Asia, bounded on the N. by Mongolia, on the E. by China, and on the S. and W. by Hindustan. The native name is Bod or Bodyul, the land of Bod. It covers an area of from 600,000 to 800,000 sq. miles, with the north-eastern part of which we are still almost totally unacquainted. The pop. is estimated at 6,000,000.

Surface.—From an elevated tract at the western extremity of T., where the Hindu-Kush and Pamir highlands meet, the mountain-system of the Kuenlun runs east, and the greater chain of the Himalaya south-east, enclosing in the angle between them the Tibetan table-land, which extends eastward to the frontier of China. Although T. is described as a table-land by geographers, its surface is traversed by mountain-chains, which, near its western and eastern frontiers, interlace and ramify in a complicated manner. On the southern border, the height of the plateau through which the Sanpu runs, from a point near its source to H'lassa, was in 1866 carefully ascertained by barometrical observations. Along the great route from H'lassa to Gartok, in the basin of the Indus, for a distance of 800 miles, the average elevation was found to be 13,500 feet. Several stages of the journey along the route were above 16,000 feet; only one sank to 11,000. To the north and east of this elevated tract, the plains of T. are supposed to descend to much lower elevations; but accurate observations are still wanting. The Himalaya, 20 summits of which are higher than the loftiest of the Andes, stand out from the plateau, and are only connected with it by ridges of lesser elevation. They project from the highlands like buttresses which rise higher than the walls they support. In general, the descent from T. on the south is by three gradations, the first of which is very abrupt. The mountain-roads by which T. is entered from India, pass through deep ravines cut by the streams in the mountains, and present the wildest and grandest scenes described by travelers.

The mountains which rise from the table-land divide T. into several natural regions. The Karakorum range, which runs parallel to the Himalaya, forms with them a great valley, drained on the west by the tributaries of the Indus, and on the east by the Sanpu. To the whole basin of the Indus north of the Himalaya, the name of Little Tibet is sometimes given; but more generally the upper basin is known as Ngari, the middle basin as Ladak (q. v.), or Middle Tibet; and the lower as Bultistan, or Lower Tibet. The countries drained by the Sanpu are described as Tibet proper, which is in turn divided into Dsang, the district of the Upper Sanpu, and Wei, surrounding H'lassa, the district of the Lower Sanpu. Further east, the tract drained by the tributaries of the Yang-tze-kiang, in which are Lithang and Bathang, is known as Kham. North of the basin of the Sanpu, lies another region, a great elevated desert, called Khor on the west, and Katchi on the east; and at the north-eastern extremity of T. is a hilly tract, in which the Hoangho takes its rise, and in the center of which is situated the Lake Ko-ko-nor. The provisional name given to the tract is the country of the Ko-ko-nor.

Geology.—The geology of T. is little known except on the south and western frontier. The highest part of the Himalaya consists of granites and crystalline strata, and in the neighborhood of the Lake Manasarowar, of volcanic rocks. On the table-land, the strata belong to the most recent Tertiary epoch (the Pleistocene). They lie horizontally as they were deposited, and seem to have been lifted up in one unbroken cake to their present prodigious elevation. T. is believed to abound with silver, copper, and tin, but the absence of fuel renders its mineral wealth unavailable. Gold is found in considerable quantities; and salt, sulphur, borax, and nitre abound.

Climate.—T. lies between the latitude of Naples and Cairo, and might be supposed to enjoy a similar climate. But its great elevation renders it excessively cold during the winter, when its climate resembles that of the arctic regions more than that of countries in the zone to which it belongs. The mountains and the great plains which lie between T. and the sea rob the winds of their moisture, and hence another peculiarity of the climate is its excessive dryness. Timber never rots, but it breaks from brittleness; flesh exposed to the wind does not become putrid, but dries, and can be reduced to a powder. The air loses its conducting power; and persons dressed in sheepskins give out long electric sparks when they approach conducting substances. During the winter, the winds are excessively high, and the weather-beaten rocks break into a dust, which mixes with the loose alluvial soil, and with it is blown about in blinding clouds. The limit of perpetual snow is from 16,000 to 18,000 feet high on the Tibetan side of the Himalaya, while on the Indian or southern side it is in some places only 13,000—a fact attributed to the dryness and purity of the air above the table-land. The Tibetan glaciers, particularly in the mountain region of the west, are of enormous extent. Pastures and low bushes make their appearance at 18,544 feet—2800 feet higher than Mont Blanc, and 1279 feet above the snow-line on the Andes near Quito. Below this level extends a country of bare and scanty pastures. Owing to the great dryness of the air, trees (the cedar and birch) are only met with in a few scattered spots on the hills. In the great plains, the pursuits of the inhabitants are chiefly those of the pastoral tribes of the steppes of Central Asia. In the valleys, however, the soil is more productive; and fruit-trees, the vine, and the European grains are cultivated. The conditions of the climate render irrigation necessary, and the construction and maintenance of terraces along the slopes. This has given rise to a kind of agriculture characteristic of T., which demands skill and continuous labor, and which has called into existence an intelligent, strong, and hardy population. Among the productions of T. are barley, buckwheat, grapes, and all the European fruits.

Industry.—The Tibetans have made considerable progress in the industrial arts. They are ingenious jewellers, and manufacture extensively fabrics of wool and goat's hair, Buddhist idols, &c. In spite of the inaccessible nature of the country, and the absence of good roads and bridges, the rivers being crossed by inflated skins, a great trade is carried on with the neighboring lowlands. That with China is conducted chiefly at Sinning, but partly at H'lassa, by caravans, the goods being conveyed on the backs of

oxen, mules, and horses. The raw produce of T. is exchanged for tea, or Chinese manufactures, and European cutlery. A great trade is also carried on with Nepaul and Bhotan, from which, in exchange for the produce of T., broadcloths and Indian manufactures are imported. From Turkestan the trade is no less important.

Language and Religion.—The language of the Tibetans, spoken also in Nepaul, and by the inhabitants of Bhotan, belongs to the monosyllabic or Chinese class. See PHILOLOGY. Tibetan is singularly free from dialects, from which it is concluded that it spread rapidly in recent times. It has a copious literature, chiefly religious. The religion of the Tibetans is a kind of Buddhism. See LAMAISM. At the extreme west, in Bultistan, however, Mohammedanism prevails, which, having spread from Cashmere and Persia, and not from Turkestan, is Shiite. Some practices common, it is believed, to the earlier races of men, are said to survive among the Tibetans. The most remarkable is Polyandry (q. v.), brothers being allowed to have one wife in common.

Government.—Almost the whole of T. proper is now tributary to China. The government is to some extent, however, in the hands of a Buddhist hierarchy, the name of the chief priest being the Dalai-lama, and the second the Bogdo-lama. These spiritual and temporal princes rule in different parts of the country. There are Chinese soldiers in all the chief towns, and a few years ago their number was said to be upwards of 60,000. The Chinese generals have the entire control of the army, and the direction of the most important temporal affairs. Commerce is in the hands of the government, and is closely watched, there being Chinese garrisons at the entrance to all the chief passes.

There are several important towns in Tibet, of which H'lassa (q. v.) is the chief.

History.—The early history of T. is legendary. The first king, who flourished 113 B.C., was exposed in a copper box, and afterwards found swimming in the Ganges. As early as the beginning of the fifth century after Christ, a Buddhist missionary from Cashmere is said to have penetrated into T., and to have obtained a footing for the doctrines of Buddha. In 821, T. was compelled to pay tribute to China. Early in the 10th c., King Dharma adopted Mohammedanism; but he was killed in 925, and Buddhism was re-established. In the beginning of the 11th c., T. was split into several states, and its power declined. In the 12th and 13th centuries, the Chinese began to conquer the eastern parts of T., which, however, did not become tributary to Pekin till 1720, when they were placed under their present government. Western Tibet has been more exposed to the inroads of the Turkish tribes than of the Chinese. The former were, however, expelled from it by Aurungzebe in the 17th c., and then it was that Mohammedanism was introduced. In the early part of this century, Western Tibet was annexed to the Sikh empire of Runjeet Singh. It now forms part of the territory of the Maharajah of Cashmere.

Until a comparatively recent period, T. was only known from the accounts given by Marco Polo and the Jesuit missionaries, travelers respectively of the 13th and 17th centuries. It was, however, visited in 1774 by George Bogle, and in 1783 by Samuel Turner, both sent by Warren Hastings on missions to the Dalai-lama. In this century it has been partially explored by Manning (1812), Captain Strachey (1846), the French Jesuits Huc and Gabet, the brothers Schlagintweit (1855—1857). On the 15th May 1866, it was stated to the Geographical Society of London that a regular survey of Lower Tibet and Ladak had been completed by the Indian government. While the work was proceeding, Major Montgomerie, the officer in charge, conceived a plan of carrying out the survey in the neighboring districts of T., closed by the jealousy of the Chinese officials against Europeans. He had Hindus of education, or pundits, instructed specially to take scientific observations, and sent them, disguised as merchants, to explore T. beyond the Chinese frontier. The pundits traveled over and carefully surveyed that part of the country lying north of the Himalaya, and between the frontier of Cashmere and H'lassa. They visited the great gold-fields of T., which were found to extend 1000 miles south-east of Ilchi, the mart from which the produce of the diggings is exported; and they furnished accurate and copious information about districts which, as yet, no European has been allowed to enter. One of these pundits, a semi-Tibetan, who was despatched in 1871, succeeded in exploring 320 miles of unknown territory, discovering and marching round the great lake Teugri-nor in the north, which is 50 miles long. The journey of the pundit Nani Singh, in 1874 and 1875, is one of the most important in geographical results that have been made in the present century. Passing from Leh to H'lassa, he traversed for the first time the vast lacustrine plateau of T., and thence made his way into Assam. While these explorations have been made in the west of T., attempts have been made to penetrate the south-eastern corner of the table-land.—See Colonel Montgomerie's *Reports of Trans-Himalayan Explorations; Tibet in the Last Century*, by Clements Markham (1876); and Sir William Temple in the *Proceedings of the Geographical Society*, 1882.

TIBU'LLUS, ALBIUS, the Roman elegiac poet, was born of equestrian family, probably 54 B.C., and died young, not long after Virgil, about 18 B.C. We know nothing of his youth or education. From his equestrian ancestors he inherited an estate at Pedum, between Tibur and Præneste, which, like the estates of Virgil and Horace, had been either wholly or partially confiscated in the civil wars. T., however, recovered part of his property, and spent upon it the best part of his short life. He was patronized by Messala, whom, in 31, he accompanied into Aquitania, to suppress a serious revolt which had broken out in that province. He was present at the battle of Atax, which gave the final blow to the insurgents; and he celebrates, in a fine strain of poetry, the honorable part he bore in the campaign. Next year, Messala was sent to the East, and again T. accompanied him; but having been obliged from illness to stop at Corcyra, he returned to Rome. At this point, the public life of T. ceases; and henceforth he devoted himself to the study and composition of poetry. His Elegies, divided into four books, are mainly addressed to his mistresses, Delia, Nemesis, and Glycera, whose inconstancy or coldness he bewails in tender and exquisitely finished verses. The third book, however, is now believed to be the work, not of T., but of another and inferior poet; while the hexameter poem on Messala, with which the fourth book opens, is, from internal evidence, supposed to be also by another and inferior hand. Only the first book was published during the poet's lifetime, which, brief as it was, yet passed peacefully away amid all the blessings of pecuniary competence, patronage of the great, health, and fame. The character of T. was singularly pure, amiable, and winning. During life, he had the honor of being addressed in an ode and an epistle by Horace: after death, of being bewailed in an elegy of matchless beauty by Ovid. The best edition of his poems is that of Dissen (Göttingen, 1835).

TIC DOLOREUX. See NEURALGIA.

TICHVI'N, a town of Great Russia, in the government of Novgorod, 168 miles east-south-east of St. Petersburg, on the Tichvinka, which, together with the canal of the same name, connects the Volga with the Baltic. It contains numerous churches, but is best known for its monastery, which contains a 'thaumaturgical' or miracle working image of the Virgin. The inhabitants are chiefly employed in the transit-trade by land and water. Pop. (1880) 6000.

TICI'NO, the most southern canton of Switzerland, bounded on the W. and S. by Italy, and on the E. by Italy and the canton of Grisons. Area, 1082 sq. m.; pop. (1880) 130,777. Its surface, forming a portion of the southern slope of the Alps, comprises lofty mountains in the north. The northern boundary between T. and the cantons of Uri and Grisons is a range of the Lepontine Alps, rising in Mount St. Gothard (q. v.) to the height of about 12,000 feet. Offsets from the Lepontine and Rhætian Alps occupy the greater part of the canton. In the south, the country falls away into flats, and the scenery becomes Italian in character. The principal rivers are the Ticino (q. v.), by which the whole of the canton, with the exception of a trifling portion, is drained, and from which it receives its name. In the north, cattle-breeding and the preparation of dairy produce are the chief employments. South of the Alpine regions are elevated forest-clad districts; and further south, olive-yards and vineyards, cornfields and plantations of figs, almonds, oranges, citrons, and pomegranates occur. The canton varies as much in climate as in productions. Cattle, cheese, wine, fruits, and hay are exported. The northern part of Lake Maggiore, and almost the whole of Lake Lugano, are included within the canton. The inhabitants belong to the Italian type, and for the most part speak the Italian language, and are of the Catholic religion. The chief towns are Bellinzona, Locarno, and Lugano, each of which is by turns the seat of government.

TICINO, a river of Switzerland and the north of Italy, rises on the southern slopes of Mount St. Gothard, and flows south through Lake Maggiore, and south-south-east through the north of Italy to its junction with the Po, four miles below Pavia. Entire length about 120 miles, for the last 75 of which, from the point at which it leaves Lake Maggiore, it is navigable.

TICK, the popular name of a great number of *Acarides* (see ACARUS), forming a section called *Suctoria*, having the mouth in the form of a sucker, with no apparent mandibles. They live by sucking the juices of plants and animals. Some of them are aquatic. The Harvest-bug (q. v.) is a well-known example of the suctorial *Acarides*. It belongs to a family called *Leptidæ*. The name T. is more particularly given to the family *Ixodidæ*. They abound in almost all parts of the world, but chiefly in warm countries, in which they are very troublesome pests. Many of them live in woods, attached to branches, but are ready to attach themselves to animals, which sometimes suffer greatly from their numbers, their blood-sucking powers, and the inflammation which they cause. The Tampan (q. v.) is a very troublesome T. of South Africa. The Carapata of Brazil is scarcely less annoying.

It infests dry bushy places, clusters of many hundreds being found clinging to very slender twigs, and they instantly transfer themselves to any horse, ox, or other quadruped which comes in contact with them, burying their serrated suckers in its skin, so that they cannot be withdrawn without considerable force. If not taken off, they go on increasing in size, till they become as large as a horse-bean, or even larger. Whole herds of cattle sometimes perish from the exhaustion which they cause. Wet weather,

Harvest Bug
(*Leptus autumnalis*).

Dog Tick
(*Ixodes plumbeus*).

however, soon kills them, and an animal made to swim across a river, is almost freed from them at once. Travelers in the interior of Brazil are sometimes obliged to pick hundreds off their own bodies before retiring to rest for the night.—The Dog T. (*Ixodes plumbeus*) is common in Britain, abounding on ferns in fir plantations, &c., in many places in autumn, and attaching itself to dogs, oxen, and other animals, sometimes even to man. It is in form and size like a grain of linseed, oval, shining, reddish, with a pale margin. The body swells to the size of a small horse-bean after the T. has attached itself to an animal, and the wound is attended with much inflammation and pain. Tortoises have ticks peculiar to them, which adhere to their neck, and by the thickness of their leathery coat, are preserved from being crushed when the head is retracted. The sheep-tick is not a tick: see SHEEP-LOUSE.

TICKET OF LEAVE is a term which is properly applied only in regard to convicts in the Australian colonies. A kind of permit was given to them after a certain period of their sentences, if they could be trusted at large. It required the convict who held it to remain within a particular district. The term was afterwards popularly applied to the kind of document, called technically an 'order of license,' which sets a convict at large in the British Empire before the expiry of his sentence. The occasion of its being first used was when, after the year 1840, the colonies, one after another, refused to receive convicts. If those sentenced to transportation were kept in prison in this country for the whole period of sentence, its severity would be greatly increased; and hence, by way of compensation to the convicts not taken abroad, part of their sentence was remitted. On the form of the sentence being recently changed from transportation to penal servitude, the partial remission was made systematic, as an inducement to good conduct and industry. Under the existing act of 1864, the period of remission which may thus be gained is for males about a fourth, and for females about a third, of the whole sentence. The method of adjusting the period is by debiting the convict with so many marks, representing the amount of industry that must be accomplished to gain the largest period of remission; and according to the proportion of these gained is the amount of remission or order of license or ticket of leave. See CONVICT, PRISON DISCIPLINE.

TICKING, a strong cloth, used chiefly for making beds, mattresses, and paillasses. Formerly, it was always manufactured of linen, but cotton is now largely used for this purpose. A very general character of ticking is that it is woven in stripes of two colors, blue and white.

TICKNOR, GEORGE, an American scholar and author, born in Boston, August 1, 1791, educated at Dartmouth College, admitted to the bar in 1813, but devoted himself to literature. From 1815, he spent four years in Europe, residing at Gottingen, Rome, Madrid, Paris, Edinburgh, and London, where he made the acquaintance of the most distinguished men of letters. Returning to America, he became Professor of French and Spanish Languages and Literature in Harvard University. In 1835, resigning his professorship, he went with his family to Europe, where he remained three years collecting materials for his *History of Spanish Literature* (New York, 1849, 3 vols. 8vo), an exhaustive and admirable work, which has been translated into Spanish and German. Mr. T. also edited *The Remains of Nathaniel Appleton Haven*, and wrote a *Life of Lafayette*, first published in 1824 in the *North American Review*. He published in 1864 a biography of his friend W. H. Prescott, the historian. Mr. T. died in 1871. See *Life, Letters, and Journals of George Ticknor* (Boston, 1876).

TICONDERO'GA, a small township in New York, U. S., on Lake Champlain, enclosing the outlet of Lake George, 95 miles north-by-east of Albany; and the name also of a lofty promontory in the township, of which the extremity, Mount Defiance, rises 750 feet above the lake. The falls of the outlet of Lake George, 150 feet in 1½ miles, afford constant water-power for timber-mills; and a vein of graphite supplies 30 tons of fine blacklead a year. The promontory was fortified by the French in 1755. In 1757, Montcalm assembled here a force of 9000 men, with which he took the English fort, William Henry, on Lake George. In 1758, General Abercrombie, with 15,000 men, attempted to storm the French fort, then called Carrillon, but was repulsed, with a loss of 2000. In 1759, it was invested by General Amherst, and the French dismantled, and abandoned both this fort and Crown Point, which were then enlarged and strengthened by the English at a cost of £2,000,000. Being weakly garrisoned after the cession of Canada to Great Britain, it was, in 1775, surprised and captured by Ethan Allen. In 1777, it was recaptured by General Burgoyne, by erecting a battery on an unprotected height which commanded it; but after the surrender of Burgoyne, it was dismantled and abandoned. It was again occupied by the British troops in 1780, and at the close of the war, became a picturesque ruin.

TIDE-MILL. See WATER-POWER.

TIDES. It was known, at least as early as the time of Cæsar, though probably long before, that the time of high-water, and also the height of the tide, are in some way connected with the age of the moon. And even in the present state of science, what is called the *establishment* of a port, or the time of high-water at new or full moon (that is, the interval between the moon's crossing the meridian and the full tide), which is practically the most important part of the whole question, cannot be predicted by theory, but must be obtained by observation. The first attempt to explain the phenomena of the tides was made by Newton; and, considering the little that has, since his time, been effected, his approximate solution must be pronounced highly creditable, although in many respects unsatisfactory. D. Bernouilli and others have since slightly improved Newton's method; and a complete solution of the problem has been attempted by Laplace. The principles involved in this solution are undoubtedly correct, and the result, so far as it goes, leaves little to be desired. But it does not go far, for two reasons: we know very little as to the depth of the sea; and, even had we that knowledge, the excessive difficulties of the mathematical processes required in taking account of it, and of the forms of continents and islands, would be such as to render Laplace's method inapplicable.

Newton's approximate method consists in the study of the problem as a *statical* one, and this we will presently describe. Laplace, on the other hand, treats the problem as one of fluid *motion*. Airy and others have, more recently, attempted, with success, to simplify Laplace's process. Curiously enough, however, the results of all these theories are very much alike; and, while some of the results agree well with observation, others seem irreconcilable with it. We cannot explain Laplace's method without employing high analysis, quite unsuited to this work; so we must be content to describe the faulty theory.

In the Newtonian or *Equilibrium* Theory, we consider the earth to be spherical, and covered with a layer of water, which would, of course, if left to itself, be uniformly deep over the whole surface. The attraction of the moon (per unit of mass) on the water immediately below her, is greater than her attraction on the solid earth (per unit of mass), and tends, therefore, to raise the water at that part of the surface. At the point of the surface directly opposite to the moon, the water-layer is further from the moon than the bulk of the earth, and, consequently, the moon attracts the water (per unit of mass) *less* than it attracts the earth. The tendency is, as it were, to pull the earth away from the water, so that here also the water is raised, though not *quite* so much as on the other side, as the moon's attraction diminishes with distance. The effect of the moon's action on the previously uniform layer of water, is thus to elongate it both ways in the direction of the line joining the centers of the earth and moon. On account of the very small amount of this elongation, it is found by mathematical processes, which we cannot give here, that the form of the surface will become very nearly a prolate spheroid (a solid formed by the revolution of an ellipse about its *longer* axis).

[Before proceeding further with our explanation, it is necessary to say a few words with reference to a mistake often fallen into by those whose knowledge of mechanics is scanty; and at times paraded with a show of learning by a class of men who doubt such plain matters of fact as the moon's rotation, the oblateness of the earth, the inertia of matter, and what not. Such people say that, since, if the moon and earth were rigidly fixed to each other, the water would rise only on the side next the moon, this must be the case in nature also. This is the same mistake as those commit (see PERTURBATIONS) who allow that at new moon the sun virtually diminishes the moon's gravitation towards the earth, but refuse to allow that the same is true at full moon.]

We have next to consider that the moon revolves about the earth, and that the earth also revolves about its axis. Thus, the equilibrium figure has never time to form; but an imperfect form of it travels round the earth in the time of a lunar day (24 hours 54 minutes). If the moon be on the equator, it is obvious that similar portions of the water-spheroid will reach any one spot on

the earth at intervals of half a lunar day (12 hours 27 minutes). If the moon's declination be considerable, such will not be the case—a place, for instance, whose latitude is equal to the moon's declination, will be reached by one pole of the wave-spheroid when the moon is on the meridian; but in 12 hours 27 minutes, the other pole of the spheroid will not pass over the place, but at a meridian distance of twice the latitude of the place, or twice the moon's declination. Thus, when the moon's declination is sensible, the two tides of each day are not generally equal in height, except for places on the earth's equator. This gives rise to what is called the *diurnal* tide, which is, as it were, superposed upon the ordinary, or *semidiurnal*, tide and ought to be more sensible as the latitude is greater. Owing to fluid friction, and other causes, we should expect that the axis of the tidal spheroid would lag a little behind the moon, and this is found to be the case.

So far, we have a general explanation of the occurrence of tides twice a day, and of their dependence on the moon. But we started with two assumptions which are not consistent with fact, viz., that the earth is spherical and uniformly covered with water, and that the moon is the only tide-producing body. The corrections to be made in consequence of the inaccuracy of these assumptions, must now be explained. We commence with the latter. The sun, although at an immense distance compared with that of the moon, has such an enormous mass, that his tide-producing influence is comparable with that of the moon. In fact, it is easy to see that, as Newton showed, the tide-producing power of an attracting mass is directly as the mass, and inversely as the *cube* of its distance. That it is directly as the mass, is obvious. To prove the other assertion, let R be the earth's radius, D the distance of the attracting body from the earth's center, then the attraction per unit of mass on the earth is to that per unit of mass on the water nearest the attracting body as

$$\frac{1}{D^2} \text{ to } \frac{1}{(D-R)^2},$$

according to the law of gravitation. The difference between these quantities is proportional to the tide-producing force. But

$$\frac{1}{(D-R)^2} = \frac{1}{D^2\left(1-\frac{R}{D}\right)^2} = \frac{1}{D^2}\left(1+\frac{2R}{D}+\text{&c.}\right)$$

$$= \frac{1}{D^2}+\frac{2R}{D^3}+\text{, \&c., the remaining terms being omitted, since D}$$

is always much greater than R. The difference is therefore approximately

$$\frac{2R}{D^3},$$

as stated above.

Now the mass of the sun is to that of the moon as 355,000 to 0·0125, and the sun's distance is about 400 times that of the moon. Hence the tide-producing power of the sun is to that of the moon as

$$355{,}000 \text{ to } {\cdot}0125 \times 400^3$$
$$\text{or } 355 \text{ to } 800.$$

By calculations, which we cannot give here, it has been shown that the difference of length of the axes of the wave-spheroid produced by the moon alone is about 58 inches; so that in that due to the sun it will be about 25·7 inches.

In consequence of the extremely small amount of these effects on the sea-level, we are entitled to simply add or superpose the separate effects of the sun and moon, in order to obtain their joint effect. And now we have at once the explanation of what are called *spring* and *neap* tides. At new and at full moon, the wave-spheroids due to the sun and moon have their axes almost coincident, so that we have a tide which is to the lunar alone as 800 + 355 to 800, or as 13 to 9 nearly; while, when the moon is in her first or last quarter, the axes are nearly at right angles, and the compound tide is to the lunar tide alone as 800 — 355 to 800, or as 5 to 9 nearly. Thus, the height of the spring-tide is to that of the neap-tide in the ratio of about 13 : 5.

Another curious phenomenon, which we can now easily account for, is the 'priming' and 'lagging' of the tides, or the *acceleration* and *retardation* of the time of high-water. If the tides were due to the sun or moon alone, they would recur at equal intervals of time; and, in fact, this is the case with the lunar and solar tides separately. But what we observe is the compound tide, and this will obviously have its maximum *between* two consecutive maxima of the lunar and solar tides; but nearer to the lunar tide, as it is the greater. Thus, if about new moon the sun passes the meridian *before* the moon, the tide is accelerated; if *after*, it is retarded. And the same is true about full moon, only that in this case our statement refers to passages of the sun and moon on opposite sides of the meridian. This retardation or acceleration has for its greatest value a period of rather less than an hour; and the respective maxima occur about 4½ days before and after the spring-tides.

But we meet with far more serious difficulties when we come to consider the actual distribution of water over the earth's surface; and it is here that future improvements must be looked for.

But even so inadequate an attempt at a solution as is the equilibrium theory, gives us the means of explaining a great many curious observed phenomena. It shows, for instance, how exceedingly small we should expect to find the tides in an inland sea, such as the Mediterranean; for there, even when the moon is most favorably situated, the utmost difference of level would be (by calculations which we cannot give here) only about an inch or two; and of this, part would be the rise in one portion of the sea, the rest the fall in others. The popular explanation of this phenomenon is very simple. We have but to notice that, according to the equilibrium theory, the form of the water is a spheroid of definite dimensions, its axes differing from each other by 58 inches. But a small portion of such a spheroid (of the dimensions of the Mediterranean, for instance) can hardly be distinguished from a sphere; so that the form of the surface of a limited mass of water will be but slightly altered by the attractions of the sun and moon.

It is obvious from what we have just said, that the rise of the water in tidal rivers, estuaries, and deep bays, where it sometimes amounts (even in calm weather) to more than 100 feet, cannot possibly be due to the moon's action upon the water of the mere river or bay, but must be almost entirely produced by the tidal wave in the ocean; and, in fact, this part of the problem presents comparatively little difficulty. Once grant the fact of the tidal disturbance of sea-level at the mouth of a river, and the calculation of the motion of the consequent wave in the river-channel is within the power of mathematics. It is by means of investigations made from this point of view, and by others concerning the effect of the moon on long canals, that Laplace's method has been improved. For the details of the process, see Airy on 'Tides and Waves,' in the *Encyc. Metrop.* All we can do here is to point out a few of the immediate consequences of the periodic rise and fall of the sea-level as regards the motion of the water of a tidal river. Here the tide always runs *up* the river, even when, as in the case of the Severn, this is the opposite direction to that in which the moon appears to move. In the open sea at the mouth of the river, the interval from high to low water is almost exactly equal to that from low to high water, each being about 6¼ hours nearly. But the further we go up the river, the greater becomes the disparity between these periods, high-water following low-water at shorter and shorter intervals, while the intervals during which the tide falls are correspondingly increased. In some cases, as at certain points in the Seine and Severn, the interval from low to high water is so short that the tide-wave rushes suddenly up, and, spreading over the flat sands at the side of the channel, forms a dangerous surf called a *Bore* (q. v.).

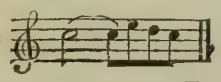
Connected with these peculiarities, there is also a singular effect produced on the direction of the current in a tidal river. In the open ocean, the water merely rises and falls, there being no perceptible tidal current. Sailors are in the habit of associating the cessation of currents, or 'slack' water, with the occurrence of high and low water. This is the case in bays, but not in rivers, and it gives rise to some curious errors regarding the time of high-water in rivers. Thus it is sometimes said that it is high-water in the center of the Thames' channel long after it is high-water at the shore—an obvious absurdity. The truth is, the current does not cease simultaneously at the shore and in mid-channel. At the mouth of a tidal river, the water runs upwards for hours after high-water, and downwards after low; and the same is true, in a less degree, at places higher up the stream.

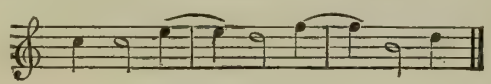
When considerable alterations of breadth or depth occur in the channel of a river, we find corresponding alterations in the amount of rise of the tide. Thus, according to Airy, at the entrance of the Bristol Channel, the whole rise at spring-tides is about 18 feet; at Swansea, 30 feet; and at Chepstow, 50 feet. At Annapolis, in the Bay of Fundy, the tide is said to rise 120 feet. Again, the same port may be reached by two tide-waves coming from the ocean by different channels; and here we have to compound the two disturbances just as we did with the separate lunar and solar tides. In the German Ocean, we have a very good example; but the most remarkable is the tide at Batsham, in Tonquin. At this port, two tide-waves meet, coming respectively from the Indian and China seas; these bring, simultaneously, opposite but nearly equal changes in the water-level, and the effect is, that there is almost no perceptible tide.

Whewell, Lubbock, and others, have lately added much to our knowledge of the *facts* of the tides; and have constructed what are believed to be tolerably accurate charts of *Cotidal Lines*—that is, lines representing the positions of the crest of the tide-wave at hourly intervals as it sweeps round the earth. A great deal, however, remains to be done in this direction, before we can hope to elicit from observation such hints as may enable us to improve the mathematical theory of the subject.

The frictional resistance to the motion of the tide-wave of course produces heat. This heat is a transformation of part of the earth's energy (see FORCE) of rotation; and thus it appears that the tides are gradually lengthening the day. We may see easily that this would go on, were the moon the only tide-producing body, so long as the earth rotates about her axis in less time than a lunar month. For, if the length of the (sidereal) day were that of a lunar month, the earth would always turn the same face to the moon; and the tide-spheroid would have a *fixed* position on the earth, and there would be no loss of energy by friction. Simple as this deduction is, though it seems to have been roughly guessed at by Kant, it was not formally enunciated till about thirty-five years ago. Mayer was the first to publish anything on the subject, but it seems to have been previously noticed by others. One of the most curious deductions from it is the recent speculation which assigns, as the cause of the moon's turning always the same face to the earth, the friction of the enormous tides which must have been produced by the earth in her mass when it was in a molten state, on the surface at least, if not throughout.

For tidal evolution and the theory, based on Dr. G. H. Darwin's calculations, that in early geologic times the size of the tides was vastly greater than at present (owing to the greater nearness of the moon), see *Nature*, vols. xxv., xxvi.

TIE, in Music, an arch drawn over two notes on the same degree, uniting them so that they are played or sung as one single note of the same value. Thus, for the two C's written in the example  one is played of the value of a minim and quaver combined. The tie is often used in syncopated passages to connect the last note of one measure with the first of the succeeding one, when the former note, which would otherwise be unaccented, acquires the emphasis of the latter:



See SYNCOPATION.

TIE-BEAM. See ROOF.

TIECK, LUDWIG, a brilliant and prolific German novelist and poet, was born at Berlin 31st May 1773, and studied at the universities of Halle, Göttingen, and Erlangen. He made his first appearance as an author in the *Straussfeder* (Ostrich-feather) Magazine, conducted by Musäus (q. v.) and J. G. Müller, for which he wrote a series of little tales, of which the best was *Die beiden merkwürdigsten Tage aus Siegmann's Leben* (The Two most Remarkable Days in Siegmann's Life). But the originality of his genius first displayed itself in his romances of *Abdallah* (Berl. 1795) and *William Lovell* (3 vols., Berl. 1795). These were followed by his *Peter Lebrecht, eine Geschichte ohne Abenteuerlichkeiten* (Peter Lebrecht, a History without Adventures, 2 vols., Berl. 1795—1796), and *Peter Lebrecht's Volksmärchen* (3 vols., Berl. 1797), which were equally remarkable for richness of fancy, artless simplicity, and an overflowing humor. In some of these *Märchen*, as, for example, his 'Bluebeard,' 'Puss-in-Boots' (*Der gestiefelte Kater*) and 'The Life and Death of Little Red Ridinghood' (*Leben und Tod des kleinen Röthkappchen*) he combated with satiric humor, perhaps, too, with somewhat of youthful arrogance, the 'enlightened' notions on which the literature of the 18th c. prided itself—showing very distinctly his strong tendencies towards the deeper poetic spirit of the middle ages. The same polemic was maintained in his comedy, *Die verkehrte Welt* (The Topsy-turvy World, 1799). To this period also belong his *Herzensergiessungen eines kunstliebenden Klosterbruders* (Heart-effusions of an art-loving Monk, Berl. 1799), *Franz Sternbald's Wanderungen*, an art-novel (2 vols. Berl., 1798), and *Phantasien über die Kunst* (Fancies on Art, Hamb. 1799), all of which are full of a noble enthusiasm for art, but pervaded at the same time by a dreamy mystical religiosity, which is no longer admirable. These works brought T. into close relationship with A. W. von Schlegel and others, and led to the establishment of the literary sect or coterie known as the 'Romantic School,' whose influence on the later literature of Germany and France has been very great, and not always very good.

T. now married the daughter of a Hamburg clergyman who had been a friend of Lessing; and in 1799 went to Jena, where he added Steffens to the list of his friends. Here he published his famous *Romantische Dichtungen* (2 vols., 1799—1800). His translation of *Don Quixote* (4 vols., Berl. 1799—1801, 3d ed. 1831) far surpassed all previous attempts. In 1802, he joined A. W. von Schlegel in the *Musen-Almanach;* and in 1804 published his longest romance, *Kaiser Octavianus*. T.'s health now began to fail him, and in 1805 he visited Italy. On his return to Germany, he settled, after some changes, at Ziebingen in 1811, where he formed a friendship with the philosopher Solger, who exercised a great influence over his mind. Henceforth, we find less of the dreamy and formless mysticism of his earlier years, and more of the artistic element. The change becomes visible in his *Phantasus* (3 vols., Berl. 1812—1815), and in his *Ulrich's von Lichtenstein Frauendienst* (Tüb. 1815). In 1817, along with a friend Burgsdorf, he paid a visit to England, where he collected fresh materials for his Shakspeare. From 1819 to 1840, he resided at Dresden; but on the accession to the throne of Friedrich Wilhelm IV. of Prussia, he was invited to Berlin, whither he proceeded, and where he resided for the rest of his life. His death occurred 28th April 1853. Other important works of T.'s besides those already mentioned, are his *Novellenkranz* (Berl. 1831—1835; complete in 12 vols., Berl. 1853); in which there is hardly a trace of the credulous Romanticism of his earlier years, but abundance of lively and subtle talk on the literature and life of the Present; *Dramaturgische Blätter* (2 vols., Bresl. 1826), republished in his *Kritische Schriften* (4 vols., Leip. 1848—1852); *Shakspeare's Vorschule* (2 vols., Liep. 1823—1829); and his splendid continuation of Schlegel's translation of our great poet. T. revised a collected but incomplete edition of his works in 20 vols. (Berl. 1828—1842). —See Köpke's *Life of Tieck* (2 vols).

TIEL, the seat of an arrondissement in the Netherlands, province of Gelderland, is picturesquely situated on the right bank of the Waal. In the 5th c., it was called Tellum or Thiela. The fortifications have been demolished, and formed into beautiful walks. Pop. (1879) 8933. Principal buildings are the Townhouse, Court-house, Chamber of Trade, and the great Reformed Church of St. Martin.

T. has a good haven, and large trade in agricultural produce and cattle. It imports grain, earthenware, wood, lime, coal, bricks, salt, &c.; and exports potatoes, grain, colza, pigs, flax, apples, cherries, &c. Principal industries are copper-founding, brick-making, tanning, book-printing, paper-making, beer-brewing, &c.

TIEN-TE (celestial virtue), the name given to the *Tae-ping-wang* (king of universal peace), the pretender to imperial authority in China, and the head of the mighty insurrection which for 16 years convulsed that country. See CHINESE EMPIRE and TAE-PINGS. The insurrection was under the direction of five chiefs, Hung-sew-tseuen, Hiang-tsew-tsing, Siao-tsha-kuei, Fung-hien-san, and Wei-tsing, independent of each other, but all acknowledging the supremacy of T.; and as, according to the plan of the rebellion, China, after being delivered from its Mantchu rulers, was to be divided among those chiefs, each of them assumed beforehand the title and insignia of 'king.' So little reliable were the statements which were forwarded to Europe respecting this insurrection, that for some time Hung-sew-tseuen, the chief among the five kings, and the military leader of the rebels, was confounded with their supreme head.

TIEN-TSIN, a large and important city and river-port of China, in the province of Chih-le, on the right bank of the Pei-ho, 34 miles from the mouth of that river by land, and 68 miles by the windings of the stream. It is the port of the city of Pekin, from which it is distant 80 miles south-east. The streets are unpaved, and the houses, principally built of mud or dried bricks, have a mean appearance, though the central parts of the town are filled with well-built houses. The maximum of heat in the summer is 106°, the maximum of cold is 6° below zero. The river is generally frozen over from about the 15th December to the 15th March, and the business at other times carried on by means of boats and junks, is taken up by sledges, which swarm on the river. By the Treaty of T., signed here November 1858, and by the subsequent Convention of Pekin, October 1860, the port was declared open; and a British consulate was established in January 1861. In 1881, T. was connected by telegraph with Shanghai (the line extending to Pekin). In 1881, T. had 435 vessels of 260,337 tons. In 1881, the value of the imports was £6,452,057; of the exports, £763,040. In 1875, the imports amounted to £4,610,677; the exports to £506,936. There is also a large and rapidly increasing transit trade with Russia *viâ* Siberia, tea to the value of £906,914 having been forwarded in 1875 from T. overland to Russia. The principal articles imported are opium, shirtings, chintzes, and other cotton goods; needles, window-glass, sugar (brown and white), and paper. The chief exports are peas and dates. Pop. reckoned at 1,000,000.—*Reports of Her Majesty's Secretaries of Embassy and Legation* (1866); and *Commercial Reports from Her Majesty's Consuls* (1875).

TIERCE. See FENCING.

TIERCE, TIERCÉ, in Heraldry, a term of blazon used to indicate that the field is divided by lines into three equal parts. A shield may be tiercé in pale, in fess, in bend, in bend sinister, or in pall; all which, with other arrangements in tierce, are common in French heraldry. Tierce in pale, in English heraldry, is an

occasional mode of marshalling three coats in one escutcheon under special circumstances.

TIE'RRA DEL FUE'GO (Land of Fire), an archipelago situated at the extreme south of South America, from the mainland of which it is separated by Magellan's Strait, consists of 11 large islands, of which the chief is King Charles's South Land, and about 20 islets; lat. 52°—56° S., long. 65°—75° W. The area of King Charles's South Land, which forms more than three-fourths of the entire area, is about 21,260 sq. m. This island, like the other islands of the archipelago and the coast of the mainland, is much broken on the west side by gulfs and inlets. The eastern coasts are, as a rule, level and wooded; while the western coasts are generally rocky and mountainous. The general aspect of the group is wild and desolate in the extreme. Some localities, however, are of quite a different character. The coast-scenery of Picton Island resembles that of the south-west coast of England. The south part of the island is chiefly in moor and down; the north part is covered with thick forests. The scenery is fine, and there are fine freshwater lakes, frequented by abundance of waterfowl. Many of the mountains are volcanic—from which circumstance this region has derived its name—and lava and volcanic productions are seen everywhere. The highest mountains rise to from 6000 to 7000 feet, and are covered with snow. The climate is raw and cold, violent rains and snowstorms occurring in every season of the year. In this region, the waters of the Atlantic and Pacific meet and struggle together, and terrific tempests are frequent. The flora of the region comprises some plants found in Great Britain. Wild celery and spoonwort are the only edible plants; but by far the most important articles of food are shellfish, which abound on the coasts, and a globular fungus, which grows in clusters round the trunk of the antarctic beech—an elegant evergreen, and the prevailing tree in the archipelago. The inhabitants, the number of whom is estimated at 2000, are generally described as a short, ugly, beardless race with long black hair, of a rusty iron color, and occupying the lowest rank in the scale of civilization. Captain W. Parker Snow, who visited T. del F. in 1855, reports somewhat differently of the inhabitants. According to him, the natives are robust-looking, powerful, and of the middle height, being on an average over 5 feet 3 inches in height. The only quadruped among them is the dog. When driven to extremities, they first eat their dogs, and then kill and eat the old women of their tribe. More than one attempt has been made to convert these savages to Christianity, but hitherto such attempts have proved abortive.

In 1850, a mission-party of seven men, under Captain Allen Gardiner, the projector of the expedition, arrived at Tierra del Fuego. The missionaries were not well received by the natives, and the narrative of their residence on these coasts is simply a record of miserable disasters. Owing to the grossest mismanagement on the part of the home authorities, the wants of the mission-party were neglected, and they found themselves in a short time destitute of provisions. The relief that had been promised never came; and in the autumn of 1851, the whole party, after undergoing horrible sufferings, died of starvation. In the autumn of 1854, another missionary expedition set sail from Bristol for T. del F., under command of Captain W. Parker Snow; but after many endeavors, the attempt to form a mission-station on T. del F. was abandoned.

TIERS ETAT (Fr. third estate), the third branch of the French estates, which consisted of representatives of the trading inhabitants of the towns, and of the peasantry in the country. The *tiers état* played an important part in the opening scene of the Revolution. On the two other estates of nobles and clergy refusing to join them and deliberate in a common chamber, they, on June 17, 1789, assumed the title of *Assemblée Nationale*, and the sole right to legislate for France. The French *tiers état* differed completely in its origin from the third estate or Commons of England. The latter originated in the permission granted to the minor barons, instead of personally attending the national council, to appear by representatives; and with the representatives of the minor barons were joined in one house the representatives of the municipalities, which, as corporations, came to be considered in the light of tenants *in capite* of the crown. The designation 'Commons,' and the absence of title have often misled foreigners to suppose that the men who gained their liberties and constitution for the English people were the *roturiers* or *bourgeois;* whereas they mostly belonged to the class which would, in continental phraseology, be called the nobility of the country.

TIETJENS, or TITIENS, TERESA, one of the greatest of recent operatic singers. She was born at Hamburg, of Hungarian parents, in 1834, and made her *début* in that city in the character of Lucrezia Borgia in 1849, taking at once a very high position on the lyric stage; at Frankfurt and Vienna she was even more warmly received; and her first appearance in London, in 1858, was quite a triumph. The great volume and purity of her voice, and her energetic but dignified acting, combined to make her an unrivaled representative of strong dramatic parts. She acquired great fluency and flexibility of voice by hard practice. She was probably the hardest-worked singer that has appeared; and though this did not seem to injure her voice, it doubtless wore out her constitution. She died 3d October 1877.

TI'FFANY, a kind of very thin silk gauze.

TI'FLIS, a government of the Russian lieutenancy of Caucasia, lying immediately south of the Caucasus. Area, 15,553 sq. miles; pop. (1873) 660,800, chiefly Georgians, Armenians, and Tartars. It is traversed by several chains of mountains, which belong either to the Caucasian Mountains (the peak of Kazbeck, 17,500 feet high), and extend over the north and east parts of the government, or to the Ararat, Achaltzick, and Alagiz Mountains, spreading from the sources of the Kur and Arax over the south districts. The principal lake, that of Goktcha, is about 50 miles long, and nearly 20 miles in extreme breadth. The rivers, the chief of which are the Kur and Arax, rise amid mountains, are very rapid, are confined between high banks, and are not navigable. The climate varies with the varieties of elevation of the surface; the soil, very fertile in some tracts, is not in general cultivated. Grain, tobacco, cotton, indigo, vegetables, and grapes are produced abundantly. T. is rich in mineral springs and in timber, the principal trees being the oak, elm, chestnut, and maple. The Christian and Mohammedan are the predominant creeds.

TIFLIS, an important Russian city, capital of the government of the same name and of the territory of the Caucasus (and south of the mountain range of that name), stands on both banks of the Kur, 165 miles—direct line—east-south-east of the Black Sea. There are several manufactories, in which woollen and linen cloths, carpets, and arms are made. T. was formerly a fortress, and the capital of the district of Georgia. It carries on an active trade with Persia, and is the great emporium of the Russian territory south of the Caucasus. In the vicinity are naphtha springs as well as thermal springs, which are much visited. T. was founded in the 4th c., and annexed to Russia in 1802. Pop. (1876) 104,024, mostly Armenians.

TIGER (*Felis tigris*), one of the largest of the *Felidæ*, equal perhaps to the lion in size and strength, and superior in activity. It has no trace of mane. It is more slender than the lion, its whole form more cat-like, its head smaller and rounder. All its

Head of Bengal Tiger.

motions are performed with the utmost grace and apparent ease. It does not climb trees, but winds its way through brushwood or jungle with great dexterity, runs very swiftly, and can leap an immense distance. It takes its prey either by running, or, more frequently, by lying in ambush and leaping upon it. Its strength is such that it is capable of carrying off an ox or buffalo. It is sometimes 15 feet in entire length to the tip of the tail; an instance is on record of 18 feet; the height is from 3 to 4 feet. The tigers of some regions differ considerably in size from those of others; thus the T. of Bengal is much larger than that of Bokhara. The hair is thick, fine, and shining; in the colder countries which the T. inhabits, it is thicker and longer than in tropical regions. The color is a bright tawny yellow, beautifully marked with dark transverse bands, passing into pure white on the under parts; the dark bands are continued as rings on the tail. The tail is long, slightly tapering, clothed with hair similar to that of the body. Individuals sometimes occur, of a pale whitish color, obscurely striped, the stripes only visible in particular lights.

The T. is found only in Asia. It abounds in Hindustan, in the Eastern Peninsula, in Java, Sumatra, and other tropical islands. It is found also in China and Japan, and in Persia. Its range, however, does not extend much to the west of a line drawn from the mouth of the Indus to the Caspian Sea. It is found as far north as the south of Siberia, and even on the banks of the Obi. It inhabits woods, and cannot exist without free access to water. The islands of the delta of the Ganges have long been celebrated as a haunt of tigers. The T. generally lies concealed in a thicket during the day, and seeks its prey by night. The prey is very often obtained by watching near the places to which animals resort for the purpose of drinking. Tigers prowl about villages, and enter cattle-folds; they also follow traveling-parties, and seize

the yoke-oxen and buffaloes, particularly those which straggle away from the encampment at night. The ravages of tigers in some parts of the East Indies are very great; and a great number of human beings are destroyed by them. A notion prevails that a T. which has once tasted human flesh becomes eager for it, and prefers it to all other food; and a single T. has been known to kill

Bengal Tiger (*Felis tigris*).

and devour many people, watching near some frequented path, or prowling around a village. The truth appears to be that this is the mode of obtaining prey to which a T. sometimes resorts, when incapable, through old age, of the active exertion necessary for capturing buffaloes or deer. The T. brings forth three, four, or five young ones at a birth. When taken young, it is easily tamed, and often shows much affection for those who treat it with kindness. Tame tigers are not unfrequently to be seen in India.

The T. was less familiarly known to the ancients than the large African *Felidæ*. It is, however, mentioned by Aristotle, and it is frequently mentioned by the Latin poets. Pliny tells us that the first T. seen at Rome was a tame one belonging to Augustus. Claudius exhibited four tigers at once.

The T. frequently breeds in captivity, but not so frequently as the lion. A hybrid between the lion and T., the offspring of the male lion and the tigress, has been sometimes produced in menageries. It is striped like the T., and not maned. None of the hybrid cubs, however, have lived long.

Tiger-hunting is a favorite Indian sport, not unattended with danger, but all the more exciting on that account. Europeans generally ride on elephants when engaged it it, and the T. is shot from the back of the elephant. Natives, however, are employed to beat the wood or jungle for the T., and lives are not unfrequently lost in this way. During the decade 1870—1880, over 800 persons in all, and 16,000 cattle, were sometimes killed in a year by tigers; while 16,000 tigers were slain by native hunters (about £4000 being paid for rewards), without reckoning those killed by English sportsmen. Tigers are now less numerous than they were. Many expedients are adopted for their destruction in the countries infested by them. Bows with poisoned arrows are fixed in their paths, so as to be discharged on being touched. Heavy beams are also so placed as to fall upon the T. pressing against a rope, and crush it by their weight. Traps of various kinds are set, sometimes baited with a live goat or other small animal. The Chinese use a box-trap with a looking-glass placed in it, and the T., attracted by his own image, disengages the fastening of the lid, and is captured. This method is very ancient, and is represented in ancient sculpture. A very curious mode, practised in Oude, consists in scattering numbers of broad leaves smeared with a substance like bird-lime in the tiger's path, and if he sets foot on a smeared leaf, his fate may be regarded as sealed. He rubs his paw on his face, to get quit of the leaf, and the case becomes worse, the leaves are transferred to his face; fresh attempts to remove the nuisance only add more leaves, till he becomes completely blinded, and rolls on the ground for very rage; while the hunters, ambushed close by, apprised by his howlings, hasten to despatch him.

The T. is an emblem of power in the East. A tiger's head, georgeously adorned with jewels, decorated the throne of Hyder Ali and Tippoo Sahib, and was among the spoils taken by the British at Seringapatam.

TIGER-CAT, a name often given to some of the *Felidæ* of middling size, which resemble the tiger in their form or markings. The Ocelots (q. v.) and the Serval (q. v.) sometimes receive this name, which, however, is not of very definite signification. The CHATI (*Felis mitis*) is a tiger-cat of South America, rather more than two feet in length, exclusive of the tail, which is about eleven inches. The color is yellowish, with irregular dark patches, those on the back forming four longitudinal rows; the markings, indeed, more leopard-like than tiger-like. The chati prowls by night, and often carries away poultry from their roosting-places. Almost all tropical and sub-tropical countries have their tiger-cats. Several species are found in the East Indies.

Tiger-cat, or Margay (*Felis tigrina*).

TIGER-FLOWER (*Tigridia pavonia*), a plant of the natural order *Iridaceæ*, the only known species of its genus, which is distinguished by the three outer segments of the perianth being larger, and by the filaments being united into a long cylinder. It is a native of Mexico, but hardy enough to endure the climate of Britain, and much cultivated in flower-gardens for the singularity and great beauty of its flowers, which are, however, very evanescent. The root is a scaly bulb.

TI'GRIS (Heb. *Hiddekel;* i. e., the 'Dekel,' equivalent to *Digla* or *Diglath*, probably a Semitic corruption of *Tigra*, Medo-Persic for an arrow; hence Gr. *Tigris*, the 'arrowy' stream), a large river of Asiatic Turkey, rises south of Lake Goljik, in the mountains of Kurdistan, within a few miles of the eastern bend of the Euphrates (q. v.), flows south-east to Diarbekir, after which it makes a sharp turn, and flows due east for 100 miles to Til. Here it receives from the north a considerable affluent, the Bitlis, and once more altering its course, runs in a south-easterly direction through desert wastes and unpeopled pastures, until it falls into the Persian Gulf, after a course estimated at 1150 miles. Its chief tributaries, besides the Bitlis, are the Great and Little Zab, and the Dyala, all from the left, the waste land between it and the Euphrates (ancient Mesopotamia) not furnishing a single stream. At Kurna it joins the Euphrates, 90 miles above the mouth of that river in the Persian Gulf, and henceforth the united rivers bear the name of Shat-el-Arab (see EUPHRATES). In the upper part of its course, the T. is a very swift stream, whence probably its name, and it brings down great quantities of mud. The principal places on its banks are Diarbekir, Mosul, and Bagdad, with the ruins of Nineveh, Seleucia, and Ctesiphon.

TI'LBURG, a flourishing trading and manufacturing town in the Netherlands, province of North Brabant, is 15 miles south-west from 'sHertogenbosch, and 14 east-south-east of Breda. In 1879, pop. 28,390, having more than doubled in 50 years. This prosperity began with King William II., when Prince of Orange, and commander of the army, taking up his headquarters at T., during the long contest which ended in the independence of Belgium. Much heath has been converted into arable and pasture lands, and numerous brick-works and woollen-cloth factories have arisen. In 1847, there were 13 wool-spinning works with steam-power; they now number 37, and the workers have increased from 2900 to 5000. The workmen's houses have each a strip of land attached, for the growth of vegetables and potatoes. Weaving woollen cloth, spinning, finishing and dyeing woollen fabrics, making soap, salt, tiles, bricks, and beer, are the principal industries. The chief buildings are the new palace, the town-house, the barracks, and the cloth-hall. T. has a high school with a course of five years, a drawing-school, and several charitable institutions. The people are nearly all Roman Catholics. The town is mentioned as early as 709.

TI'LBURY FORT, in Essex, is situated on the north bank of the Thames, opposite to Gravesend. Originally erected in the time of Henry VIII. as a block-house, it was converted (1667) into a regular fortification after the bold expedition of De Ruyter into the Thames and Medway. It is of a rectangular form, built chiefly of brick, with a massive stone portal, and is surrounded by a deep and wide fosse, which can easily be filled with water. Batteries of heavy ordnance are placed so as to command the river and the reach below; there are also piers for the landing of troops, stores, &c. The banks of the Thames being here very flat, the ground around the fort is during floods and high tides laid under water. The East and West India Dock Company began extensive new docks here in 1881.

TILES (Lat. *tegula*, from *teg-*, to cover; Fr. *tuile*), plates of baked clay, of various shapes, according to their use, some being for roofs, some for pavements. The finer kinds of paving-tiles are known as Encaustic Tiles (q. v.). The small cubical pieces of burnt clay, stone, glass, or other material used for mosaic pavements, are called tesseræ (Gr. *tessares*, four). See MOSAIC. Besides ornamental tiles, much improvement has been lately affected by various manufacturers in the different kinds used for roofing purposes, especially by the use of fire-clay, by which a tile is

made not only greatly superior in strength and durability, but also in sharpness of form and diminution of thickness. Ridge-tiles of a very ornamental character are also largely made. Drain-tiles have been described under the head of PIPES.

TI'LESTONES, the uppermost group of the Silurian period, consisting of a reddish, thin-bedded, slightly micaceous sandstone, which in some places attains a thickness of 1000 feet. The beds were originally considered as of Old Red Sandstone age; then they were regarded as a transition group, forming a passage from the Silurian strata to the Old Red Sandstone; but it is now ascertained that the fossils agree in great part specifically, and in general character entirely, with those of the underlying Upper Ludlow Rocks, and they are accordingly considered to be the newest group of the Upper Silurian division. The Tilestones are well seen at Kington in Herefordshire, and at Downton Castle near Ludlow, where they are quarried for building purposes. From the latter locality, they have received the name of the Downton Sandstones.

TILIA'CEÆ, a natural order of exogenous plants, of which nearly 400 species are known, mostly trees and shrubs, with a few herbaceous plants. They are mostly natives of the tropics. A few are found in the temperate parts of the northern hemisphere. They have simple, alternate leaves, with stipules, and axillary flowers. The calyx is usually of four or five sepals; the corolla, of four or five petals. The corolla is sometimes wanting. The stamens are generally numerous, hypogynous, distinct; the outer ones sometimes abortive and petal-like. The ovary is composed of 2—10 carpels; there is one style, and the stigmas are equal in number to the carpels. As the characters somewhat correspond with those of *Malvaceæ*, so do the properties of the order, which are generally mucilaginous and wholesome, the bark fibrous. Some yield a light and useful timber, as the Lime (q.v.) or Linden tree, a well-known European representative of the order, the Halmalille (q.v.) of Ceylon, the *Grewia elastica* of India, and the *Luehia divaricata* of Brazil. The *bast* of the lime-tree is valuable from its fibrous character; that of the species of Grewia is used in the same way in India, and that of all the species of *Apeiba* in South America. The most important fibrous plants of the order, however, are the species of *Corchorus* (q. v.), which yield Jute (q. v.).

TILL, a term employed, chiefly in Scotland, for the Boulder-clay (q. v.). See also PLEISTOCENE.

TILLA'NDSIA. See BROMELIACEÆ.

TILLEMONT, SEBASTIAN LE NAIN DE, the well-known ecclesiastical historian, was born at Paris, November 30, 1637. His father was Jean le Nain, who held the office of *Maître des Requêtes*, the title, De Tillemont, by which the historian is commonly known, being derived from a small estate near Vincennes, which belonged to his family. He was educated at Port Royal, where he early imbibed those serious and rigorous views of the spiritual life which characterized the members of that celebrated society. His theological studies were marked from the first by a spirit of inquiry into the writings of the Fathers; and he is said to have begun as a student those analyses of the works of the Fathers, especially of the Apostolic Fathers, which form the staple of the early volumes of his History. Naturally of a timidly scrupulous disposition, he hesitated long about the choice of a profession; but after various changes of life, he at last received sub-deacon's orders in 1672, being then 35. He deferred his ordination as deacon till the end of 1673; nor was it till 1676 that he was ordained a priest, mainly at the persuasion of his friend, Le Maistre de Sacy, who had long been his spiritual adviser, and with whose attachment to the Jansenistic principles he sympathized at least to a certain extent. In 1679, T. took up his residence at his family estate of Tillemont, where he resided till 1681. In that year, he made a visit to Holland and the Low Countries for the purpose of visiting Arnauld and the other Jansenist refugees. He was induced, in the following year, to undertake a parochial charge—that of St. Lambert; but he held it only for a short time.

During these years, he had steadily pursued the historical studies which he had commenced almost during his school-days; and he had now prepared the first portion of his long-projected work on the History of the Church. He was induced, on the very eve of printing, to change the plan of the work. In order to avoid the opposition of the censor, to whom, as a theological work, it would have been necessary to submit it in its first form, and whose suspicions were aroused by the known association of T. with the Jansenist party, T. separated from the Church History the History of the Emperors, which he was enabled to print as a distinct work, without referring it to the censorship, under the title *Histoire des Empereurs* (6 vols., 4to, 1690). The success of this work disarmed the opposition of the church authorities.

The hostile censor was replaced by a less exacting one; and eventually, in 1693, the first volume of the Church History appeared under the title *Mémoires pour servir à l'Histoire Ecclésiastique des six Premiers Siècles* (16 vols. 4to). Neither of these works, however, was completed during the author's lifetime. Only four out of the six volumes of the *Emperors*, and four out of the sixteen of the *Histoire Ecclésiastique*, were printed under his own care. The remaining volumes were completed by him, but did not appear till after his death. The *Emperors* comprises all the reigns from Augustus to Anastasius (518); the *Histoire Ecclésiastique* comes down to about the same period. The plan of both is very much the same, being in great part a compilation of the original writers, as far as possible in their own words, but arranged with great skill and judgment, and linked together by such explanations and such a chain of narrative (within brackets) as is necessary to render them intelligible, and to cary on the course of events in a connected recital. Both these works have maintained, even to this day, their reputation for learning and impartiality; and even in the acrimonious contests of the 17th c., there was but litle impeachment of T.'s orthodoxy, so far as the Histories are concerned. His other writings, left in manuscript, were for the most part used as materials by later compilers. Some of his letters have been appended to his *Life*, published by his friend Tronchet, canon of Laval (Cologne, 1711). T. died at Paris on the 10th January 1698, having just entered upon his 61st year. The extent and accuracy of his erudition are still freely acknowledged, and his authorities have supplied the materials of most of the church histories compiled since his time.

TILLER. See HELM.

TILLICOU'LTRY, a manufacturing town of Scotland, beautifully situated in the county of Clackmannan, on the Devon, nine miles east-north-east of Stirling, with which it is connected by railway. There are large manufactures of shawls and plaidings. Pop. (1871) 3745; (1881) 3732.

TILLOTSON, JOHN, Archbishop of Canterbury, was the son of a clothier, and was born at Sowerby, in Yorkshire, in 1630. His father, Mr. Robert Tillotson, was a zealous Puritan—a circumstance that is not a little curious, when we consider that the son ultimately turned out the most catholic churchman of his age. T. studied at Clare Hall, Cambridge, where he took the degree of B.A. in 1650, and of M.A. in 1654. The writings of Chillingworth are said to have exercised a powerful influence on his mind during his university curriculum; but he owed not less to his friendly intercourse with Cudworth, More, Rust, Smith, Wilkins, and other eminent scholars. In 1656, he became private tutor in the house of Edmund Prideaux of Ford Abbey, Devonshire, Attorney-general under the Protector, but appears to have returned to London shortly before Cromwell's death. At what time T. entered into orders, or who ordained him, is not known, but he was a preacher in 1661—attached apparently to the Presbyterian party in the Church of England, for at the famous Savoy Conference (q. v.) he was present on the Presbyterian side; but he submitted at once to the Act of Uniformity (1662); and in December of that year, was offered the church of St. Mary Aldermanbury, London, of which Edmund Calamy had been deprived; but declined it. In 1663, he was appointed to the rectory of Keddington in Suffolk; but almost immediately after, was chosen preacher at Lincoln's Inn, where his mild, evangelical, but *un*doctrinal morality was at first little relished. 'Since Mr. Tillotson came,' said the Benchers, 'Jesus Christ has not been preached among us.' However, as the graces of his character gradually displayed themselves, his popularity increased, especially when it was found, that although not a Puritan, he was nevertheless averse to atheism and popery.

In 1664, he published a sermon *On the Wisdom of being Religious;* and in 1666, *The Rule of Faith*, in reply to a work by an English clergyman named Sargeant, who had gone over to the Church of Rome. About the same period, he took the degree of D.D.; and in 1670, was made a prebend of Canterbury. Two years later, he was promoted to a deanery; and in 1680, published a somewhat notable sermon entitled *The Protestant Religion vindicated from the Charge of Singularity and Novelty*, in which he advanced the proposition, untenable by a Protestant, that 'no man is at liberty to affront (i. e., to attack) the established religion of a nation, though it be false.' This proposition he subsequently, on reflection, abandoned. Along with Burnet, he attended Lord Russell during his imprisonment for complicity in the Rye-house Plot; and on the accession of William III., rose high into favor. In 1689, he was appointed Clerk of the Closet to the king; and in April 1691, was raised to the see of Canterbury, vacant by the deposition of Sancroft (q. v.), after vainly imploring William to spare him an honor which he foreboded would bring him no peace. Nor was he mistaken in his painful presentiment. The non-juring party pursued him with unrelenting rage to the end of his life; but their animosity could not extract one murmur of complaint, or one vindictive retaliation from the meek, humane, and tolerant primate. He did not long enjoy his dignity, dying of palsy, 18th November 1694, at the age of 65. A collected edition of his *Sermons* was published after his death by his chaplain, Dr. Barker; and has been frequently reprinted. They were translated into German by Mosheim; and were long highly popular on account

of their clear, solid, and refined thought, their easy eloquence, and their humane and moral piety. T.'s life was written by Dr. T. Birch (Lond. 1752).

TILLY, JOHN TZERCLAS, COUNT OF, one of the greatest captains of the 17th c., was born in 1559, at the château of Tilly in Brabant. A pupil of the Jesuits, his natural sternness of character inclined him to embrace their fanatical ideas; and this bent of mind was fixed by the examples of Alba (q. v.) and Requesens, under whom he was initiated into the art of war in the Low Countries. After a term of distinguished service in Hungary against the Turks, he was appointed (1609) by Duke Maximilian of Bavaria to reorganize his army, but resigned this post to take the command of the Catholic army at the outbreak of the Thirty Years' War (q. v.), and in conjunction with the Duke Maximilian gained (8th November 1620) the battle of Prague which dissipated the ambitious dreams of the Elector-palatine. During the course of this war, he separated, by able strategy, the armies of Mansfeld and of the Markgraf of Baden, beat the latter at Wimpfen, expelled Christian of Brunswick from the Palatinate (1622), defeating him at Höchst (22d July 1622) and at Stadion (August 1623); the latter conflict, which was of the most desperate character, lasting for three days. Created a count of the empire, he was next opposed to the king of Denmark, whom he conquered at Lutter (17th August 1626), and in conjunction with Wallenstein, compelled to sign the shameful treaty of Lübeck (1629). In the following year, he succeeded Wallenstein as commander-in-chief of the imperial forces, and took by storm the town of Magdeburg (10th May 1631). The unheard-of atrocities which he allowed the Croats and Walloons of his army to perpetrate on this occasion, have affixed to his otherwise high reputation, a foul blot, ineffaceable by all the cosmetic arts of his numerous apologists.

On the 14th May, he made a solemn entry into the ruined city, attended the celebration of a *Te Deum* in the cathedral, and then sent to the emperor a despatch in which occurs the remarkable passage: 'Since the capture of Troy, and the destruction of Jerusalem, a victory such as this has never been seen!' From this time, however, fortune deserted him; for his next opponent was the great Gustavus Adolphus, who completely routed him at Breitenfeld (17th September 1631); and though, in the following spring, he obtained some minor successes over the Swedish general Horn, the king speedily forced him to retreat behind the Lech in Bavaria, and (5th April) forced the passage of the river right in his front, after a desperate conflict, in which T. was mortally wounded. He was removed to Ingolstadt, where he died 30th April 1632. T., the victor in 36 battles, was reckoned the best general of the time till his defeat by the Swedes; he was small in stature, and of a meagre habit of body, with a stern and energetic cast of countenance. Sober and continent, a despiser of luxury and wealth, his zealous support of the Catholic party was entirely founded upon fanatical zeal for the supremacy of a religion which he regarded with more than monkish devotion.

TIL-SEED. See SESAMUM.

TI'LSIT, a town of Prussia, in the province of Prussia, on the left bank of the Memel or Niemen, 65 miles N.E. of Königsberg. Pop. (1880) 21,400. It stands in a fruitful district, called the Tilsit Flat, has broad streets, and a cleanly appearance. Its castle and town-hall are the chief buildings. It carries on an active transit-trade with Russia, besides considerable trade in timber, corn, butter, cheese, and Russian products, and has paper, sugar, and oil-mills.

T. will be ever memorable in history for the treaties which were there signed between France and Russia on 7th July, and France and Prussia on 9th July, 1807. By the former of these, Napoleon agreed to restore to the king of Prussia a great portion of his dominions, his Polish acquisitions being joined to Saxony (see POLAND), and his possessions west of the Elbe formed into the nucleus of the new kingdom of Westphalia; Danzig was declared an independent city; the Prussian province of Bialystok was ceded to Russia; the dukes of Oldenburg and Mecklenburg, the czar's relatives, were reinstated by Napoleon, and in return, the Bonapartist kings of Naples and Holland were recognized by the czar; &c. By the latter, the king of Prussia recognized the kings of Holland, Naples, and Westphalia, and the Confederation of the Rhine, agreed to the cessions laid down in the Russian treaty, and to other minor alienations and concessions to Saxony, amounting in all to nearly one half of his dominions; to the exclusion from his harbors of the commerce of Great Britain, and to the occupation of the Prussian fortresses by the French, till the payment of an enormous ransom. The weighty importance of the alterations effected by this treaty is, however, dwarfed before the startling magnitude of the *secret provisions* signed between France and Russia. By these were arranged the resignation of the empire of the East to Russia, Roumelia and Constantinople being specially excepted by Napoleon, and the acquisition of the Spanish peninsula by France; the two powers were to make common cause against Great Britain, and were to force the three courts of Stockholm, Copenhagen, and Lisbon to join them; and Napoleon agreed to increase no further the power of the duchy of Warsaw, and to do nothing which might lead to the re-establishment of the Polish monarchy. By a further agreement, not put formally into writing, the mouths of the Cattaro, the Ionian Isles, Sicily, Malta, Egypt, and the papal dominions were to be taken by France; and Greece, Macedonia, Dalmata, and the Adriatic coasts, on the partition of Turkey; while on the other hand, Russia was to obtain the rest of Turkey, and was allowed to seize Finland. These secret articles are given on most excellent authority, and their correctness is further vouched for by the conduct of France and Russia for the next few years.

TIMBER, a general term appplied to all wood used for purposes of construction. Most of these have been described under their respective names; but the following tabular statement will show the value of some of the leading sorts of colonial timber which are now beginning to be imported into Britain:

Name.	Colony whence imported.	Breaking Strain of Specimens two in. sq. by twelve in. long.	Specific Gravity.
		lbs.	
Iron-wood,	Jamaica	14,991·2	
Greenheart,	B. Guiana	12,215 6	1·089
Hickory,	N. S. Wales	7,795·4	
Mora,	B. Guiana	9,700·2	0·922
Water-gum,	N. S. Wales	7,760·1	
Blue-gum,	N. S. Wales	7,167·1	0·843
Bully Tree,	Jamaica	6,724·0	
Purple-heart,	B. Guiana	6,393·3	
Locust Tree,	B. Guiana	6,062·7	
Stringy-bark,	N. S. Wales	5,795·9	
Cedar,	Jamaica	3,196·7	
Yacca,	Jamaica	2,204 6	

The trade in timber is, of course, very extensive. Besides that grown in Great Britain, there is annually imported from the colonies and foreign countries an enormous quantity. Of fir, the imports in 1865 were 4,014,655 loads, of which rather more than one half was from the North American colonies, and the remainder from foreign countries. In 1877 the total quantity of all kinds of timber imported was 6,788,779 loads, the load being 50 cubic feet. There were besides 90,720 tons of mahogany and other hard wood, and the total value of the whole amounted to the sum of £20,628,424.

TIMBER, in point of English Law, when growing on land, belongs to the owner of the land; or in case of a lease, to the landlord. In the case of a life-estate in the lands, the tenant for life, unless restrained by covenant or agreement, is entitled to estovers or botes; i. e., wood necessary to repair or burn in the house, and to repair hedges and fences. But the tenant for life cannot commit voluntary waste by felling trees. If the timber is in such an advanced state that it would be injured by standing longer, the Court of Chancery has power to grant leave to sell it, in which event the principal of the price will belong to the reversioner, and the interest thereof to the tenant for life. If, however, the estate for life is declared to be given without Impeachment of Waste (q. v.), as is often the case, then the tenant for life may cut timber to a certain extent with impunity. The tenant for life is entitled to all timber that is blown down on the estate. With regard to ordinary tenants or lessees of lands, though the timber is part of the inheritance, and belongs to the landlord, yet the tenant may cut down the underwood, and take sufficient estovers, or wood, to do repairs. Timber is also protected against third parties who steal or injure it. Thus, whoever steals, cuts, breaks, or damages trees with intent to steal them, provided the injury exceed one shilling in value, incurs a penalty of £5; and on repeating the offence, imprisonment may be added: so whoever unlawfully and maliciously cuts, breaks, barks, or otherwise destroys trees to the value of one shilling and upwards, forfeits £5, or may be imprisoned, in addition to, or as a substitute for such payment, with increased punishment for repeated offences of the same description.

TIMBERS of a ship are the upright ribs, based on the keel, and rising to the gunwale, on which the planking is fastened. See SHIP-BUILDING.

TIMBER TREES. Trees valuable for their timber are very numerous, and are found in all the warm and temperate parts of the world, except where the aridity of the soil, or the sea-breeze, prevents their growth. They belong to very many and widely different natural orders, all of which, however, are orders of Phanerogamous plants; the only Cryptogamous plants which assume the form of trees being the Tree Ferns (q. v.), none of which

yield valuable timber. Of Endogenous plants, none have any claim to be mentioned among timber trees, except some of the Palms (q. v.); the only other endogens, indeed, which can be called trees being a very few of the *Liliaceæ*, as the Dragon Tree. See DRAGON'S BLOOD. Of Gymnogens, the *Coniferæ* are in general of some value for their timber, and some of them are amongst the most useful of all timber trees, as the different kinds of Fir and Pine. A far greater number of timber trees, however, are true exogens, as the Oak, Ash, Elm, Beech, Sycamore, &c., among British trees; the Chestnut and Walnut among those of the south of Europe; the Mahogany, Teak, &c., among those of tropical countries. It is impossible, within our space, to attempt an enumeration. Notice is taken of the most valuable timber trees of different countries in the articles on these countries; of those belonging to particular natural orders, in the articles on these orders; and the most valuable kinds are noticed in separate articles. For the cultivation of timber trees, see the article ARBORICULTURE. Some trees, of comparatively small size, are valuable on account of the quality of their timber, which is used for veneering, or for turnery. Some trees, chiefly valuable as fruit trees, may also be reckoned amongst timber trees, although not of great importance, of which the apple tree may be mentioned as an instance.

TI'MBREL (Spanish *tamburil*), a small musical instrument, of the drum species, in use in ancient times, which was carried in the hand, and was apparently not unlike the modern Tambourine (q. v.), with or without bells.

TIMBU'KTU, a famous city of Sudan, occupies a position of the highest commercial importance on the great north-western bend of the Niger; lat. 17° 37′ N., long. 3° 5′ W. It stands only a few feet above the level of the Niger, and at a distance of about six miles from the principal branch of that river, is triangular in shape, is from 2½ to 3 miles in circumference, and at present without walls, though in former times it covered a much greater area, and was defended by walls. It is laid out mostly in straight, but partly in winding streets of hard sand and gravel, and having a sort of gutter in the middle. There are three chief squares. There are about 980 clay houses—some low and unseemly, and others rising to two stories, and exhibiting considerable architectural adornment—and about 200 huts of matting, almost all in good repair. In the north of the city is the mosque of Sánkoré, an edifice of great grandeur, and which imparts an imposing character to the whole district in which it stands; and the other chief buildings are the 'Great Mosque,' an immense edifice of stately appearance 286 feet in length by 212 feet in width; and a few other mosques. The climate is not considered very healthy. T. is not a manufacturing town, almost the whole life of the city being based upon foreign commerce, for which its situation renders it the most favored center. The quantity of corn raised here is much too small to supply local consumption, and almost all the victuals used are imported by water-carriage from Sansanding, on the Upper Niger. The only manufactures carried on are blacksmiths' work, and articles in leather, especially luggage-bags, cushions, tobacco-pouches, and gun-covers. Most of the clothing sold here is imported from Kano, Sansanding, and England. There are three great highways for foreign commerce to the city of T.—down the river from the southwest, and by two roads from the north, from Morocco and Ghadames respectively. Of this commerce, gold, which arrives at this place chiefly in the form of rings, is the staple; and the amount which the city exports is set down at about £20,000 yearly. Salt, and the kola-nut, which is used in place of coffee (see TEA), are also largely imported and re-exported, as are also tobacco and dates. Rice and corn are brought from Sansanding; English manufactures, consisting of red cloth, sashes, looking-glasses, cutlery, and calico, arrive from the north and north-west. The regular pop. of T. is 13,000; with floating pop., during the months of the greatest traffic, from 18,000 to 23,000. T. was founded about the end of the 11th c., and first became known to Europeans in 1373. It has been visited by but five or six Europeans, including Lenz in 1880.

TIME, in Music, is used in three different senses: 1. The relative duration of musical sounds as measured by the rythmical proportion of the different notes, a minim being half of a semibreve; a crotchet, half of a minim; a quaver, half of a crotchet, &c. 2. The division into measures or bars, and the division of each measure into equal parts, and sub-division of these parts; the different combinations of sounds into equal measures and values being said to form different kinds of time, each indicated by a distinct rhythmical signature. 3. The degree of movement—that is, the absolute, and not relative velocity, which is now more generally expressed by the Italian word *tempo*.—For time in the first two senses, see RHYTHM; in the third sense, TEMPO.

TIMES, THE, is the largest and most important daily newspaper in England and in the world. It was founded towards the end of the last century by Mr. John Walter, a London printer. In January 1785, he established *The Daily Universal Register*, which he continued to publish until January 1788, when he changed the name to *The Times, or Daily Universal Register*, afterwards shortened to *The Times*. The publication, until the close of the century, remained undistinguished by any extraordinary merit or success. But in 1803, a son of Mr. Walter, also named John, became joint-proprietor and sole manager; and under his guidance it soon became remarkable for the accuracy and freshness of its news, and the independence with which it expressed opinions on social and political questions. Reporters and correspondents were engaged with great discrimination, and their best services were secured by prompt and liberal remuneration. The younger Mr. Walter acted himself as manager and editor. In 1805, the *Times* made an attack on Lord Melville's administration at the Admiralty, and the Walter family were in consequence deprived of the lucrative post of printers to the Board of Customs, which they had held for 18 years. At that time, there was, in consequence of the war, a great demand for continental news. The letters of the *Times'* correspondents abroad were transmitted through the regular channels, but the packets were stopped by the government, and Mr. Walter was informed that he would be supplied as a favor, like the other newspapers, with official information. He declined to avail himself of this offer, and it was then he took means to secure the special and early transmission of news for his paper. His success was remarkable; and on many occasions the public dispatches were anticipated.

Thus, the *Times* announced the capitulation of Flushing two days, and the result of the battle of Waterloo some hours, before the arrival of the regular dispatches. An increased circulation was the reward of these efforts, and the only limit to the increase of circulation was the impossibility of throwing off a sufficient number of copies of the paper by the hand-printing press. Mr. Walter saw the importance of introducing steam-printing, and so early as 1804, he encouraged an ingenious compositor, named Martyn, to complete a machine he had invented; but Mr. Walter the elder, who was then alive, was less sanguine, and the scheme fell to the ground. Some years later, Frederick Koenig, a German, invented and patented a new press, which could be worked by the steam-engine, and Mr. Walter became his patron. He gave him, in 1814, an order for two machines, which, in anticipation of opposition on the part of the pressmen, were put up in premises adjoining the office. On November 29, in the same year, it was announced to these men that the paper had been printed by steam, and that there was no further occasion for their services. It is very creditable to the proprietors of the *Times* that no advantage was taken of the violent language used by the workmen on this occasion, and that their wages continued to be paid while they remained without employment. Under the old mode of going to press, about 250 copies could be printed per hour; but with the new machine it was possible to take 1100 impressions in the same time, so that the *Times* had a means of increasing its circulation not at the command of the other newspapers. From this time, Mr. Walter intrusted the superintendence of the literary department of the paper to Mr. Thomas Barnes, the first editor, born in 1785, who remained in the same situation until his death in May 1841. Mr. Barnes wrote few articles, but he fixed on the subjects to be discussed, and displayed great ability in giving uniformity of tone and point to the articles passing through his hands. It was during his editorship that a series of leaders by Mr. Edward Sterling obtained for the paper new political and social influence, recognized by the name then applied to it, of 'the Thunderer.' It was in his time, too (1834), that O'Connell attacked the accuracy of the *Times'* reports of the parliamentary debates, and was signally defeated by the testimony of those whose speeches were said to have been tampered with.

In 1841, Mr. John T. Delane succeeded Mr. Barnes as editor of the *Times*, and continued to conduct the paper with distinguished ability till his retirement in 1877. It was also in 1841 that newspaper won a new title to the confidence of the mercantile community, by the detection of a great scheme to defraud the leading banking-houses. If Mr. O'Reilly, the Paris correspondent, had not discovered the conspiracy, which was headed by a French baron, and other persons holding a good position in society, it was shown that the leading banking-houses would have been defrauded to the extent of a million sterling. The *Times* did not altogether escape punishment. It had to defend an action at law, in which, although a verdict for a farthing of damages only was given, the defendants were obliged to pay their own costs. To relieve them of this burden, £2700 were in a very short time subscribed by the bankers and merchants chiefly of the city of London. The offer of this sum was declined, and it was in consequence employed in another way, to commemorate the event which had led to its being collected. Two sums of £1000 each were devoted to found *Times'* scholarships at Oxford and Cambridge in connection with Christ's Hospital and the City of London School; and the balance was employed to erect marble tablets at the *Times'* office and the Royal Exchange, recording the obligations the mercantile community were under to the proprietors for the generous manner in which their interests had been protected. After the death

of Mr. Barnes, Mr. Walter did not relax his efforts to obtain early intelligence. In 1842, a remarkable instance of the trouble and expense he incurred with this view, was brought under public notice. The news of the massacre in the Cabul Pass was first made known in the *Times*. The correspondent's letter containing it had been forwarded from Marseille to Paris by carriages specially hired; from Paris to Boulogne by horse; thence to Dover by the steamer belonging to the newspaper (which had been for days in the Channel with steam up); and from Dover to London again by horse. The letter reached the *Times*' office at 2 o'clock on Sunday afternoon, and was immediately put in the hands of compositors, who had been kept in attendance from the preceding day, in expectation of its arrival.

The only news of the event which had reached England at the meeting of the House of Commons next day was that contained in the *Times*, and it was at once assumed by the government as having all the authenticity of a dispatch received by the ordinary channels. The cost of conveying this letter from Marseille to London was upwards of £300. Noteworthy events in the recent history of the *Times* have been the publication of the letters by Dr. W. H. Russell and other special correspondents at the seat of successive European wars; the establishment of the *Times*' fund for the relief of the soldiers in the Crimea (£15,000 of which was collected in a fortnight); the formation of a fund, in 1858, for the relief of the homeless poor. Important mechanical improvements have recently been introduced in the printing office: the 'Walter' Press in 1871, and the composing-machine in 1872. A new office was built in 1873. The annual summaries from the *Times* for 1851—1875, and its obituary notices of *Eminent Persons* (1870—1879), have recently appeared as volumes. In 1877, a weekly edition of the *Times* began to be issued. In 1880, the *Quarterly Review* stated the circulation of the *Times* at 100,000. The prosperity of the paper may be fairly attributed to the great fulness and accuracy of the parliamentary intelligence; the literary merit of the leading articles; the value of the special telegrams and letters; the care and good taste displayed in the revision of contributions; the respect with which honest opinion is treated; and above all, perhaps to the absence of that sarcastic or abusive tone towards classes and sects, and that harsh literary criticism, by which other publications have obtained popularity.—See Hunt's *Fourth Estate;* Andrews' *History of Journalism;* Grant's *Newspaper Press;* Hatton's *Journalistic London* (1882).

TIME-TABLES. See BRADSHAW'S RAIL. GUIDE.

TIMO'LEON, a great Greek general, and the liberator of Sicily from the dominion of 'tyrants,' belonged to one of the noblest families of Corinth, and was born there about 394 B.C. T.'s brother, Timophanes, having made himself tyrant of his native city, T. either killed him with his own hand, or caused him to be killed. Opinion was divided in Corinth as to the merit of this deed, one party extolling it as an act of the noblest patriotism, while the other demanded T.'s death as a murderer. The difficulty was got over by appointing him leader of a small band of mercenaries sent (344 B.C.) to Syracuse, the exiled citizens of which had begged assistance from Corinth, the mother-city, against the 'tyrant' Dionysius and the Carthaginians. Outwitting the Carthaginians, T. arrived safely at Tauromenium, where he was welcomed by the Syracusan exiles. Hicetas, 'tyrant' of Leontini, was then striving to dispossess Dionysius, and secure the tyranny of Syracuse for himself, and had succeeded in getting possession of the whole city except the island citadel. T., with only a fifth of the number, defeated him at Adranum; and marching to Syracuse, made himself master of two quarters of the city. From this time onwards, T.'s career in Sicily was one of complete victory over all opponents. Dionysius the Younger (q. v.) in 343 B.C., surrendered in despair the citadel of Syracuse, and was sent to Corinth. Hicetas having failed in the attempt to assassinate T., called in the assistance of a Carthaginian force of 50,000 men, which, however, was shortly after withdrawn by Mago, who had become suspicious of treachery. Hicetas at last fled to Leontini, leaving T. sole master of Syracuse. After repeopling the almost desolate city by recalling exiles, and inviting new colonists from Greece, Italy, and Sicily, he spent the next two years in enacting laws and organizing a constitution, which he put on a completely democratic footing.

The Carthaginians, alarmed at the reviving power of Syracuse, and the prospect of union among the Sicilian Greeks, now sent an army of 80,000, under Hasdrubal and Hamilcar, to subdue the whole island. T., with only 12,000, encountered them (339 B.C.) on the Crimissus, and gained one of the greatest victories ever won by Greeks over barbarians. He now proceeded with his great project of expelling the tyrants of the other Greek cities, who, however, again called in the aid of the Carthaginians; but the successes of T. soon made the Carthaginians glad to conclude a treaty, fixing the river Halycus as the boundary between their dominions and those of the Greeks. Hicetas, 'tyrant' of Leontini, being now captured, was put to death with his wife and daughters; and shortly after, Mamercus of Catana suffered the same fate. T. thus in about six years freed Sicily from nearly all its tyrants, and conferred upon the cities free constitutions, himself all the time taking no advantage of the immense influence which he thus obtained. After his great work was accomplished, he lived among the Syracusans as a private citizen, receiving from them and from all the Greek world the greatest honor and respect: his advice was had recourse to by all the Sicilian cities in any emergency. He died in 337 or 335 B.C., having been blind for a considerable time previously; and was buried in the market-place of Syracuse, where a gymnasium, called the Timoleonteum, was afterwards erected over his tomb. T. was undoubtedly one of the greatest generals and noblest characters produced by Greece; he appears to have been thoroughly unselfish, and to have set before him as his great aim the abolition of tyranny, and the establishment of freedom.

TIMON THE MISANTHROPE was a native of Athens, and lived in the time of the Peloponnesian War (431—404 B.C.). The little that is known concerning him is learned chiefly from Aristophanes and the other comic writers who attacked him. Disgusted with mankind, on account of the ingratitude of his early friends and companions, he lived a life of almost total seclusion from society, his only visitor being the 'bold and insolent' Alcibiades. Numerous stories were current in antiquity regarding his eccentricities, one of which is, that he died because he would not allow a surgeon to visit him to set a limb. His grave, which was on the sea-shore, is said to have been planted with thorns, and to have been rendered inaccessible by the sea forming it into a small island.

> We know him out of Shakspeare's art,
> And those fine curses which he spoke—
> The Old Timon with his noble heart,
> That strongly loathing, greatly broke.
>
> TENNYSON.

'The Timon of Plutarch and of the popular stories of Shakspeare's time was little different from the ordinary cynic. The Timon of Shakspeare is essentially high-minded and generous, his all-absorbing defect—the root of those generous vices which wear the garb of virtue—being the entire want of discrimination. If Timon had possessed one friend with whom he could have exchanged confidence upon equal terms, he would have been saved from his fall, and certainly from his misanthropy.'—See Introductory Remarks to *Timon*, in Knight's Shakspeare.

This T. must be distinguished from the Greek poet and philosopher of the same name, who lived about a century and a half later.

TIMO'R, the most important of the chain of islands which stretch eastward from Java, lies in 8° 16′—10° 25′ S. lat., and 125° 25′—127° 10′ E. long., has an area of 8820 sq. m., and pop. of about 400,000. A chain of wood-clad mountains runs throughout its entire length; Alas, on the southeast, being 11,800 feet in height; Lakaan, in 9° 10′ S. lat., 6175 feet; and Miomaffo, 4630. The prevailing rocks are of the graywacke formation, which, at the south base of Miomaffo, is cut by serpentine mountains of limestone; and calcareous rocks resembling ruins frequently occur. Magnetic iron, porphyry, syenite, gold, copper, malachite (containing 22 per cent. of pure copper), sulphur, and naphtha, are found.

The dry monsoon is from May to November, during which no rain falls. From November to April, there are daily storms of rain and wind from the north-west; the streams are swollen; the thermometer rises to 94° F. in the shade; the earth is covered with a dark-green carpet, and myriads of insects come into life. The rivers are numerous, but small, and most of them yield gold. Near the sea, are very fertile lands, on which are grown rice, maize, beans, tobacco, sugar-cane, cotton, potatoes, and all sorts of tropical fruits. There are many varieties of the palm, the lontar being useful for food and other purposes. Timber trees suited for masts attain a height of 100 feet, and from 3 to 4 in diameter; the wild nutmeg, cinnamon, and tamarind are plentiful; and bamboos make the forests impenetrable in many parts. About 600 species of plants are known, a great number being medicinal, and few poisonous. Indigo grows everywhere, and potatoes in the mountains.

Three-fourths of T. on the south-west is subject to the Dutch, whose chief settlement is Koepang (Kūpang); the remaining part in the north-east belongs to the Portuguese, who have a town called Dilly, on the north coast, with a safe roadstead, and a fort, which was nearly destroyed by an earthquake in 1857. T. is divided into small kingdoms, ruled by rajahs under Dutch or Portuguese control.

Koepang lies at the base of a semicircle of wooded hills, on a beautiful bay in the south-west. It is irregularly built, the principal buildings being the governor's house and the Protestant church. There is a Mohammedan and a Chinese temple, one Dutch, and two Malay schools. Pop. 3500, including 100 Europeans and 500 Chinese. Whalers and trading-ships from Sidney,

Van Diemen's Land, &c., call for provisions on their way to or from Java and Singapore; and T. will be a convenient market for horses and supplies to the settlements in North Australia, which is only eight days' sailing distant.

The exports are—sandal-wood, horses, wax, tortoise-shell, edible nests, &c.; imports—cotton, woollen, and silk fabrics, provisions, and general supplies. Pearls are found on a bank 30 miles south-east from Koepang. The natives are partly Oceanian negroes, and partly of Malay race. They worship a supreme being called 'Lord of the Sun.' Near the Netherlands' settlements, some hundreds have been baptized, but missionary efforts have not been very successful. The fathers dispose of their daughters for gold and buffaloes, and polygamy prevails among the rich.

Koepang is the capital of the Netherlands' residency or government of T., which includes Samao, Rotti, Savu, the Sandal-wood Island, Sumbawa, Flores, Adanara, Solor, Lomblem, Ombay, and all the small islands belonging to the chain.

TIMO'R-LAUT, THE, or TENIMBER ISLANDS, lie east from Timor, in 6° 40′—8° 23′ S. lat., and 130° 26′—132° 2′ E. long., having an area of 3150 sq. m. Pop. 15,000. By far the largest island of the group is Timor-Laut, which is 78 miles in length, and 21 in breadth. The soil is rich, and covered with the most luxuriant vegetation, various palms and other useful trees growing in great abundance. At a little distance from the shore, mountains encircle the island.

The next in importance is Larat, the north-west point of which is in 7° 6′ S. lat., and 131° 47′ E. long. Area, 147 sq. m.; pop. 2500. It is also mountainous. Further north are Vorhate, Marū, and Molo. On the west of Timor-Laut are Selū and Sejrah; a multitude of smaller islands of coral formation being scattered around.

On the larger islands are small horned cattle, goats, swine, fowls, and a great variety of birds. Nothing can exceed the beauty of the Blue-streaked Lory (*Eos reticulata*) and the Citron-crested Cockatoo (*Cacatua citrino-cristatus*). Fish are plentiful in the rivers of T. and surrounding seas, and there is a considerable export trade in tortoise-shell and Bêche-de-Mer (q. v.). English trading-ships from Singapore, and South-sea whalers, sometimes visit these islands, and not unfrequently have been treacherously attacked. The natives are tall, well-made, fairer-complexioned, and have more regular features than the Alfoors. They are low in the scale of civilization.

TIMOTHY, FIRST AND SECOND EPISTLES TO, form, along with the Epistle to Titus (q. v.), the three 'Pastoral Epistles,' the authorship of which is all but universally ascribed to St. Paul. The external evidence for their genuineness is very strong, yet not complete. They occur in the Muratorian Canon and the Peshito version as writings of St. Paul; Eusebius classes them among the *homologoumena;* while still earlier, Irenæus, Tertullian, and others of the Fathers quote them as authoritative. On the other hand, Tatian (q. v.), one of the earliest of the Fathers, denies their genuineness, as did also Marcion, Basilides, and most of the Gnostic teachers. Origen speaks of some who rejected 2d T. on account of the mention of 'Jannes and Jambres,' two apocryphal characters; while in modern times, Schleiermacher and Neander admit the Pauline origin of 2d T., and endeavor to disprove the genuineness of 1st. Eichhorn, De Wette, Baur, and others go further, and seek to demonstrate the spuriousness of the whole three Pastoral Epistles. They consider the language and mode of thought quite distinct from the Pauline, and they (particularly Eichhorn) find no period in the apostle's life to which they could be properly fitted in. Their arguments have largely influenced the conclusions of very many scholars in this field. The purpose and scope of the Epistles to T. are so well known, that an analysis, however slight, is almost superfluous. They consist of a series of warnings, exhortations, advices, and predictions.—See the 'Introductions' of Alford, Wordsworth, Davidson, Wiesinger, Hug; and the list of commentators on the 'Pastoral Epistles,' appended to the article on the Epistle to TITUS.

TIMOTHY GRASS, the name commonly given to *Phleum pratense*, a grass much valued for feeding cattle. It first received the name T. G. in America, from the name of a person who did much to promote its cultivation there. Along with the other species of the genus, it often receives also the English name of CAT'S-TAIL GRASS. The genus *Phleum* is distinguished by a panicle so compact as to resemble a close spike, single-flowered spikelets, with two nearly equal accuminate or almost awned glumes, two awnless paleæ, and the seed free. The species are mostly natives of Europe; a number of them are British, but the T. G. alone is of any economical value. It varies very much in size according to soil and situation, succeeding best in moist rich soils. It is very extensively cultivated both in Britain and in America. It has strong culms, attaining a height of 4—5 feet, but is tender and nutritious, and much relished by cattle. It is perennial, but springs up rapidly, even in the year in which it is sown. Its spikelike panicle, from the form of which the name Cat's Tail has been given, is cylindrical, and often of several inches in length. The seed is very small.—*Phleum nodosum* is a very similar species, perhaps a mere variety, with the lower part of the culm prostrate and swollen into knots or bulbs; the spike much smaller than in *P. pratense*. It is a very inferior grass, and is found only on dry soils.

TIMUR, called also TIMUR-BEG and TIMUR-LENG from his lameness, and vulgarly known among western writers as TAMERLANE, was the second of the great conquerors whom Central Asia sent forth in the middle ages, and was born at Sebz, 40 miles from Samarkand, April 8, 1336. His biographers make him the fifth in descent from Karatchâr Nuyan, the relative and counselor of Genghis Khan (q. v.), and the ninth from Tûmna Khan, the direct ancestor in the male line of his renowned predecessor. The royal line of Jagatai (see TURKESTAN) had so utterly degenerated that the real power was in the hands of a number of independent chiefs of Mongol blood, each of whom, choosing a prominent city of the kingdom, there set up his standard, and lorded it over the surrounding district. One of these chiefs, Hadji Berlas, the uncle of T., had established himself at Kesh, and here the future conqueror passed the first 24 years of his life in peaceful obscurity, devoting himself to the national amusements of hunting and equestrianism. But a formidable inroad (1360) of the Kalmucks of Jettah, who speedily subjugated Turkestan, expelling those chiefs who refused submission, effectually called forth T.'s hitherto untried energies. Declining to accompany his uncle in his flight, he boldly advanced with a small retinue to meet the invader, who was so charmed with his eloquence and address, that he at once confirmed him in the government of Kesh, and appointed him one of the principal ministers of his son, the new monarch of Turkestan. But neither chiefs nor people of the conquered country could long endure the tyranny of a race more cruel and barbarous than themselves, and the exiles and fugitives having been collected by the Ameir Husseyne, and joined by a powerful force under T., the Kalmucks were ultimately expelled in 1365, and Turkestan divided between its two liberators, who ruled together in the utmost harmony for some time; but war having arisen beween them, Husseyne was defeated and slain, and T., by unanimous consent of the chiefs, was hailed as supreme lord of Turkestan.

It was in the war against the Kalmucks that T. received the wound in the thigh which rendered him lame for the rest of his life. He did not, however, either then or afterwards, assume the rank of a sovereign, but elevating one of the royal race to the throne, reserved for himself the real authority and the title of *emir*. Having thus, in the space of ten years, risen, by dint of superior ability, to absolute authority over a numerous and warlike people, he proceeded to avenge his nation's wrongs on the Kalmucks of Jettah and Mogulistan; then turned westward to punish the predatory tribes of Khaurezm, who had plundered Bokhara; and spent the interval between these campaigns in supporting Toktemesh Khan, one of the claimants to the throne of Keptchak, ultimately (1376) placing him in undisputed possession. With the view of restoring its former limits to the empire of Jagatai, he summoned the prince of Herat and the other chiefs of Northern Khorassan to attend a 'kouriltai;' and on their refusal, immediately attacked and reduced them to submission, levying a moderate contribution as a penalty. But soon after (1383), the people of Herat again rebelled, murdered the envoys whom he sent to remonstrate; and 2000 of the garrison, built up with an alternate layer of brick and mortar into the form of a pyramid, were left by T. as a horribly singular and effective reminder of the consequences of rebellion. Seistan was next reduced, the Afghans of Suliman Koh chastised, and T. returned, as was his wont, to spend the winter in the bosom of his family, at one or other of his numerous palaces near Samarkand. In the following year, he commenced his career of aggression by the invasion of Mazanderan; and by the close of 1387, the whole of the districts west of the Tigris, from Tiflis to Shiraz, were subdued; those chiefs who voluntarily submitted being mostly confirmed in their governments, while the inhabitants of Ispahan—who, after a pretended submission, suddenly rose upon the Tartar garrison, and massacred 3000 of them—were almost completely exterminated. Meanwhile, Toktemesh Khan, of Keptchak, took advantage of his absence to invade T.'s territories on the Amu-Daria; on which T. returned home, and, after driving the invaders out, pursued them to the head of the Tobol, then west across the Ural mountains and river, and though long baffled by the Arab tactics of his opponents, finally brought them to bay on the banks of the Bielaya (a tributary of the Kama), 18th June 1391, and almost wholly annihilated them.

Resuming, in 1392, his conquering march westwards, he crossed the Tigris, subdued the numerous and warlike principalities to the east of the Euphrates, then advanced northwards, through the gates of Derbend, to the Volga, and again routed Toktemesh (who had ventured to resume hostilities), on the banks of the Terek (1395), turned west as far as the Dneiper, and then north to Mos-

cow, returning by Astrakhan and the Caucasus, leaving death and desolation in his track. In 1398, T. campaigned in Hindustan, entering by the passes of the Hindu Koh, near Cabul, and routing *seriatim* the numerous armies collected to oppose him, till the number of prisoners became so great, that four days before the great battle before Delhi between T. and the Indian emperor, the former, as a precautionary measure, ordered the murder in cold blood of all the males (said to be 100,000 in number), and then, after totally routing his opponents, took the capital. After a further advance to the Ganges, and more military successes, T. retraced his steps to Samarkand, where the immense spoils of the expedition were expended in the adornment of the capital. T. returned to Western Asia in the following year, and attacked the Egyptian Empire in Syria, to avenge the murder of his ambassador, and the aid which the Mamluk sultan had given to his enemies. T. was as usual completely successful in the field; and the capture of Aleppo, Hama, Hems, Baalbek, and Damascus, equally proved his skill in the attack of fortified places. His mode of attack was to undermine the fortifications on all sides, then to fire the mines with wood steeped in naptha, and on the destruction of the walls and battlements, which uniformly resulted, to charge in overwhelming force through the breaches. Similar conduct to that of the Mamluk sultan on the part of Sultan Bajazet I., drew from T. repeated remonstrances, which the other, in the overweening confidence springing from uninterrupted success, treated with contempt, and answered with insult; but the advance of the Tartars to his frontiers soon opened his eyes to the greatness of his error, and with a powerful army, he hastened to oppose them. The two hosts met at Angora (July 20, 1402), and after a long and obstinate contest, in which, although the generalship of Bajazet and the steadiness of 20,000 Servian auxiliaries long balanced the superiority of T.'s troops, the Turks were totally routed, and Bajazet captured.

The conquest of the whole of Asia Minor speedily followed; the Byzantine emperor did submission to the victor, as did also the Turkish ruler of Thrace; and the Knights of St. John were expelled from Smyrna. The unfortunate Bajazet died after a few months' captivity, though uniformly treated with the greatest consideration; and about the same time, T. commenced his return —receiving on the way a most satisfactory embassy from the Egyptian sultan, who was now glad to come to terms—conquering Georgia, where he passed the winter, and resuming his march in the following year by Merv and Balkh, reached Samarkand in 1404. Here he resumed preparations for the long projected invasion of China, continued the embellishment of the capital, and celebrated his great successes by the most gorgeous festivities. All things being now ready, he started with a large army for the Sihun, marched down that river to Otrar, where, being detained by the severity of the weather, he was attacked by an ague-fever, and died after a week's illness, February 17, 1405. T. holds a high position as a mere conqueror: his antagonists were mostly warlike and disciplined, and seldom much inferior in number; yet, from the savage horsemen of the Siberian steppes to the mail-clad warriors of Servia, all were alike forced to bow before the invincible prowess of the Mongol conqueror. The charge of cruelty brought against him is completely established by the massacre in India, but opposite to this might be placed numerous instances of a lenity and forgiveness almost incredible in a 'barbarian.' He did much to promote the arts and sciences throughout his dominions, but the speedy dissolution of his empire deprived his labors of any permanent utility.—The principal authority for the life of T. is Sherif-ed-Din-Ali's *History* (in Persian), translated into French by Pétis de la Croix, under the title of *Histoire de Timur-Bec, connu sur le nom du grand Tamerlan* (4 vols., Par. 1722). Several writings exist in Persian, attributed to T., but are of doubtful authenticity. Among these are the *Institutions* (with an English translation and a valuable index, Oxford, 1783); and the *Commentaries* of T., translated from a MS. of Major Davy by Major Stewart, late Professor of Oriental Languages in the East India Company's College. See also a translation of the narrative of Clavijo, envoy of Henry III. of Castile to T., by C. R. Markham (Hakluyt Society, 1860).

TIN (symb. Sn. atomic weight 118,* spec. grav. 7·29) is a beautiful silvery-white metal, with a tinge of yellow, and a high metallic lustre. It possesses a crystallized texture, and may be obtained in well-formed crystals of the pyramidal or tetragonal system; and it is in consequence of this crystalline texture that a bar of tin, when bent, emits a creaking sound, termed the *cry* of tin (the *Zinngeschrei*, or tin-shriek of the Germans). Tin is a soft metal—being softer than gold—and is very malleable, and can be beaten out into very thin laminæ, in which form it is known as *tinfoil*. At a temperature of about 212° F. its ductility is considerable, but by no means remarkable, and it may be then easily drawn into wire, the tenacity of which is only moderate, as a wire with a diameter of 0·17 of an inch is broken by a weight of about 50 lbs. It is a tolerably good conductor both of heat and electricity, and when handled communicates a peculiar odor to the skin. It melts at a temperature of 442° F.; and at a higher temperature, if air be present, it becomes converted into the binoxide and burns with a brilliant white light. At ordinary temperatures, it is very slightly acted on by exposure to the air, or to moisture. With regard to the action of the ordinary acids on this metal, Professor Miller observes that 'nictric acid of specific gravity 1·3 acts upon it violently, and produces an insoluble hydrated binoxide, known as metastannic acid; at the same time, owing to the decomposition of water, a considerable quantity of ammonia is formed, which enters into combination with the excess of acid. Strong hydrochloric acid, when heated upon tin, dissolves it gradually, with extrication of hydrogen. Aqua regia, if not too concentrated, dissolves the metal, and converts it into bichloride. Dilute sulphuric acid is without action on the metal in the cold; but if the concentrated acid be boiled upon it, the tin becomes converted into sulphate, while sulphurous acid escapes. The hydrates of potash and soda act upon tin at high temperatures, hydrogen being evolved, whilst a soluble metastannate of the alkali is formed.'—*Inorganic Chemistry*, 2d ed., p. 588.

There are two principal oxides of tin—viz., the Protoxide (SnO) and the Binoxide (SnO_2). There is also a Sesquioxide, Sn_2O_3.

Protoxide of Tin, or stannous oxide (SnO), is obtained as a white hydrate ($2SnO, H_2O$) by precipitating a solution of the protochloride of tin with an excess of carbonate of soda. The protoxide acts as a base, forming salts which are colorless, redden litmus, and are for the most part soluble in water, from which crystalline tin is deposited on an inserted mass of zinc, constituting the so-called *Tin Tree*. None of these salts are of any special importance. *Binoxide of Tin*, or stannic oxide (SnO_2), occurs native in the anhydrous form, crystallizing in square prisms, which are sufficiently hard to scratch glass, and generally of a brown color, from the presence of peroxide of iron or of manganese. In its artificially prepared, hydrated condition, it has the character of an acid, and according to its different modes of preparation, forms two remarkable varieties, known as stannic and metastannic acids. *Metastannic Acid* is prepared by the action of strong nitric acid on tin, and occurs as a white crystalline, insoluble mass, which, when dried in air, consists of $H_{10}Sn_5O_{15}5H_2O$, but when dried at 212° F., loses five molecules of water, and consists of $H_{10}Sn_5O_{15}$. By ignition it becomes anhydrous, and of a pale straw color. In this form (in which it resembles the native binoxide in its properties), it is known in commerce as *putty-powder*, and is employed for polishing plate, and for giving whiteness and opacity to enamels. In the hydrated state, it is insoluble in hydrochloric or nitric acids, but is freely soluble in solution of potash or soda, forming salts which are not crystalline, but may be obtained in a granular form. Metastannic acid, in its hydrate state, may be recognized by the beautiful golden yellow metastannate of tin which is formed when it is moistened with protochloride of tin. *Stannic Acid* ($SnO_2,2H_2O$) is procured by the addition of carbonate of lime or of baryta to a solution of bichloride of tin, when it falls as a gelatinous precipitate. Unlike metastannic acid, it is readily soluble in nitric and hydrochloric acids; and at a temperature of 284° F. it is converted into metastannic acid. In combination with the alkalies, it forms stannates, which crystallize readily, and whose formula is MO,SnO_2. The stannate of soda (Na_2SnO_2) is largely used as a mordant by the dyer.

There are two chlorides of tin—viz., a Protochloride and a Bichloride. The *Protochloride of Tin*, or stannous chloride ($SnCl_2$), may be obtained in a hydrated form by dissolving the metal in hydrochloric acid, and evaporating the solution, when the salt crystallizes in prismatic needles, having the composition $SnCl_22H_2O$. The hydrated protochloride is extensively used as a mordant, and for deoxidizing indigo and the peroxides of iron and manganese, by the dyer and calico-printer; and in consequence of its deoxidizing or reducing powers, it is sometimes employed in analytical chemistry, especially in the determination of the quantity of mercury, since all the mercurial salts, when boiled with it, are decomposed, and yield their mercury in the metallic form. *Bichloride of Tin*, or stannic chloride ($SnCl_4$), forms numerous double salts with the soluble chlorides; the compound of this nature which it forms with chloride of ammonium is represented by the formula $2NH_4Cl.SnCl_4$, and is employed by the dyer under the technical term of *Pink Salt*. An impure bichloride, prepared by dissolving tin at a gentle heat in a mixture of nitric acid and sal-ammoniac, and known in the trade as *Nitromuriate of Tin*, or *Composition*, is also largely used by dyers and calico printers.

The sulphides of tin are three in number—viz., the protosulphide, the sesquisulphide, and the bisulphide. The *Bisulphide of Tin* (SnS_2) may be obtained in the hydrated state, in the form of a dingy yellow precipitate, by passing sulphuretted hydrogen through a solution of a persalt of tin. In the dry way, it is procured in the form known as Mosaic Gold, which is insoluble in

* The atomic weights (and corresponding 'notation') adopted in this article are those of the Unitary system (H = 1, O = 16, S = 32, C = 12), instead of the older dualistic system (O = 8, S = 16, C = 6). See art. CHEMISTRY.

any acid, though soluble in aqua regia; and is employed in the arts to give an appearance of bronze to the surface of metals.

Tin forms two sets of salts—the protosalts and the persalts, of which the protochloride and bichloride of tin may be taken as good examples. The *Protosalts* (stannous salts) yield a very characteristic reaction with sulphuretted hydrogen, a chocolate-colored precipitate of hydrated protosulphide of tin being thrown down; moreover, with a dilute solution of chloride of gold, they give either a beautiful purple precipitate, known as the *Purple of Cassius*, or a brown precipitate of reduced gold, according to the quantity of the test that is used. The *Persalts* (stannic salts) yield a dirty yellow precipitate of hydrated bisulphide of tin; while all the compounds of tin, when exposed on charcoal to the reducing flame of the blowpipe, give a white malleable globule of the metal.

Reduction and Manufacture.—Tin must have been one of the metals earliest known, as it enters into the composition of Bronze (q. v.), of which the most ancient metallic weapons and tools were made. Tin and oysters were the products for which Great Britain was earliest famous. This general statement of facts is particularly noticeable. Tin is still largely obtained in Cornwall; and from that locality the Phœnician navigators took it to Tyre and Sidon. To this day, England is by far the greatest tin-producing country, having raised in 1880 about 13,737 tons of dressed ore, or 8918 tons of the metal. Bohemia and Saxony have some tin mines, and so also have Spain and Portugal. Tin has long been obtained from Malacca, in the Malayan Peninsula, and from some of the neighboring islands. Australia, among her other mineral riches, produces tin, and the import from that country in 1876 amounted to 8392 tons.

There is but one ore of tin of any importance—viz., the binoxide, or stannic oxide (SnO_2), which in its pure state consists of tin 78, and oxygen 22. It is called Tinstone or Cassiterite. Tin ore has nothing remarkable in its appearance; it is of various colors—as gray, various shades of yellow, and red, and black. Its specific gravity—a notable feature—is 6·9; and it strikes fire with steel. In Cornwall, the tin ore occurs in mineral veins running through granite and slate rocks, or disseminated in crystals through their mass. The tinstone obtained from the veins or lodes is called *Mine-tin;* and that procured by washing alluvial deposits is called *Stream-tin*—the latter is the result of the disintegration of granite and other rocks which contained veins of tin. Washed Cornish tin ore, usually called 'black tin,' produces on an average about 67 per cent. of metallic or 'white' tin. Tin pyrites, or sulphide of tin, is found in some of the Cornish mines, but it is of little importance commercially. It may also be stated that ores containing copper are sometimes found with so large a proportion of tin that it is difficult to say whether they should be regarded as tin or copper ores.

The dressing of tin ore obtained from the mine is a difficult and delicate operation. It is so much dispersed through the gangue, that it requires to be stamped to a very fine powder by apparatus described under METALLURGY, before the metallic particles can be effectually separated. So small comparatively is the valuable portion of the ore, that at Huel Kitty Mine, St. Agnes, not more than 84 lbs. of oxide of tin is obtained from a ton of the material brought to the surface; and in some mines, the proportion of oxide to the rest of the material is not so much as 10 lbs. to the ton.

The stamped ore is copiously supplied with water passed through a grating adjoining the stamps, and conveyed into a channel where there are two pits. The purer and heavier portion falls into the first, and is called the *crop;* the remainder, called the *leavings,*

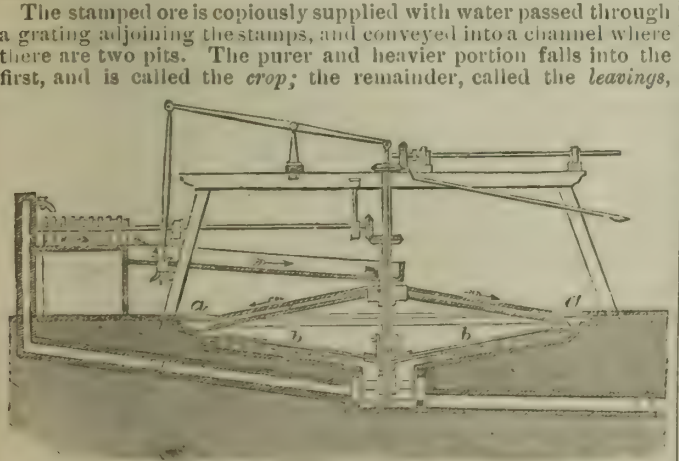


Fig. 1.

passes through the first, and is retained in the second pit. Repeated washings are now necessary to separate as thoroughly as possible the impurities from the ore, and for this purpose a machine called a *buddle* is largely employed. Various kinds of apparatus are, however, used, but they are similar in principle to the jigging sieve and sleeping table described under METALLURGY. We may notice here that a new form of buddle, known as 'Borlase's Buddle,' has been recently introduced for dressing tin ores, by which a saving of about 30 per cent. is said to be effected. Figs. 1 and 2 show this machine. The ore and earthy matters, in the state of a thick mud, are conveyed by square pipes or channels to the circumference *a*, *a*, around which, by the aid of water, the metallic portion separates, while the lighter stony impurities flow towards the center, and are carried away. There are brushes at *b*, *b*, for agitating the ore during the operation. In the older form of buddle, this action is reversed, and the machine, instead of being depressed, is raised in the center.

The tin ore thus far purified, has next to be deprived of its sulphur and arsenic; this is done in a Reverberatory Furnace (q. v.), the flues of which are connected with large condensing chambers, in which the arsenic is deposited in a crystalline form (see ARSENIC), and is afterwards resublimed, to form the white arsenic of commerce. The sulphur, which is present in the state

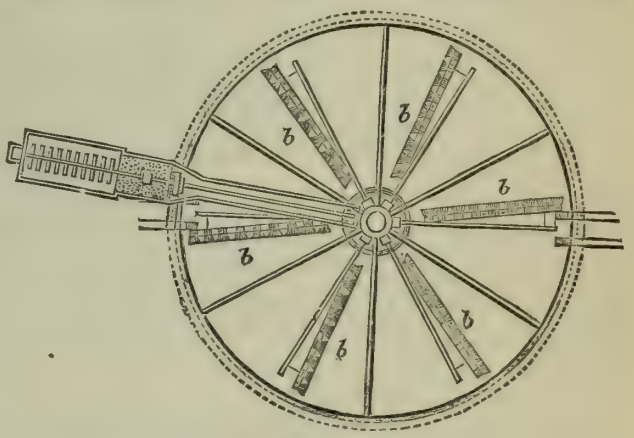


Fig. 2.

of sulphide of iron, is decomposed by the heat into sulphurous acid gas, and the remaining oxide of iron is removed by a subsequent washing. Sulphide of copper, when present, is converted by roasting, and afterwards exposing it to the air, into sulphate of copper, and is then easily dissolved out by lixiviation.

After this final washing, the ore is ready for smelting in a reverberatory furnace. The charge consists of from 20 to 25 cwts. of ore mixed with one-sixth of its weight of powdered anthracite or charcoal, and a small quantity of lime or fluor-spar, to serve as a flux for the siliceous impurities. Before being put into the furnace, the mixture is moistened with water, to prevent the finely powdered ore being carried away by the draught. When the charge is placed on the hearth of the furnace, the doors are closed, and the heat gradually raised for about six hours; the oxide is then reduced by the carbon of the coal. At this stage, the furnace-door is opened, and the mass worked with a paddle, to separate the slag, which is raked off, and the richer portion of it melted over again. The reduced tin subsides to the bottom, and is run off into a cast-iron pan, from which it is ladled into moulds, to produce blocks or ingots of a convenient size.

The tin has still to be purified, first by a process of *liquation*, and afterwards by that of *boiling*. 'Liquation' consists in moderately heating the blocks in a reverberatory furnace till the tin, owing to its comparatively easy fusibility, melts, and flows into the refining-basin, leaving on the hearth of the furnace a residuary alloy of tin with iron and other metals. More blocks are added, and heated in the same way, till the refining-basin contains about five tons. The tin is then ready for 'boiling.' In this operation, billets of green wood are plunged into the melted metal, the disengagement of gas from which produces a constant ebullition, and so causes a scum (chiefly oxide of tin) to rise to the surface, which is then easily removed; at the same time, impure and dense parts fall to the bottom. When the agitation has gone on long enough, the bath is allowed to settle and cool. The tin then separates into zones—the upper consisting of the purest portion; the middle being slightly mixed with other metals; and the lower so much so, that it requires to go through the refining process again. The residuary alloy of the liquation process has also its tin extracted and refined again.

In former times, in Cornwall, tin was smelted in a Blast Furnace (q. v.) instead of a reverberatory one; and this is still the case on the continent. By this method a pure tin is obtained, but the loss of metal in the process is greater. It suits best where coal is scarce and wood abundant.

The ores which contain the mineral wolfram (tungstate of iron and manganese) are treated by a special process, patented by Mr.

R. Oxland of Plymouth. This mineral and tin ore are so nearly the same in specific gravity, that no mechanical process of washing will separate them. Mr. Oxland's process consists in roasting the dressed tin ore with sulphate of soda, for the purpose of converting the insoluble tungstate of iron and manganese into the soluble tungstate of soda, which is easily removed by lixiviation. The oxides of iron and manganese, which are left in a finely-divided state, can then, from their lower density, be readily got rid of by washing. Since the invention of this process, some of the Cornish tin ores which used to sell at the lowest, now bring the highest price. The tungstate of soda procured in the operation has lately been found to be one of the most valuable substances for rendering cotton cloths non-inflammable.

Tin when heated up to nearly its melting-point becomes brittle, and can then be broken into prismatic fragments called *dropped* or *grain tin*. The metal which is susceptible of this change may be considered to be of fine quality, as impure tin does not become brittle when so treated. The peculiar properties of tin, especially its malleability, its brilliancy, and the slowness with which it oxidizes at common temperatures in the atmosphere, render it of great service in the arts. Utensils coated with silver require six cleanings for one that would suffice with 'tinned' vessels. Tin is consequently very largely used to coat the surface of other metals, as iron and copper, especially thin sheet-iron to form Tin-plate (q. v.). Tin-plate goods are now manufactured on a gigantic scale in Birmingham, Wolverhampton, and Dudley. The increase has been brought about mainly by the introduction of stamping machinery.

With other metals tin forms some valuable alloys. See ALLOY. An amalgam of tin and mercury forms the metallic coating of minerals. Tin-foil, $\frac{1}{1000}$th of an inch thick, is used for various purposes, and contains from 96 to 98·5 per cent. of tin, with small proportions of copper, lead, iron, and sometimes nickel. From 60 to 80 tons of tin are annually used in Birmingham in the manufacture of coffin-lace. See Flower's *History of the Tin Trade* (1880).

TINCAL. See BORAX.

TINCTURE. See HERALDRY.

TI'NCTURES are defined by Sir Robert Christison to be 'solutions of vegetable and animal drugs, and sometimes of mineral substances in spirituous liquids.' The spirit most commonly employed is proof-spirit: sometimes rectified spirit is used; and occasionally ether. Ammonia is sometimes conjoined with the spirit, in which case the solution is termed an ammoniated tincture. (It may be as well to remind the reader that *Rectified Spirit* is alcohol with 16 per cent. of water, and that its specific gravity is ·838; and that *Proof Spirit* is composed of 5 parts of rectified spirit mixed with 3 parts of water, the resulting compound containing about 47·5 per. cent. of water, and having a specific gravity of ·920.)

The choice between proof and rectified spirit depends on their respective solvent powers over the active principles of the drugs employed. The ether and ammonia are principally used for their antispasmodic properties. 'The form of tincture,' says Sir Robert Christison, 'is one of the best in pharmacy; for the menstruum is a powerful solvent of the active constituents of drugs; it presents them in small volume; it preserves them very long unaltered, and it is for the most part a convenient medium for uniting them with other substances in extempore prescriptions.'

TINDAL, DR. MATTHEW, a notable deistical writer, was the son of a clergyman at Beer-ferris, in Devonshire, where he was born about 1657. He was educated at Lincoln and Exeter Colleges, Oxford; took the degree of B.A. in 1676; and shortly after, was elected Fellow of All Souls' College. In 1685, he became a Doctor of Law; and after a brief lapse into Romanism during the reign of James II., reverted to Protestantism, or rather, as events showed, into Rationalism. His first work was entitled *An Essay concerning Obedience to the Supreme Powers*, &c. (Lond. 1693); followed in the course of a few months by *An Essay concerning the Laws of Nations and the Rights of Sovereigns;* but it was not till 1706 that he attracted any particular notice, when the publication of his treatise on *The Rights of the Christian Church asserted against the Romish and all other Priests who claim an independent power over it; with a Preface concerning the Government of the Church of England, as by Law established*, raised a storm of opposition, that may perhaps be considered to have fulfilled the prediction of the author, who told a friend that 'he was writing a book which would make the clergy mad.' A perfect torrent of replies and refutations poured from the press. Among those who signalized themselves as the adversaries of T., the least obscure were Dr. G. Hickes and Conyers Place. Swift, it may be noticed in passing, also indulged in some 'Remarks.' On the continent, T.'s work was quite differently received.

Le Clerc, in his *Bibliothèque Choisie*, praises it very highly, as one of the solidest defences of Protestantism ever written. In 1730, when he had nearly reached the age of 73, he published his most celebrated treatise, entitled *Christianity as old as the Creation, or the Gospel a Republication of the Religion of Nature* which effectually settled the question of his religious creed. The design of the work is to strip religion 'of the additions which policy, mistake, and the circumstances of the time have made to it'—in other words, to eliminate the *miraculous* element, and to prove that its morality, which is admitted to be worthy of an 'infinitely wise and good God,' is its true and only claim to the reverence of mankind. T.'s purpose was rather constructive than destructive; and it was on this account that he called himself a 'Christian Deist.' He was answered, among others, by Dr. Waterland, Mr. Foster (an eminent dissenting minister), Dr. Conybeare (afterwards Bishop of Bristol), and Dr. Leland (q. v.), with various degrees of ability and success. T.'s book is written in excellent English, and is unquestionably a very able performance, giving its author a distinguished place among the 18th c. deists. T. died 16th August 1733.

TINDER, an inflammable material, usually made of half-burned linen. It was formerly one of the chief means of procuring fire before the introduction of chemical matches. The tinder was made to catch the sparks caused by striking a piece of steel with a flint; and the ignited tinder enabled the operator to light a match dipped in sulphur. This intermediate step was necessary in consequence of the impossibility of making the tinder flame. Partially decayed wood, especially that of willows and other similar trees, also affords tinder; and certain fungi furnish the German tinder, or Amadou (q. v.).

TINEA is a term somewhat vaguely employed to designate certain parisitic diseases of the skin, and especially of the scalp. Three of the most important varieties of tinea, viz., *T. circinatus*, (ringworm of the body), *T. tonsurans* (ringworm of the scalp), and *T. sycosis* (ringworm of the beard), have been already described in the article RINGWORM (q.v.). In these three varieties, which are included in the general term *T. tondens*, the vegetable parasite known as *Trichophyton tonsurans*, figured in the above article, is always present. It now remains to notice the *Tinea decalvans* of Bateman, known also as *Porrigo decalvans, Alopecia circumscripta*, &c. It is defined by Aitken as 'a fungus disease, causing the formation of rounded or oval patches of baldness, sometimes solitary, more generally multiple. It affects the hairy scalp principally; but the beard and hairy portion of the skin may also suffer.'—*The Science and Practice of Medicine*, 2d ed., vol. i. p. 925. The fungus which causes these patches of baldness was detected by Gruby in 1843, and named the *Microsporon Audonini*. It differs from the *Trichophyton* by its numerous waved filaments, and the extremely small size of its sporules, and likewise by its position, not being found in the interior of the root of the hair, but forming a little tube round each hair, and thus causing it to soften and break down. The hairs thus affected become dull and partially loose; the skin in which they are implanted becomes red, swollen, and slightly itchy; and a whitish matter (the sporules of the fungus) may soon be observed on the diseased skin and hairs. The hairs then suddenly fall off from the affected part, leaving a round bald patch of a very white color. The disease is capable of transmission from one person to another, although less readily than *Tinea tonsurans*. It chiefly affects children. The treatment consists in preventing the spread of the disease by extracting the hairs round the circumference of the patch, and washing the head daily with soft soap; and all the young hairs within the patch must be extracted till a healthy crop begins to appear. Moreover, a solution of sulphurous acid, as recommended for ring-worm, should be applied. When by these means the fungus has been destroyed, stimulants must be applied to the bald patches. A mixture of equal parts of *Collodium* and of *Ether cantharidalis* (*Collodium vesicans*) is, according to Dr. Aitken, the most useful stimulant in these cases.

Fungus in *Tinea decalvans*: AF, lower part of an affected hair, highly magnified; FG, its root; C, sphcroidal swelling due to accumulation of spores, E, between the longitudinal fibres of the hair; D, rupture of long fibres; I, spornles and tubes of the parasite; H, a group of sporules proceeding from G, the ruptured root. (From Aitken's *Science and Practice of Medicine.*)

TINEÏ'DÆ, a family of small moths, the smallest insects of the lepidopterous order. The body is long and slender, the wings entire, often narrow, mostly convoluted in repose. Many of them are very brilliantly colored, exhibiting beautiful little stripes and patches of gold and silver. Many deposit their eggs in ani-

mal substances, on which the larvæ feed, making cases for themselves out of the substance they feed on. The Clothes Moths (q. v.) are a familiar example.

TI'NGI (*Magonia glabrata*), a tree of the natural order *Sapindaceæ*, which covers large tracts of country in some parts of Brazil, to the exclusion of almost everything else, generally growing to the height of 30 or 40 feet, but sometimes much higher. An infusion of the bark of the roots is used to poison fish. The fruit is a large dry triangular capsule, filled with broad flat seeds, from which a kind of soap is made. The membrane which covers the cotyledons is stripped off, and they are steeped in water till they begin to swell and soften, and boiled with a little tallow. A homogeneous mass is formed, which is used for washing clothes.

TI'NKAR'S ROOT (*Triosteum perfoliatum*), a shrubby plant of the natural order *Caprifoliaceæ*, a native of North America, the root of which is used as an emetic and mild cathartic. It derives its name from Dr. Tinkar, who first brought it into notice.

TINNEVE'LLY (*Tiru-nel-véli*), a chief town of the British district of the same name, is situated near the river Chindinthoora, 350 miles south-west of Madras. The town of T. is connected with the town and military station of Pallamcottah, on the opposite bank of the river. Pop. about 20,000.

TI'NNITUS AU'RIUM is the Latin translation of, and ordinary medical term for, ringing in the ears. In most cases, it is an unimportant symptom, depending on some local temporary affection of the ear, or on some disturbance of the digestive system with which the part of the brain, from which the auditory nerve springs, sympatizes, or which excites the cerebral circulation (as often occurs in the morning after too liberal evening potations); but as it is also a common symptom of organic disease of the auditory nerve, it may indicate a dangerous condition, or may be a prelude to complete deafness. Hence, although commonly of no consequence, it is a symptom that, especially if permanent, must be carefully watched. It may be readily induced for a few hours by a large dose of quinia.

TI'NOS, or TINO (anc. *Tenos*) an island in the Grecian Archipelago, belonging to the group of the Cyclades, lies immediately south-east of the island of Andros, 53 miles off the coast of Bœotia. It is 18 miles long, 8 miles in extreme breadth, has an area of 70 sq. m., and a pop. of about 13,000. The Tenians were conspicuous among the ancient Greeks for their industry, and they still maintain their pre-eminence in that respect. The island is carefully cultivated, well-watered, has a delightful climate, and is very productive in silk, wine, barley, and fruits. Silk gloves and stockings are manufactured; and the inhabitants have made themselves famous as workers in marble, which is found in the island. In the modern town of Tenos, or St. Nicholas, is a cathedral built of white marble, and famous as a resort for pilgrims.

TIN-PLATE. The manufacture of this article forms a branch of the iron trade. The art of tinning plate-iron is said to have been invented in Bohemia, about the beginning of the 16th c., although the tinning of copper was known some time earlier. Tin-plate was first made in England about the year 1670.

Sheet-iron for tin-plates is made either of charcoal-bar or coke-bar, which has been rolled with particular care, in order to avoid scales on the surface. Before tinning, the plates are called 'black plates.' When the iron has been cut to the required size, the plates are 'pickled'—that is, they are immersed in hot sulphuric or hydrochloric acid which has been diluted by 16 parts of water to 1 of acid, the use of the acid being to remove all oxide. After this, the plates require to be washed several times in water; and then follows an annealing in closed cast-iron boxes in a reverberatory furnace. The next operation consists in passing the plates two or three times through chilled iron rollers highly polished with emery and oil, so as to give them a well-polished surface. Once more they are sent to the annealing furnace, passed again through dilute sulphuric acid, which is followed by another washing, but this time in running water, and then scoured with sand. This should leave them quite clean and bright for the tinman.

Each plate is now put singly into a pot of melted grease (which has become sticky by use), and left till it is completely coated, after which the plates are taken in parcels, and plunged into a bath of melted tin covered with grease, called the 'tin-pot.' They pass from this to another vessel with two compartments called the 'wash-pot,' both of which contain melted tin of the purest quality, and like the last, covered with grease. The plates are put into the first compartment in parcels, where thay receive a coating of purer tin than that of the 'tin-pot,' and are then withdrawn one by one, and wiped on both sides with a hemp brush; the marks of which are obliterated by another dipping in the second compartment of the 'wash-pot.' This last dipping also gives the plates a polish. The next thing is the removal of the superfluous tin by immersing the plates in a pot containing tallow and palm oil, maintained at a temperature no higher than will keep the tin in contact with the oil, liquid, and so allow it to run off. The final treatment consists in working the plates separately in troughs of bran with a little meal, and then rubbing them with flannel.

There is a variety of tin-plates called 'terne-plates,' coated with an alloy of tin and lead, in which the proportions vary from one of lead and two of tin to two of lead and one of tin. They are largely exported to Canada, where they are used for roofing.

The manufacture of tin-plates has extended very rapidly of late years; and in 1880, 290 mills were at work in Great Britain which produced in that year no less a quantity than 237,084 tons of manufactured material. The exports, which in 1864 amounted to 1,003,569 cwts., of the declared value of £1,264,100, had in 1880 increased to 217,718 tons, valued at £4,457,887.

TI'NSEL OF THE FEU, in the Law of Scotland, means an irritancy or forfeiture of a feu-right caused by the failure to pay the feu-duty for two whole years. A statute of 1597 authorized, in such a case, the superior to take steps to obtain a decree of declarator that the feu was forfeited; but the vassal might, any time before decree, purge the irritancy by paying the arrear.—TINSEL OF THE SUPERIORITY is a similar remedy which a vassal has against the superior who has not got himself infeft, so as to be in a position to complete the vassal's title. In such a case, the tenant may under the statute 1474 charge the superior, that if he do not within forty days obtain infeftment, he shall loose the tenant or vassal for his (the superior's) lifetime, and thereby all the casualties that may fall to the superior from the act or delinquency of such vassal.

TI'NTERN ABBEY, a famous ecclesiastical ruin on the right bank of the Wye, in Monmouthshire, about 9 miles south-south-east of Monmouth. The Abbey—properly so called—was founded in 1131 for Cistercian monks, by Walter de Clare, and dedicated to St. Mary; but already in the previous century a church had been built, and in 1268, mass was celebrated by abbot and monks for the first time. The style of architecture is a transition from Early English to Decorated, and is very fine. Most of the building, except the roof and tower, remains. T. A. owes not a little of its celebrity to Wordsworth's poem, entitled *Lines composed a few Miles above Tintern Abbey, on revisiting the Banks of the Wye*—though in reality the poem has nothing whatever to do with the Abbey, which is not once mentioned or alluded to in it.

TINTORETTO, a Venetian historical painter, so called from the fact of his father being a dyer (*Tintore*), but whose real name was JACOPO ROBUSTI, was born in 1512. He studied for a short time under Titian, but appears to have been for the most part self-taught. His motto was a very fine one: *Il disegno di Michael Angelo, e 'l colorito di Tiziano* (the design of Michael Angelo, and the coloring of Titian); but it cannot be said that he adhered to it, and he is certainly a long way inferior to either artist. Still, his assiduity, when young, in acquiring a varied knowledge of the human figure under all possible aspects of light and shade, commands respect, in spite of the theatrical means to which he often resorted; and the rapidity of his pencil (which got him the name of *Il Furioso*) is at least astonishing. Sebastian del Piombo remarked that T. could paint as much in two days as he could do in two years. A catalogue of T.'s works, specimens of which are to be found in almost all galleries, is impossible within our limits. We can only mention a few of the more famous, as 'Belshazzar's Feast, and the Writing upon the Wall' (fresco, for the Arsenal at Venice), 'The Tiburtine Sibyl,' 'The Last Supper and the Washing of the Disciples' Feet,' 'A Crucifixion,' 'The Worship of the Golden Calf,' 'The Last Judgment' (the last two immense pictures 50 feet high, and very splendid in conception); 'St. Agnes restoring to Life the Son of a Prefect,' 'The Miracle of St. Mark,' a 'Resurrection of Christ,' 'The Slaughter of the Innocents,' and a grand picture of 'Paradise'—34 feet high by 74 long, with upwards of 100 figures. Some of T.'s earlier pictures are very carefully finished, but his later ones are dashed off with a fatal haste, that justifies the remark of Annibal Caracci, that if he 'was sometimes equal to Titian, he was often inferior to Tintoretto.' T. lavishly indulged in *chiar' oscuro*, but his coloring is not gay or brilliant; it is rather cold and leaden, as might be expected of a painter who, when asked what were the prettiest colors, replied: 'Black and white.'

TIPPECANOE', a river of Indiana, U. S., which rises in a lake of the same name in the northern part of the state, flows south-west 200 miles, and empties into the Wabash 9 miles above Lafayette. It is famous for the battle fought on its banks, November 5, 1811, in which the Indians, under Tecumseh's brother, the prophet, were defeated by General Harrison.

TIPPERA'RY, an inland county of the province of Munster, Ireland, bounded on the S. by Waterford; and on the W. by Cork, Limerick, Clare, and Galway. Area, 1659 sq. m., or 1,061,731 acres, of which 843,837 are arable, 178,183 uncultivated, 2359 in towns, and the rest under plantations and water. Pop. (1871) 216,713, of whom 203,227 were Catholics, 13,459 Protestants: this

includes Presbyterians and other sects of Christians; (1881) 199,004, a decrease in ten years of 17,709. In the year 1881, the number of acres under crops of different kinds was 265,760. In the same year the cattle numbered 244,029; sheep, 205,850; and pigs, 74,540. The inhabitants are mostly engaged in agriculture. The annual value of property in the county is £681,172. The number of children attending the national schools in the county of T. in 1880 was 41,512, of whom 40,574 were Roman Catholics, and 820 of the Episcopal Church.

The county of T. for the most part lies in the basin of the river Suir. This river rises near Templemore, in the north of the county; and after traversing T. a distance of about 76 miles, forms for a time its boundary with Waterford, through which county it ultimately passes to the sea. The other rivers of T. are the Nore, the Nenagh, and the Brosna. The lakes are numerous, but of small size. The county is intersected by the Great Southern and Western, and the Limerick and Waterford Railways. The surface is generally plain, and the mountains which diversify it are rather groups than portions of any connected range. These mountains are the Galtees, rising to 3000 feet, Knockmeledown (2700 feet high), and Slievenaman on the south; Keeper Mountain, 2100 feet high, and its group on the west; and the Slievardagh Hills on the east. There is one very curious isolated height called the Devil's Bit, to which many popular legends attach.

The soil of the plain is a rich calcareous loam, singularly fertile and productive, especially a district called the Golden Vein, in the center of which stands the town of Tipperary (q. v.), and which extends from Limerick to the county of Kilkenny. There is another similarly fertile district in the north of the county. In geological formation the plain belongs to the great central limestone district. The mountains are for the most part of clay-slate, surrounded or surmounted by sandstone; the Galtees, together with a contiguous group called Slievenamuck, as well as the intervening valley, being sandstone. There is a large amount of bog in the central and eastern districts, one continuous tract extending a distance of thirty miles. The mineral productions are coal (anthracite), copper, and lead, also zinc and very good fire-clay; and slates of an excellent quality are quarried near Killaloe. Wheat was formerly grown in large quantities; but of late years dairy-farming and the raising of cattle have been rapidly taking the place of the production of cereals. Flax is but sparingly produced.

The county, which sends two members to the House of Commons, is divided into two ridings, North and South, each of which is subdivided into six baronies.

Anciently, T. formed part of the two distinct principalities of Ormond, or North Munster, and Desmond, or South Munster: after the English invasion, T. was formed into a county by King John in 1210; but the authority of the conquerors was long little more than nominal. Eventually, it came to be divided between the Anglo-Norman families of Butler, which held Ormond, and Geraldine, to whom a portion of Desmond fell. The antiquities are numerous, as well Celtic as Anglo-Norman. In the latter, the city of Cashel is specially rich; and the ruin of Holy Cross is a noble specimen of the monastic remains of the medieval period, as the castle of Cahir is of the military and baronial architecture of the same age. There is a series of caves near the border of the county of Cork, in the vicinity of Mitchellstown, which attract much notice as a natural curiosity. They consist of a number of chambers and galleries formed by stalactite deposits, one portion of the range being no less than 870 feet in length.

TIPPERARY, a market-town of the county of the same name, on the river Arra, 111 miles south-west from Dublin by the mail-coach road, and 110 by the Great Southern and Western Railway, with which it is connected by the Limerick and Waterford Railway. T. occupies a central position in a fine county, and carries on, therefore, an extensive trade in butter. Pop. (1881) 7274; town rates levied, £120. The town is of very ancient foundation, and soon after the invasion was occupied as a strong place by the English, who built a castle in it during the Irish expedition of King John. This castle, however, fell soon afterwards into the hands of the Irish under the Prince of Thomond. The town is well built, but of no architectural pretensions, and contains a large and handsome Roman Catholic church, a Protestant church, Presbyterian and Methodist meeting-houses, two National Schools, and one school of the Erasmus Smith endowment.

TIPPOO SAHIB, sultan of Mysore, and son of Hyder Ali (q. v.), was born in 1749. Efforts were made to carefully instruct him in the various branches of learning cultivated by Mohammedans; but T. much preferred the practice of athletic exercises, and the companionship of the French officers in his father's service, from whom he acquired a considerable acquaintance with European military tactics. This knowledge he put to effective use during his father's various wars, by completely routing Colonel Bailey at Perimbakum (10th September 1780), and (18th February 1782) Colonel Braithwaite on the banks of the Kolerun in Tanjore, though these were his only important engagements with the British forces in which he could boast of success. On the death of his father, he was crowned with little ceremony, returning at once to the head of his army, which was then engaged with the British near Arcot. On 28th April 1783, he captured and put to death most of the garrison of Bednore; but news of the peace between France and England having reached his French allies, they retired from active service, and T. ultimately agreed to a treaty (11th March 1784), stipulating for the *status quo* before the war. During the continuance of this peace, he occupied himself in regulating the internal administration of Mysore, sent ambassadors in 1787 to France to stir up a war with Britain, and failing in this, at length so far allowed his inveterate hatred of the English to overcome his judgment, as to invade (April 1790) the protected state of Travancore.

In the ensuing war (1790—1792), the British, under Colonel Stuart and Lord Cornwallis, were aided by the Mahrattas and the Nizam, who detested their powerful and aggressive neighbor equally from fear and religious hatred (T. being a fanatical Mohammedan); and though the tactics of the Sultan in laying waste the Carnatic almost to the very gates of Madras, baffled his opponents for a time, he was ultimately compelled (16th March, 1792) to resign one half of his dominions, pay an indemnity of 3030 lacs of rupees, restore all prisoners, and give his two sons as hostages for his fidelity. Nevertheless, his secret intrigues in India against the British were almost immediately resumed; another embassy was sent to the French; and the invasion of Egypt by the latter in 1799, and T.'s machinations, having become known to the governor-general almost contemporaneously, it was resolved to punish the perfidious sultan. Hostilities commenced in March 1799; and two months after, T. was driven from the open field, attacked in his capital of Seringapatam, and after a gallant resistance, slain. He was buried in his father's mausoleum, 5th May 1769, during a storm of thunder and lightning, which caused the death of several Europeans and natives. His government of Mysore after 1792 was of a most oppressive character, yet T. was extremely popular, and after his death was esteemed by the Mohammedans as a martyr to the faith of Islam. Of the chief articles of *virtù* with which his palace abounded, many are now in Fife House, Whitehall (having been removed thither from the East India House in Leadenhall Street), as also the half of his library, the other half being preserved at Fort-William, Bombay.

TI'PULA AND TIPU'LIDÆ. See CRANE-FLY.

TIRABOSCHI, GIROLAMO, an eminent Italian author, was born at Bergamo, 28th December 1731, studied at Monza, and afterwards entered the order of the Jesuits. Towards 1766, he was appointed Professor of Rhetoric at Milan, where he wrote his first work *Vetera Humiliatorum Monumenta* (1766); and in 1770 succeeded Father Granelli in the post of librarian to the Duke of Modena. T. now availed himself of the rich stores of the ducal library, besides making extensive researches in other archives, to compose his *Storia della Letteratura Italiana* (History of Italian Literature), which began to appear in 1772, and was finished in 1783 in 13 vols. It embraces the history both of ancient and modern Italy, and is especially valuable for the light which it throws upon the intellectual condition of the Peninsula during the dark ages, and the brilliant period from Dante to Tasso. T. ends his elaborate survey with the close of the 17th century. It is impossible to praise too highly the learning and the conscientious accuracy of the author, even although the circumstance that many of the epochs have since been made the subject of minute and special inquiries, necessitates a revision of parts of the work. A second edition was edited by T. (1787—1794), and abridged translations have appeared in French and German. The best edition is that published at Milan (16 vols. 1822—1826). A continuation embracing the literature of the 18th c., was written by Lombardi (*Storia della Letteratura Itatiana nel Secolo XVIII.*). T. died at Modena, June 3, 1794. Other works by this author are *Biblioteca Modenese* (6 vols., Mod. 1781—1786); and *Memorie Storiche Modenesi* (3 vols., Mod. 1793).

TIREE', one of the Inner Hebrides, included in Argyleshire, lies 20 miles north-west of Iona. It is 13 miles long, and over 6 miles in extreme breadth. The surface is low, rising in the north to little more than 20 feet, and in the south to about 400 feet above sea-level. The absence of trees and shrubs gives to the island a bleak appearance. There are numerous small lakes. Upwards of 5000 acres are under tillage, while 10,700 acres are in pasture or waste-land. Some interest attaches to the island from the number of Scandinavian forts which dot the shores, and from the standing-stones, ruined churches, and ancient graves which occur in the interior. Pop. (1881) 2730, who support themselves by rearing cattle, fishing, and exporting poultry and eggs.

TIRE'SIAS, in Greek Mythology, figures as a famous prophet, who, according to one legend, was struck blind by the goddess Athena, because he had seen her bathing. Another legend rep-

resents Hera as depriving him of his sight because, being made arbiter in a dispute between her and Zeus, he had decided in favor of the latter; when Zeus as a compensation granted him the inner vision of prophecy, and prolonged his life for several generations. He is consequently prominent in many of the mythical stories of Greece, but at last found death by drinking from the well of Tilphossa. Even in Hades, T. retained his prophetic power.

TIRLEMONT (Flemish, *Thienen*), a town of Belgium, in South Brabant, on the Great Geete, 38 miles east-south-east of Brussels, on the Brussels and Cologne Railway. The church of St. Germain, on an eminence, dates apparently from the 9th c., and contains an alter-piece by Wappers. Beer and hosiery are manufactured. T. was ravaged by Marlborough in 1705; and here the French, under Dumouriez, defeated the Austrians in 1793. Pop. (1876) 13,296.

TI'RNOVA, a town in the principality of Bulgaria, on the Jantra, 35 miles south-south-east of Sistova. It was formerly the chief town of Bulgaria; and since 1878 (see BULGARIA) it is again the seat of the Chambers and the national government. There are numerous mosques, churches, and synagogues; dyeing is carried on, and silk and coarse cloth are manufactured. The population is estimated at 16,000.

TI'RYNS, an ancient city of Argolis, in the Peloponnesus, one of the very oldest cities of Greece, situated a short distance south-east of Argos, near the head of the Argolic Gulf. According to the common tradition, it was founded by Prœtus, a mythic king of Argolis; and its massive walls, like other rude massive structures in Greece of unknown antiquity, were reputed to be the work of the Cyclopes. Prœtus is said to have been succeeded by Perseus; and in this place Hercules was believed to have passed his youth. At the time of the Trojan War, T. appears to have been subject to the kings of Argos. Some time subsequently to the battle of Platæa (to which the Tirynthians sent troops), probably about the year 468 B.C., the city was taken by the Argives, and entirely destroyed; and after this period T. remained uninhabited, the walls of the citadel only being left standing, the wonder and admiration of later ages. T. affords one of the most interesting specimens of what is called Cyclopean architecture, the ruins of this place, and those of the neighboring city of Mycenæ, being the grandest of all in Greece. The Acropolis, or citadel of T., was built on the summit of a low, flat, rocky hill, rising abruptly out of the dead level of the plain of Argos, and appears to have consisted of an upper and a lower enclosure of nearly equal size, with an intermediate platform. There were two main entrances, on the east and on the south sides, with a postern on the west. The entire circuit of the walls still remains more or less preserved; they are upwards of 20 feet in thickness, and are formed of unhewn stones of enormous size, rudely piled in tiers one above the other, without the use of mortar or cement, the interstices being filled up with smaller stones, to as to make the whole mass solid and compact. There are several covered galleries of singular construction in the body of the wall, on the east and the south sides, the roof being formed by sloping the courses of masonry on each side of the passage at an angle to each other. One of them has six recesses, or niches, on the outer side of the walls, intended probably to facilitate defence. Altogether, 'this colossal fortress is the greatest curiosity of the kind in existence.'

TI'SANE, TISAN, or PTISAN, an infusion made of certain herbs, leaves, or flowers, used as tea for medicinal purposes. It is a very favorite form of remedy in the domestic medicine of France.

TISCHENDORF, LOBEGOTT FREDERICK CONSTANTINE VON, a very eminent Biblical scholar, was born at Lengenfeld, in Saxony, on January 18, 1815. His labors in search of the best and rarest MSS. in reference to the Bible, in which he was liberally assisted by the Saxon and Russian governments, were exceedingly valuable. Among the most important of his numerous excellent works are the editions of the *Sinaitic MS* (1862, 1863, 1865), the *Eighth Critical Edition of the New Testament* (1864—1872), and the *Monumenta Sacra Inedita* 1855—1870). After being an extraordinary and ordinary professor at Leipzig, from 1845, he became Professor of Theology and of Biblical Palæography in 1859, a chair in the latter subject having been instituted for him. He was created a Count of the Russian empire, an LL.D. of Cambridge, a D.C.L. of Oxford, &c. He died on December 1, 1874.

TISSUES, ANIMAL, may be either normal or pathological. The most important of these tissues have already been considered in special articles, and we shall here merely notice the view at present most generally adopted regarding their classification (see HISTOLOGY). The normal tissues are divisible, according to Virchow and his followers, into three groups or categories. We have (1) tissues which consist exclusively of cells, when cell lies close to cell; or (2) tissues in which one cell is regularly separated from the others by a certain amount of intermediate matter, or intercellular substance; or (3) tissues in which the cells have attained specific, higher forms of development, by means of which their constitution has acquired an entirely peculiar type. As illustrations of the first group of tissues, the simple cellular tissues in the modern sense (cellular tissue here being quite distinct from areolar or connective tissue), we may take the epithelial formation, such as occur in the epidermis and the nails, and in the epithelium of mucous and serous membranes, in the crystalline lens of the eyes (which is originally a mere accumulation of epidermis), and in the glands. The second group is formed by the connective tissue, which is composed of intercellular substance, with cells of various forms embedded in it, and includes cartilage, fatty tissue, &c. In the third group, which is somewhat heterogeneous, the structures are usually more or less tubular. This group includes the muscles, nerves, and vessels, and Virchow also places the blood in it. Such an arrangement as this is quite distinct from, and altogether at variance with, those adopted a comparatively few years ago.

This arrangement has reference to General Histology (*tissues*, properly so called), while *that* has reference to Special Histology, or the structure of organs in which a combination of various tissues may enter. Thus, the *osseous tissue* of general histology consists of bone-cells + calcified intercellular substance, while *bone as an organ* consists of osseous tissue + medullary tissue + periosteum + vessels + nerves; similarly, nervous tissue is by no means identical with cerebral matter, which additionally contains membranes, vessels, &c.

Morbid tissues may be classified upon exactly the same plan as the physiological or normal tissues. The belief is gradually extending that there is nothing peculiar or specific in pathological structures, or, in other words, that every pathological tissue has its physiological prototype, and that 'no form of morbid growth arises which cannot in its elements be traced back to some model, which had previously maintained an independent existence in the economy.'—Virchow's *Cellular Pathology*, translated by Chance, p. 60. The distinguished pathologist whose words we have just quoted, maintains that there is no other kind of heterology in morbid structures than the abnormal manner in which they arise, and that this abnormity consists either in the production of a structure at a point where it has no business, or at a time when it ought not to be produced, or to an extent which is at variance with the typical formation of the body; 'but,' he adds, 'practical experience shows us that it would be altogether incorrect to conclude from the mere correspondence of a pathological tissue with a physiological one that the case would continue to follow a benignant course.' The curious bodies provided with large nuclei and nucleoli, which have been described by many pathologists as 'the specific polymorphous cells of cancer,' are merely irregularly developed epithelial cells, such as occur, for example, in the lining of the urinary passages; and the apparent heterology of other morbid growths may be similarly explained.

TISSUES, VEGETABLE. See CELLULAR TISSUE, VASCULAR TISSUE, and VEGETABLE TISSUES.

TIT, or TITMOUSE (*Parus*), a genus of birds of the order *Insessores*, tribe *Conirostres*, and family *Paridæ*. The *Paridæ* are small birds, of which there are more than 50 known species, widely distributed throughout Europe, Asia, Africa, and North America. They are more numerous in cold and temperate than in tropical regions, those which are found within the tropics being mostly inhabitants of elevated mountainous districts. The bill is small, short, somewhat conical, the tip entire, the base beset with hairs, and the nostrils generally concealed by feathers. The wings are not very long, but are pointed; the tail is rounded or even; the tarsi long, slender, scaled in front, the inner toe shortest, the claws long and curved. The plumage is beautiful, often gay. The popular names Tit and Titmouse are very generally given to all the *Paridæ*. They are bold sprightly birds, extremely active, flitting from branch to branch, running rapidly along branches in quest of insects, and often clinging to the under-side of branches with their back downwards. They feed not only on insects but on grain and seeds, have no objection to carrion, and sometimes kill young and sickly birds by strokes of their bill. They are very pugnacious, and the female Tit shows great courage in defence of her nest, often continuing to sit when the nest is approached, and vigorously assailing the intruding hand with her bill. In winter, many of the species gather into small flocks, and approach houses and villages, competing with sparrows and chaffinches for a share of the food of domestic poultry. Most of the tits lay at least six eggs, some of them twelve or more, and even in temperate countries they often produce two broods in a year. They generally build in trees. The young are fed chiefly on caterpillars.

A pair of Blue Tits have been observed to carry a caterpillar to their nest, on an average, every two minutes during the day, so that these birds must be extremely useful in preventing the multiplication of noxious insects. Seven species are found in Britain, but one of them, the CRESTED TIT (*Parus cristatus*) is a mere

accidental visitor. The GREAT TIT (*P. major*) is the largest European species. It is common in almost all parts of Europe. It is not quite six inches long; the head and throat are black; the cheeks are white; the back, breast, and sides yellowish; the wings and tail grayish. Its usual note is a kind of chatter, but it sometimes imitates the notes of other birds. The BLUE TIT (*P. cæruleus*) and the COLE TIT (*P. ater*) are very common in Britain. The Blue Tit is perhaps the most pert and audacious of all the British species. It very generally receives the familiar name of *Tomtit*. The upper part of the head is light blue, and a bluish tinge

Cole Tit (*Parus ater*), and Long-tailed Titmouse (*Parus caudatus*).

prevails in the plumage. The LONG-TAILED TIT (*Parus caudatus*), common in Britain, has the tail about as long as the body. Its head is white, contrasting beautifully with the deep black of the back; the tail is also black, with white edges. The nest of this bird is a beautiful structure, of moss and wool externally covered with lichens, and profusely lined with feathers, nearly oval, with a small hole in the upper part of one side. Still more interesting is the nest of the PENDULINE TIT (*Aegithalus pendulinus*) of the south of Europe, which in form resembles a flask, and is generally suspended at the end of a flexible twig, in a situation near to or overhanging water. It is nicely woven of fibres of bark and the down of willow or poplar catkins, and the opening is in the side. The CHICKADEE or BLACKCAP TIT (*Parus atricapillus*) is very common in North America. The TUFTED TIT (*Lophophanes bicolor*) is the largest American species.

TITA'NIUM (sym. Ti, eq. 25—new system, 50—sp. gr. undetermined) is a comparatively rare metal, which, according to the method by which it is procured, occurs as a gray, heavy, iron-like powder, which burns with brilliant scintillations in the air, and is converted into titanic acid, or in prismatic crystals. At 212°, it decomposes water, and it is soluble in hydrochloric acid. It is obtained in the crystalline form by heating sodium in the vapor of bichloride of titanium. It never occurs native, but is found in association with other elements in various minerals, of which the most important are *Anastase*, *Rutile*, and *Brookite*, containing titanic acid; *Titanite*, containing silicate of lime and titanic acid; *Perowskite*, containing titanite of lime; *Æschynite*, containing titanic and niobic acids, and the oxides of cerium and lanthanum; and lastly, *Titanic Iron*, composed of titanate of protoxide of iron. A remarkable artificial compound of the metal is often found in the form of copper-colored cubic crystals, adhering to the slags of iron furnaces. They are hard enough to scratch agate; and no acid except a mixture of nitric and hydrofluoric acids has any action on them; but they are volatile at an extremely high temperature. They consist of a combination of cyanide with nitride of titanium, and are represented by the remarkable formula $TiCy,3TiN$. The most important compound of this metal is *Titanic Acid* (TiO_2), which occurs in the minerals *Menaccanite* and *Iserine*, as titanate of iron, but is more common in the uncombined state, as titanic anhydride, in the form of rutile, brookite, and anastase, each of which possesses a distinct crystalline form, and has a different specific gravity. Hence, titanic acid in the anhydrous state is trimorphous. It is usually obtained by a somewhat complicated process from rutile. Titanium was discovered by Gregor, as a constituent of menaccanite, in 1791.

TI'TANS AND TITA'NIDÆ (originally called *Ouraniones*, Celestials), in Greek Mythology, were the sons and daughters of Uranus (Heaven) and Gæa (Earth). Their names, as commonly given, were: Oceanus, Cœus, Crius, Hyperion, Iapetus, Kronos, Theia, Rhea, Themis, Mnemosyne, Phœbe, and Tethys; Dione, Phorcys, and Demeter are added by some writers. Instigated by their mother, the T., headed by Kronos, rose against their father, emasculated and deposed him, and liberated their brothers the Hecatoncheires (Hundred-handed) and the Cyclopes (q. v.), from Tartarus. Kronos being made king, threw the Cyclopes back again to Tartarus, and married his sister Rhea. In order to escape being deposed by one of his own children, as it was foretold he would be, Kronos swallowed each as it was born. Rhea, when she gave birth to Zeus (q. v.), saved his life by giving a stone wrapped in a cloth to Kronos, who swallowed it, believing it to be his child. Zeus, when he grew up, gave his father a potion which caused him to vomit the stone and the children he had swallowed. Assisted by his brothers and sisters, along with the Cyclopes and Hecatoncheires, Zeus began with the T. the ten years' conflict which resulted in the complete triumph of the former, and the overthrow of the latter, who were hurled down into a dungeon below Tartarus, surrounded by a brazen wall, and guarded by the Hecatoncheires. During the war, Zeus and his allies occupied Mount Olympus in Thessaly, his opponents being encamped on Mount Othrys.—The name T. is also given to the descendants of the T., such as Prometheus, Hecate, Helios, Selene, &c.

TITHES (A.S. *teotha*, a tenth; Lat. *decima*, i. e., *pars*, a tenth part), the tenth part of the produce of the land, which, by ancient usage, and subsequently by law, is set aside for the support of the clergy, and other religious uses. This provision for the clergy passed at a very early period from the Jewish into the Christian Church, and indeed the same or some analogous appropriation has been traced in the other ancient religions. It is observable under the patriarchal system in the words employed by Jacob (Gen. xxviii. 22), and in the offering of Abraham to Melchisedec (Gen. xiv. 20); and mystical reasons have been devised for the selection of the tenth part, rather than any other fractional portion of the produce of the earth, to be consecrated to the uses of religion and the ministers of religion. (See Spencer, *De Legibus Hebræorum*, iii. 1—10.) The details of the institution among the Jews will be found in Levit. xxvii., Deut. xiv., and many other places. The tribe of Levi not having lands assigned, as was the case with the other tribes, drew their support from this impost.

In the Christian dispensation, the very circumstance of the existence of the clergy as a distinct class supposed a certain fixed provision for their maintenance. The necessity of such provision, and the right on which it is founded, is distinctly expressed in many passages and allusions of the New Testament, as Matt. x. 10, Luke x. 7, Rom. xv. 27, 1 Cor. ix. 7—14. The obligation in the general sense which these passages involve has been put forward in ecclesiastical legislation from the earliest period. The apostolical canons, the apostolic constitutions, St. Cyprian on *The Unity of the Church*, and the works of St. Ambrose, St. Chrysostom, St. Augustine, and the other Fathers of both divisions of the church, abound with allusions to it. As yet, however, this obligation was discharged mainly in the form of voluntary offerings; and the legislation of the first Christian emperors, while it presupposed the duty of maintaining the clergy, and even assigned lands and other property for their support, did not extend to any general enactment for the payment of the tenth of the produce of the lands. The Council of Tours, 567 A.D.; the second Council of Macon, 585; that of Rouen, 650; of Nantes, 660; of Metz, 756; and some others, distinctly sanction that form; and at length Charlemagne by his capitularies formally established the practice within those portions of the ancient Roman Empire to which his legislation extended.

From this and other sources, the payment of a tenth to the church extended throughout Western Christendom. By some, the claim was held to be of divine law; by others, of human institution; but in the gradual progress of relaxation, it came to pass that the right thus established solely for the church began to be usurped for themselves and for purely secular uses by nobles or other powerful laymen. See IMPROPRIATION.

The first introduction of tithes into England is ascribed to Offa, king of Mercia, in the close of the 8th century. The usage passed into the other divisions of Saxon England, and was in the end made general for all England by Ethelwulf. It would seem that at first, although all were required to pay tithes, it was optional with each to select the church to which his payment should be made; but by a decretal of Innocent III., addressed to the Archbishop of Canterbury in 1200, all were required to pay tithes to the clergy of their respective parishes, and this parochial distribution of tithes has ever since obtained in England. The ancient canon and civil law distinguishes many varieties of tithes, into which we shall not enter, as royal, indominicate, fiscal, salic, &c. We shall confine our remarks to the provisions of the English law, premising that in most respects it is founded upon the general principles of the civil and canon law.

Tithes are of three kinds—*prædial*, *mixed*, and *personal*. Prædial tithes are those which arise immediately from the earth itself, as of grain of every kind, fruits, and herbs. *Mixed* tithes are those proceeding from things nourished by the earth, as calves, lambs, pigs, colts, chickens, milk, cheese, eggs, &c. *Personal* tithes are those arising from the profits of personal industry, in the pursuit

of a trade, profession, or occupation; but it is commonly held that personal tithes were ordinarily paid in the form of a voluntary offering at Easter or some other period of the year. From these explanations, it will be understood that no tithe was due from the proceeds of mines or quarries, as their produce is not the result of any growth or increase of the earth, but forms part of its substance; nor from houses, as having no annual increase. The common law, moreover, held wild animals, game, fish, &c., not to be proper subjects of tithe, as also tame animals kept for pleasure or curiosity, and not for profit or use.

A more arbitrary distinction is into *great* and *small* tithes, the first being tithes of corn, hay, wood, &c.; the second being the other kinds of prædial tithes, as well as all personal and mixed tithes. This distinction, although purely arbitrary, is important, inasmuch as the great tithes of a parish belong to the Rector (q. v.), and the small tithes to the Vicar (q. v.). T. were originally paid 'in kind;' that is, by the actual numeration of the products of the land, and the apportionment in each of the numerical tenth part, as of the tenth sheaf, the tenth lamb, calf, &c. The inconvenience and trouble, as well as the unsettled and variable quantities involved in this mode of payment, led to early attempts to provide other modes of apportioning the result (the particular manner being called technically a *modus decimandi*, or simply a *modus*. This was done either by making an agreement to pay a fixed quantity irrespective of actual produce in each year, or by a money payment settled between the parties; or by a partial substitution of payment or labor, as when the party contributed a smaller quantity of produce, but free from the expense of harvesting, carriage, &c.; or finally, by a payment of a bulk sum in redemption of the impost, either for a time or for ever, as the case might be, in which case the land so redeemed became temporarily or permanently tithe-free. By such compositions, many lands in England were made anciently tithe-free, and have so continued; but by 1 Elizabeth 19, and 13 Elizabeth 10, such alienations of tithe-payment were restricted to a term of twenty-one years, or three lives.

Besides the exemption from tithe thus created, a still more comprehensive occasion of immunity is traceable to the exemption enjoyed by the lands of religious houses. Originally, convents occupying lands in England paid tithes like other landowners to the parochial clergy; but a decretal of Paschal II. exempted them from such payments in regard to lands held by themselves in their own occupation. This exemption was confined by subsequent legislation to the four orders—Templars, Hospitallers, Cistercians, and Præmonstratensians, and after the 4th Council of Lateran (1215), only in respect of lands held by them before that year. Frequently, however, exemptions were given in favor of particular houses; and in cases in which religious communities were themselves the incumbents of a parish, as they could not pay tithes to themselves, their own lands within such parish became exempt by what was called 'unity of possession.' And thus it came to pass that a large extent of land in England and Wales was held free of tithes. Now, when, on the suppression of monasteries, those lands were assigned to lay possessors, they passed of course into lay hands with the same immunity; and hence this exemption from tithe has become perpetual even in the hands of lay possessors, as, on the other hand, by a similar transfer, lay proprietors have in many instances acquired the right to tithe, and the property of many rectories.

The arrangements between parties for commuting the mode of payment, to which allusion is made above, were permitted, and even protected by law; but they were nevertheless purely voluntary and partial, and the perpetually recurring contests to which the system led, as well as the oppressive nature of the exaction when the parties from whom it was claimed did not belong to the church established by law, rendered the impost odious; and in Ireland it became impossible to enforce its collection in great part of three of the four provinces. A measure of commutation became absolutely necessary. This had been recommended by committees as far back as 1822, but it did not pass into law until 1838. Various statutes for England or Ireland have since been enacted regulating the payment of tithe—6 and 7 Will. IV. c. 71, 7 Will. IV. and 1 Vict. c. 69, 1 and 2 Vict. c. 64, 2 and 3 Vict. c. 32, and 5 and 6 Vict. c. 54. Their object for England is to substitute a money rent-charge, varying on a scale regulated by the average price of corn for seven years, for all the other forms of payment. This commutation may either be voluntary, or may be effected by the Tithe Commissioners, according to a valuation. Land not exceeding twenty acres may be given by a parish in commutation of tithes; but only in the case of ecclesiastical persons, and not of lay impropriators. Similar arrangements have been made in those few Catholic countries in which tithes still continue to be paid.

In Ireland, the settlement was effected by a general commutation of tithe into a money rent-charge, regulated by a valuation of the tithes (one-forth being deducted for the cost of collection), and payable by the proprietors, who should receive it from the occupiers of the land. By the Irish Church Act (32 and 33 Vict. c. 42), this rent-charge became vested in the commissioners of church temporalities, with power to sell such rent-charge to the owner of the land charged therewith at 22½ years' purchase. Power is also given to such purchaser to pay by installments for 52 years, at the rate of 4½ per cent. on the purchase-money, deducting the estimated charge for poor-rate; the rent-charge being extinguished at the expiration of the 52 years.

TI'THING, an ancient Saxon division of the country, consisting of the tenth part of a hundred, being occupied by ten families, each of whom was responsible for the good behavior and peace of the rest. The institution has been long growing obsolete, and the Police Constables (q. v.) now supersede the officer called a tithing-man.

TITHO'NUS, son of Laomedon, brother of Priam, and spouse of Eos, the goddess of Morn. The story is that Eos, in asking immortality for her spouse, forgot to ask at the same time eternal youth, so that in his old age, he became completely shrunk and decrepit, whereby his 'cruel immortality' was rendered a burden to him.

TITIAN, or TIZIANO, Vecelli, the head of the Venetian School, and one of the greatest painters that ever lived, was born of a good family at Capo del Cadore, in the Friulian Alps, in the year 1477, or, according to some, in 1480. His predilection for drawing caused his father to send him to Venice at the age of ten, that he might learn to be a painter. His instructors were Sebastiano Zuccati and the two Bellinis, particularly Giovanni; but the painter that exercised the greatest influence on his style was Giorgione (q. v.). So vivid and keen was his appreciation of the distinctive features of any artist's work, that he never failed to reproduce them with striking fidelity, and even to leave the impression that he had beaten the master whom he imitated, in his own style. It was owing to this irrepressible superiorty that the friendship between Giorgione and him was interrupted. The first work that brought T. prominently into notice was his completion of the 'Homage of Frederick Barbarossa to Pope Alexander III.' (1512), begun by Giovanni Bellini, but left unfinished by that artist at his death. The Venetian senate, who had commissioned the piece, were so much pleased with T.'s performance, that they conferred on him an office with an annual salary of 300 crowns. In 1514, he painted a 'Bacchus and Ariadne,' and other works of a similar kind, for the Duke of Ferrara, a portrait of the duke himself, and of the lady who afterwards became his wife, besides a picture of the 'Tribute-money.'

While residing at the court of Ferrara, he made the acquaintance of the poet Ariosto, who sat to him for his portrait. On his return to Venice, he painted an 'Assumption of the Virgin,' one of his grandest achievements. His reputation now rapidly rose. Pope Leo X. and Raphael both invited him to Rome, and Francis I. to France; but he declined. During 1520—1530, the most celebrated of his numerous productions were—'St. Peter, Martyr,' a work of unsurpassable beauty; 'Victory of the Venetians over the Janizaries;' and 'St. Sebastian.' In 1530, his friend Aretino (q. v.), the poet, introduced him to the notice of the Emperor Charles V., whose portrait he painted at Bologna, and who gave him several other commissions. From Bologna, T. proceeded to Mantua, where he executed a great number of works for Duke Frederico Gonzaga. In 1532, he appears to have accompanied Charles to Spain, where he remained for three years, and painted several of his masterpieces, now found in that country. In 1537, he executed an 'Annunciation;' in 1541, a 'Descent of the Holy Ghost upon the Apostles,' a 'Sacrifice of Abraham,' 'David and Goliath,' and a 'Death of Abel;' and in 1543, pictures of the 'Virgin' and 'San Tiziano,' and portraits of Pope Paul III., Cardinal Farnese, and Duke Octavio Farnese, at Rome, where he remained three years. The Emperor Charles V., who greatly admired his genius, twice called him to Augsburg (1547 and 1550). Among the religious works which he executed for Philip II. of Spain are a 'Last Supper,' 'Christ in the Garden,' 'St. Margaret with the Dragon,' and a 'Martyrdom of San Lorenzo;' besides these, we notice a 'Venus and Adonis,' a 'Danaë,' a 'Medea and Jason,' and other classic subjects. A complete catalogue of T.'s works does not exist, but the number known is extraordinarily great—upwards of 600.

T. died of the plague in 1576, having attained the extreme age of 99. He is best studied at Venice or Madrid, but splendid specimens of his work are to be seen in the chief European galleries. As already observed, he had at first a tendency to reproduce the style of acknowledged masters, but his genius soon emancipated itself from all imitativeness, and displayed a glorious originality and power. The luxury of light did never so enrich a painter's canvas. This is, indeed, his transcendent excellence. Not inaccurate in design, not sterile in invention, not infelicitous in composition—these, his minor merits, are nevertheless wholly thrown into the shade by the splendor, boldness, and truth of his coloring, which alone has sufficed to give him a place alongside the greatest

names in art, Raphael, Leonardo da Vinci, and Michael Angelo. —See Hume's *Notices of the Life and Works of Titian* (Lond. 1829); Northcote's *Life of Titian* (Lond. 1830); and *T., his Life and Times*, by Crowe and Cavalcaselle (Lond. 1876).

TITICA'CA, LAKE. See PERU.

TITLARK AND TITLING. See PIPIT.

TITLE, REGISTRATION OF, in England, is a modern experiment, set on foot after long-continued opposition, and still frowned on by the solicitors, who conceive that its operation will be to reduce their emoluments. Owing to the total want which had always existed of a register for deeds or writs connected with the transfer of land, except in the counties of Middlesex and York, the complexity and uncertainty attending the operations of conveyancing had long been the opprobrium of English law, and the mercantile classes at last called for a remedy by which an acre of land might be sold with the same expedition and certainty as bank stock.

Under the system referred to, so far from expedition being a feature of conveyancing, delay, expense, and insecurity were the chief characteristics. It was till 1874 the inveterate practice for a purchaser of land to demand, and for the vendor to give, what is called a sixty years' title—i. e., he must show the successive owners for sixty, and since 1874 for 40 years previous to the sale, and all that these owners did in connection with it. This created great expense and delay. But if the property were sold next month, or next day, precisely the same process had to be repeated between the new purchaser and his vendor, for what might have been done between other parties previously was not binding, nor was it safely to be acted on by their successors in the property. These evils called loudly for some remedy, and of late years all the legal reformers have been busy with projects to provide some relief. An important impetus was given to reform by the passing of the Irish Incumbered Estates Act in 1848, the object of which was to break up and compel a sale of the deeply incumbered estates of Ireland. In 1854, a similar statute was applied to the estates of the West India Islands. In 1862 two acts passed for establishing in England a Land Registry, 25 and 26 Vict. 53, 67, for registering indefeasible titles, but they were confined to good marketable titles. Land of the value of about £6,000,000 had been registered under those Acts of 1862, when a more elaborate scheme was prepared by the Land Transfer Act, 1875, 38 and 39 Vict. 87, which greatly amplified and matured the previous efforts in the same direction. The office of Land Registry is conducted by a registrar, appointed by the Lord Chancellor, who must be a barrister of ten years' standing. He has assistants and clerks. The office has a seal and various forms to be used in connection with the business. The fees are all fixed by the Lord Chancellor and the Treasury, and these are paid by means of stamps. Power is also given by the Act to create hereafter district registries. And it is provided that any land situated in Middlesex and Yorkshire, two counties which already had land registries, should, if registered under the new Act, be exempt from the jurisdiction under the local acts, it being contemplated that the general law now established will gradually supersede the former local machinery.

Under the Land Transfer Act, 1875, any person who has contracted to buy freehold land, or any owner or any person having power to sell it, may apply to the registrar to be registered, with an absolute title or with a possessory title only. In case of a purchaser applying, the vendor must consent. The registrar must approve of the title submitted, and in case of a sale the vendor and his solicitor must make an affidavit that they have produced all the deeds, wills, instruments of title, and all charges and incumbrances affecting the title, as well as all facts material. The registrar can also compel third parties to produce deeds relating to the land. If doubtful questions as to law or fact arise in reference to it, the registrar may refer a case for the opinion of the High Court of Justice; and that opinion will be conclusive, because all parties having any possible interest are fully heard by the Court. The freehold absolute title will show all incumbrances on such land, and other rights which the Act declares not to be incumbrances. The possessory title does not prejudice the enforcement of adverse rights which exist at the time of registration, but in other respects it has the same effect as the absolute title. Leasehold lands may also be registered, and they are registered in a separate register. When once the title is registered, no adverse title will acquire any advantage by length of possession. The registered proprietor can by a simple form charge or burden the land with a payment of a sum of money at an appointed time. When the registered land is sold, the tranferee's name is entered on the register, and a land certificate given to him. Any person claiming on adverse interest may lodge a caution having the effect of entitling him to notice of all future dealings with the property if registered, or he may lodge a like caution against the land being registered at all. No notice of a trust is to be entered on the register, and a trustee selling land may authorize the purchaser to be registered as the first proprietor. The Land Transfer Act is not compulsory, but it was expected that it would gradually become generally accepted when the simplicity it secured for titles came to be better known.

TITLE-DEEDS are the evidences of ownership of real property in this country. Each owner is supposed to be in possession of his own, either by himself or his solicitors; and the ownership of the title-deeds passes along with that of the lands themselves. In England there is no general register, except in Middlesex and Yorkshire, and elsewhere to the extent allowed under the Land Transfer Act. It is a dangerous thing to part with title-deeds, for, by merely pledging them as a security for money, a mortgage may be created over the lands. In Scotland, there is a general register where all title-deeds may be kept, or authentic copies, so that the loss of one may be replaced without much difficulty.

TITLES OF HONOR, designations to which certain persons are legally entitled, in consequence of possessing particular dignities or offices. King and Emperor are titles of honor belonging to the sovereigns of different countries; and Your Majesty is the form of address to which, by the usage of most European countries, they are entitled. Your Grace was in England, in former times, the usual mode of addressing the sovereign. The epithet Majesty, taken from the *majestas* of the emperors of Rome, was adopted by the emperors of Germany, who considered themselves their successors; but its use by other European sovereigns is of comparatively recent date. Henry VIII. was the first king of England, and Henry II., the first king of France, who adopted it. Your Highness is the style adopted by the sultan of Turkey. The proper style of the reigning sovereign of the United Kingdom is, 'Victoria, by the Grace of God, of the United Kingdom of Great Britain and Ireland, Queen, Defender of the Faith.' The sons of the sovereigns of England are styled Princes, and their daughters Princesses; and the sovereign's eldest son is Prince of Wales (q. v.). The title of Royal Highness is given to all the children of the sovereign, and by letters-patent under the Great Seal in February 1864, her Majesty declared her pleasure that the children of the sons of the sovereign should also enjoy the same title. The different grades of the peerage have their several titles —Duke, Marquis, Earl, Viscount, and Baron—each of which was in its origin a name of office involving certain specific duties. See FORMS OF ADDRESS, COURTESY TITLES.

Though most European countries have their dukes, marquises, counts, viscounts, and barons, these often differ considerably in rank from the seemingly corresponding titles in Britain, and the English rules and practices regarding title are not applicable abroad. The complicated system of titles by law, and still more by courtesy, which prevails in England, is a source of endless perplexity to such foreigners as endeavor to make themselves acquainted with our usages.

TI'TULAR, one who enjoys the bare title of an office, without the actual possession of that office. Thus, the English kings styled themselves kings of France from the time of Henry IV. down to the year 1800; and previous to the recent changes in Italy, the king of Sardinia, as well as the king of Naples, was titular king of Jerusalem. In English Ecclesiastical Law, a titular is a person invested with a title, in virtue of which he holds a benefice, whether he performs its duties or not.—In the law of Scotland, the term has received another acceptation. When the king, at the Reformation, became the proprietor of all church lands, he erected the monasteries and priories into temporal lordships, and bestowed them on laymen, who were known as Lords of Erection, or Titulars; this latter name indicating that they had the same title as had formerly been possessed by the religious houses to the lands and tithes. See TEINDS.

There are many titular dignities in the Roman Catholic Church; but the class of them which is chiefly noticeable is that which has grown out of the separation between the Eastern and Western churches. It is well known that the Roman pontiff, notwithstanding the schism, claims to retain authority over the entire extent of Christendom; and even where there is not any longer resident within the limits of an ancient church or province a body of Christians of the Roman communion, the pope claims to appoint an ecclesiastic to be bishop, metropolitan, primate, or patriarch of the ancient see (see IN PARTIBUS INFIDELIUM). In England, and still more in Ireland, where archbishops and bishops of the Roman Catholic Church exist *de facto*, but not *de jure*, they are styled titular.

TI'TUS, EPISTLE TO, one of the three 'Pastoral Epistles,' was written by St. Paul, probably in the latter part of his life, and after he had been liberated from his first imprisonment at Rome. From the 12th verse of chapter iii., we learn that the apostle was staying at Nicopolis when he wrote the letter, and the subscription identifies this place with Nicopolis of Macedonia; but this is impossible, for, as De Wette notices, that city appears to have been founded by the Emperor Trajan long after St. Paul was

dead. Jerome's opinion is probably the correct one, that the Nicopolis referred to was the famous city in Epirus. The Epistle concerns itself mainly with the organization and discipline of the church in Crete, is very practical, and at times unpleasantly sharp in its tone, as if Paul had felt more acutely than usual the vexations which 'unruly and vain talkers and deceivers, *specially they of the circumsion*,' caused him. Above all things, however, he is solicitous that the Christians of Crete should shun the immoral practices of heathenism.—From the days of Eichhorn, the Pauline authorship of this and the other Pastoral Epistles has been disputed on the ground of their differing from Paul's Epistles not merely in style but in doctrine. See Bauer's *Die So-genannten Pastoral-briefe des Apostels Paulus*.

TITUS FLAVIUS SABINUS VESPASIANUS, emperor of Rome, was the eldest son of Vespasianus (q. v.) and Flavia Domitilla, and was born at Rome 30th December 40 A.D. Brought up at the court of Nero along with Britannicus, the son of the Emperor Claudius, he received an excellent training both of body and mind, became an adept in manly exercises, and an accomplished scholar; and subsequently, as *tribunus militum* in Germany and Britain, and commander of a legion in Judæa under his father, proved his qualities as a soldier and a general. On his father's elevation to the imperial throne, T. was left to prosecute the Jewish war, which he brought to a close by the capture of Jerusalem after a long siege. The news of the success was received with the utmost joy, and Vespasian's too suspicious temper was awakened. However, T., by returning to Rome, and laying the trophies of victory at the emperor's feet, removed his unfounded jealousy, and father and son obtained the honor of a joint triumph (71 A.D.).

About this time T. became his father's colleague in the empire, and the impression which the conduct of the young conqueror made upon the Roman people was, and with just reason, very unfavorable. He gave himself up to the pursuit of pleasure in all its forms, put to death various suspected persons very summarily, and even caused one of his guests, whom he justly suspected of conspiracy, to be assassinated as he left the palace. His *liaison* with Berenice, the daughter of Herod Agrippa I. (q. v.), was also very distasteful to the Romans; and on the death of his father (79 A.D.), whom he was at that time believed by a few to have poisoned, the Romans had satisfied themselves as to the advent of a second Nero. But T.'s behavior after his hand grasped an undivided sceptre completely belied their anticipations. The very first act of his reign was to put a stop to all prosecutions for *læsa majestas*, which had abounded since the time of Tiberius (q. v.); informers were scourged in the forum, dragged along in front of the theaters, and then either sold as slaves or banished. The ancient and venerated buildings of Rome were repaired; new ones, as the Colosseum (see AMPHITHEATER) and the baths which bear his name, were erected; and the prominent tastes of the populace were abundantly gratified by games on the most stupendous scale, which lasted for 100 days. T.'s beneficence was unbounded, and it so happened that during his brief reign there was the most urgent need of its exercise. In 79 A.D. occurred the great eruption of Vesuvius, which overwhelmed Herculaneum and Pompeii, and ruined numerous other towns and villages; in 80 A.D. a fire broke out in Rome, which raged for three days, destroying the Capitol, Augustus's library, Pompey's theater, and numerous houses; and in the tracts of these calamities followed a dreadful pestilence. T. dealt out gifts with lavish hand to the houseless and ruined sufferers; he even despoiled his palaces of their valuable ornaments to obtain money for distribution, and schemed and planned to furnish occupation for them. He was now the idol of his subjects, the 'love and delight of the human race;' but unfortunately for that part of the human race over which he ruled, in the commencement of the third year of his reign, he became suddenly ill, and died at his patrimonial villa in the Sabine country (September 13, 81), not without the suspicion that he had been poisoned by Domitian, his younger brother.

TIUME'N, a town of West Siberia, in the government of Tobolsk, stands on the Toura, an affluent of the Ob (q. v.). Its advantageous situation on the highways, both by land and water, which communicate between Russia and Siberia, has made it an important commercial center, and the seat of flourishing manufactures. The vessels which navigate the Ob, the Irtish, the Tobol, and the Toura, for the most part receive their cargoes here. Large quantities of leather, leather-goods, carpets, soap, candles, and common pottery are manufactured and exported throughout W. Siberia, the Ural countries, the Kirghis Steppes, Khokan, Bokhara, and China. Pop. (1880) 15,212.

TI'VERTON, a municipal and parliamentary borough in the north-east of Devonshire, 14 miles north of Exeter. There are important weekly markets, and four great markets for cattle annually. There is a large lace-factory, in which upwards of 1000 hands are employed. The town is built on a hill between the rivers Exe and Lowman; hence the old names of the town, TWYFORD and TWOFORD-TOWN. The streets in many places are very narrow, but clean. A new town-hall was erected in 1864, and an Athenæum has been recently founded. There is a peculiarity about the town in the rapid streams of water flowing down the channels along the sides of the streets. These streams of water were given to the town about the year 1272, by Isabella Rivers, Countess of Devon. The castle was built in 1106. The free grammar-school, an old building in the Elizabethan style, was endowed by Mr. Peter Blundell in 1604. In connection with the school there is a scholarship at Balliol College, Oxford, and another at Sydney Sussex College, Cambridge, each of the annual value of not less than £60. There are four exhibitions, of £30 per annum each, for four years, at any college in either university; one exhibition of £50 a year, for seven years, at Balliol College; and one of £25. There are other schools and numerous charities. T. sends two members to the House of Commons. Pop. (1871) 10,025; (1881) 10,462.

TI'VOLI (anc. *Tibur*), a poor town of Central Italy, province of Rome, 18 miles east from Rome, stands on the slope of Monte Ripoli, one of the Apennines. T. is walled, and has a fortress. The streets are steep, narrow, and beset by beggars. There is a fine cathedral, formerly a temple of Hercules, where Augustus held his tribunal. The surrounding hills are covered with olive trees. The vines of T. are famed for a peculiar sort of grape, in great request for its firmness and luscious flavor, noticed as early as the time of Pliny the Elder. The stone called 'travertino,' of which great part of Rome is built, comes from Tivoli. Pop. 8000. Near T. is the extensive Villa d'Este. Within and without the city, there are many monuments of antiquity. In a commanding position above the falls of the Anio, rises the Temple of Vesta, of a circular form, and in good preservation, built 70 B.C.; there are the extensive remains of the Emperor Hadrian's magnificent villa; the villa of Mæcenas; remains of mausoleums, aqueducts, baths, &c. The place is much visited by tourists for its waterfalls, which are lofty, but not very picturesque.

Tibur long existed as a town (according to ancient tradition) before the building of Rome; but the first mention of it in recorded history occurs 446 B.C., during the Roman decemvirate. It was one of the principal towns of the Latin confederation. Its healthy and picturesque situation induced many of the wealthy Romans to choose it for their country residences. Mæcenas, Scipio, Æmilianus, the famous Marius, Metellus Numidicus, and Munatius Plancus, had their Tiburtine villas. Horace preferred Tibur to all other places of resort (although he makes allusion to its moist atmosphere, calling it 'Udum Tibur'), and had a country-house in the neighborhood. It is one of the few towns of Latium which still stand on their ancient sites.

TLEMCEN', a town of Algeria, capital of the province of Oran, and 80 miles south-west of the city of that name, stands in an undulating country, everywhere irrigated, and brought completely under cultivation. It contains Catholic and Protestant churches, mosques, and synagogues, and there are numerous educational institutions, including schools for Arabs and Jews. It is protected from the south wind by a range of hills, 4200 feet in height. The town is accessible only from the south-west, the other sides presenting steeply escarped fronts. The district around T. is covered with fruit-trees of all kinds, of which the olive is one of the most valuable, and there is much cultivated land, producing cereals, tobacco, &c. Besides the special markets, a daily market is held, at which cattle, wool, grain, and oils are largely sold. Ostrich feathers and corks are exported; but the trade is for the most part in cloths, hides, grain, and oils. Pop. about 22,000.

TOAD (*Bufo*), a genus of *Batrachia*, of the *Anourous* or tailless section of the *Caducibranchiata*. See BATRACHIA. The original genus has been subdivided, and is now constituted into a family, *Bufonidæ*, to all which the popular name T. is often extended. The form resembles that of the frogs, but is more thick and clumsy, and the hind-legs are generally short, so that the species rather crawl than leap; some of them, indeed, are not known to leap at all. The skin is warty, and the warts or tubercles produce a milky exudation, which in some species is very fetid. Behind the ear there is a porous pad—a very large parotid gland—from which a copious exudation takes place. The muzzle in the restricted genus *Bufo* is rounded, but some of the family have an elongated muzzle. The mouth of the true toads is destitute of teeth. The food of toads consists chiefly of small insects and slugs, and they mostly inhabit shady places, avoiding the sunshine, and crawling about either amongst the stems and leaves of plants or amongst stones. In their adult state, they are much less aquatic than frogs, but their spawn is deposited in water, in which their tadpoles live like those of frogs. They are commonly regarded with disgust, on account of their appearance, the exudation from the skin, and the smell of many of them, yet the eye of the T. is remarkably beautiful.

A notion has very generally prevailed that the exudation of the

skin is venomous, but it is unsupported by evidence, and toads are handled with perfect impunity. They are eaten by some savage tribes.—Only two species are British. The COMMON T. (*B. vulgaris*) is abundant in most parts of Britain, and in the western parts of Europe, but is not found in Ireland. A description of it is unnecessary. It spends the winter in a dormant state, and issues from its retreat on the return of spring. Its spawn is deposited in March or April, and much resembles that of the frog, but the ova are smaller and more numerous. The young T. is very small when it loses its tail and gills, and exchanges the tadpole for the adult form. Toads are very useful in gardens, in preventing the excessive increase of some kinds of insects; and on this account, it is a frequent practice to put them into hotbed frames for which use the market-gardeners of the neighborhood of London often purchase them at the price of fourpence each. They have occasionally been tamed, and display some intelligence, readily recognizing those who feed them and are kind to them. A tame T., of which an account is given by Pennant in his *British Zoology*, lived for more than forty years, and was at last killed by a raven.

Numerous instances are on record in which toads are said to have been found embedded in rocks, walls, and even in the trunks of trees, where the necessary conclusion is that they must have lived a very long time, in a dormant state. Unfortunately, however, the discovery of these toads has almost always been made by unscientific persons, and there is a want of proper and trustworthy observations as to the places in which they have been found. Attempts have been made by several naturalists, and among others by the late Dr. Buckland, to throw light on the subject by experiment, immuring toads in various ways, and the result, although showing that when air is not wholly excluded, they are capable of living for a long time in their imprisonment, probably in a dormant state, is not favorable to the belief that such existence could extend over many years. An interesting account of Dr. Buckland's experiments will be found in Mr. F. Buckland's *Curiosities of Natural History*.

The other British species of T. is the NATTERJACK (*B. calamita*), which was first described as British by Pennant, and has since been found to be pretty abundant in some parts of England,

1, Common Toad (*Bufo vulgaris*); 2, Natterjack (*Bufo calamita*).

and in the south-west of Ireland, chiefly in the vicinity of the sea. It much resembles the common T., but is of a yellowish-brown color, clouded with dull olive, a bright yellow line passing along the middle of the back. It has a disgusting smell. It never hops, and its motion is more like walking or running than the crawling of the common toad.—Several other species of T. are found in Europe. Some of those found in tropical countries attain a very large size, and exhibit protuberances of various kinds, far exceeding even in proportion the warty excrescences of the common toad.

TOADFLAX (*Linaria*), a genus of plants of the natural order *Scrophularineæ*, very closely allied to SNAPDRAGON (q. v.), from which genus this has but recently been separated, and is distinguished chiefly by the spur at the base of the corolla, and the capsule opening by valves or teeth, not by pores.—The species are herbaceous plants, natives chiefly of the colder and temperate parts of the Old World. Some of them are natives of Britain, of which the most common is *L. vulgaris*, a species with erect stem of 1—3 feet high, glaucous linear-lanceolate leaves which thickly cover the stem, and terminal spikes of yellow flowers. It grows in hedges, the borders of cornfields, &c. It possesses purgative and diuretic properties, and a decoction of it is used as a fly-poison; but it is regarded as a troublesome weed by farmers. It has found its way, probably along with grain or other grass seeds, into the United States. A very remarkable monstrosity is sometimes seen in this plant, to which the name *Peloria* has been given, the flower presenting five spurs, and five usually imperfect stamens.—*L. Cymbalaria*, a pretty little plant with trailing stems and 5-lobed cordate leaves, is often planted to cover old walls, &c., and is either a native of Britain, or naturalized in many places.

TOADSTONE, a local Derbyshire name for a soft and earthy variety of trap, looking like an argillaceous deposit.

TOAST (Lat. *tostus*, scorched or roasted) is the name given to bread dried or scorched before the fire. So early as the 16th c., toasted bread formed a favorite addition to English drinks. Sack was drunk with toast, and so was punch. The practice of drinking healths, particularly that of an entertainer, is one so natural, so likely to spring up spontaneously, that it is impossible to say when it began. Certain it is, however, that it received an artificial development owing to the prevalence of convivial habits in the 17th century. Then it became the fashion to drink not to the health of entertainers only, but to that of each guest, of absent friends, and more especially of the unmarried woman whose attractions were most generally acknowledged. It also became the custom to describe a woman whose health was so drunk as herself 'a toast.' In this sense, the application of the word is said to have had its origin in an incident which occurred at Bath, and which is recorded in the 24th number of the *Rambler*, in the following passage: 'It happened that on a public day, a celebrated beauty of these times' (when it was the fashion for ladies to bathe publicly in elegant dresses made for the purpose) 'was in the Cross Bath, and one of the crowd of her admirers took a glass of the water in which the fair one stood, and drank her health to the company. There was in the place a gay fellow, half fuddled, who offered to jump in, and swore, though he liked not the liquor, he would have the 'toast' (making, of course, allusion to the custom of putting toast in punch). 'He was opposed in his resolution; yet this whim gave foundation to the present honor which is done to the lady we mention in our liquor, who has ever since been called a toast.' Whatever may be the origin of the use of the word 'toast' in this sense, we now apply it not only to any person, but to any sentiment mentioned with honor before drinking. The French have adopted the word from us; making it masculine when applied to a man or a sentiment, but feminine when to a woman. See Chambers's *Book of Days;* Valpy's *History of Toasting* (1881).

TOBA'CCO (of uncertain derivation, but most probably from the native American name), a genus (*Nicotiana*) of plants of the natural order *Solanaceæ*, having large broad leaves; a 5-parted calyx; a funnel-shaped, 5-lobed corolla, and five stamens; the flowers growing in panicles at the top of the stem; the fruit a 2-celled, 5-valved, many-seeded capsule. The species are mostly herbaceous plants, rarely shrubby, with large broad leaves, and everywhere covered with clammy hairs. They are natives of warm countries, most of them American, although some are found in the East Indies. They all possess the narcotic property, on account of which a few of them are extensively cultivated. It resides in almost all parts of the plant, although the leaves are almost exclusively used. The most important species is the COMMON T., or VIRGINIAN T. (*N. tabacum*), a native of the warm parts of America, the cultivation of which had extended before the discovery of the New World by Columbus, far to the north of the regions in which the plant appears to be indigenous. It is about 5 or 6 feet high, erect, with lanceolate, sessile leaves, 6—18 inches long, and rose-colored flowers, the throat of the corolla inflated, the segments pointed. There are numerous varieties, differing more or less in the size and form of the leaves, and in the form and color of the flowers, some of which are regarded by some botanists as distinct species. One of these is the BROAD-LEAVED T., or MARYLAND T., which has a thicker stem, and much broader leaves. The GREEN T. (*N. rustica*), sometimes called ENGLISH T., because it was the first kind introduced into England for cultivation, is a smaller plant, from 3 to 5 feet high, with ovate, stalked leaves, and the segments of the corolla rounded, its tube cylindrical. It is a native of the East, but is more hardy than the Virginian T., and is therefore cultivated in more northern regions. The PERSIAN T. (*N. Persica*) has the root-leaves oblong, those of the stem lanceolate and sessile; the corolla salver-shaped, with a long tube; its lobes rather unequal. It is a native of Persia, and furnishes the Shiraz T., so much esteemed in the East, and which is milder than the common tobacco. Other species of T. are used in different parts of America, and some of them are cultivated to a small extent, as *N. repanda*, in Cuba; *N. quadrivalvis*, by the Indians on the Missouri; *N. multivalvis*, by the Indians on the Columbia; and *N. nana*, by the Indians of the Rocky Mountains.

It is somewhat doubtful whether the use of T. as a narcotic was known in the East before the discovery of America. Meyen,

in his *Geography of Plants*, expresses the opinion that the smoking of T. is of great antiquity amongst the Chinese, because on very old sculptures he has 'observed the very same tobacco-pipes which are now in use.' Meyen's authority, however, is greater as a botanist, than as an archæologist, and cannot be received as decisive of the antiquity of the sculptures of which he speaks. It is not improbable that the smoking of T. has been long practised in China, but it is not certain. If it was so, the custom did not extend amongst neighboring nations, which, however, has been the case also as to the use of some other narcotics; whereas, on the introduction of the use of T. from America, it

Virginian Tobacco. (*Nicotiana tabacum*).

Green Tobacco. (*Nicotiana rustica*).

rapidly extended throughout Europe, and soon became extremely prevalent amongst Oriental nations. In the present state of our knowledge, no ethnological argument can be founded upon the prevalence of smoking amongst the Mongolians and the American Indians. The smoking of T. was found by Columbus to be practised in the West Indies, where the natives made it into cylindrical rolls, wrapped in maize-leaf. It has been prevalent from unknown antiquity amongst the American Indians as far north as Canada. With them it even has a religious character, and is connected with their worship and with all their important transactions. Thus, the Calumet (q. v.), or pipe of peace, is indispensable to the ratification of a treaty, and smoking together has even greater significance of friendship than eating together has amongst other nations. 'In the belief of the ancient worshipers, the Great Spirit smelled a sweet savor as the smoke of the sacred plant ascended to the heavens; and the homely implement of modern luxury was in their hands a sacred censer, from which the hallowed vapor rose with as fitting propitiatory odors as that which perfumes the awful precincts of the cathedral altar, amid the mysteries of the church's high and holy days.'—Wilson's *Prehistoric Man*, i. 383. The seeds of the T. plant were first brought to Europe by Gonzalo Hernandez de Oviedo, who introduced it into Spain, where it was first cultivated as an ornamental plant, till Nicolo Menardes extolled it as possessed of medicinal virtues. It was introduced into Italy in 1560.

The use of T. in the form of snuff soon followed its introduction for smoking, There is no reference to the use of T. in Shakspeare, yet it is certain from other evidence that it was well known in England in his time, although at first its use was confined to the wealthy, as the price was very high, and it was smoked in very small pipes—probably the same which are known to antiquaries as *Elfin Pipes*—and the smoke was expelled, not from the mouth, but by the nostrils, in which way the narcotic power of the herb is much greater. T. was at first recommended for medicinal virtues, which were greatly exaggerated, but soon became an article of luxury. The popes Urban VIII. and Innocent XI. fulminated against it the thunders of the church; the priests and sultans of Turkey declared smoking a crime, Sultan Amuret IV. decreeing its punishment by the most cruel kinds of death; the pipes of smokers were thrust through their noses in Turkey; and in Russia, the noses of smokers were cut off in the earlier part of the 17th century. King James I. of England issued a *Counterblaste to Tobacco*, in which he described its use as 'a custom loathsome to the eye, hateful to the nose, harmful to the brain, dangerous to the lungs, and in the black, stinking fume thereof nearest resembling the horrible Stygian smoke of the pit that is bottomless.' All opposition, however, was in vain. The use of T. increased, and has continued to increase to the present day, when it is more prevalent than at any former time, the luxury of rich and poor, of civilized nations and of savage tribes. Although it did not become prevalent in the East till the 17th c., the Turks and Persians are now the greatest smokers in the world; in India, all classes and both sexes smoke; in China, the practice—perhaps there more ancient—is universal, and girls, from the age of eight or nine, wear, as an appendage to their dress, a small silken pocket to hold tobacco and a pipe.

How the practice of smoking has increased in Britain, every one knows. The use of snuff has not increased in the same manner, but has rather diminished. T. is used in the three modes of smoking, chewing, and snuffing. Plugging, the stuffing of the nostrils with quids of T., has been almost universally discontinued, although at one time it was practised to a small extent. In Britain, chewing is now chiefly practised by sailors, smoking being prohibited or restricted at sea, on account of the danger of fire; but it is very prevalent in some parts of the world, particularly in North America. The smoking of T. is everywhere more or less social, like the use of wine; and the snuff-box is handed from one to another in token of good-fellowship.

T. derives its botanical name (*Nicotiana*) from Jean Nicot, who introduced it into France. In that country, its use in the form of snuff began in the reign of Francis II. About the same time, a snuff-manufactory was established at Seville, which produced the celebrated Spanish snuff. The T. plant was soon after introduced into other countries of Europe. In 1657, the manufacture and sale of T. were farmed out in Venice, and began to yield a considerable revenue. Much revenue has since been derived from the same source, in many countries. T. is now extensively cultivated in many parts of Europe, as well as in Asia and America. Prohibitory laws alone prevent its cultivation in the southern parts of Britain and Ireland, of which the climate is quite suitable to it. The quality of the leaf, however, deteriorates in the more northern regions in which it is cultivated, as in Germany, when it is continuously raised from home-grown seed, and seed is therefore imported from warmer countries.

Cultivation and Commerce.—The cultivation of T. requires a rich loose soil, and the strongest manures are advantageous. The influence of soil, climate, and manures on the quality of the produce is very great, almost beyond what is known in any other cultivated plant. Vegetable manures are best for T. intended for smoking; animal manures are preferred for that which is to be made into snuff. In the more northern regions in which T. is cultivated, the seed is sown in a hot-bed, protected from frost by mats, and the plants are planted out in rows from two feet to three feet apart in the field. The ground is frequently hoed and stirred. Where the plants are not intended for seed, the top is usually broken off, so as to prevent flowering, that its whole strength may be directed to the leaves. In America, when the leaves begin to become yellow, or are marked with yellow blotches, the plants are cut down, and hung up in a large barn to dry; but in Germany, the leaves are gathered as they become yellow, are tied in small bunches, and are hung up in a shady place to dry.

The cultivation of T. is comparatively easy, and although a warm climate suits it best, it is without much difficulty raised in most parts of Europe. The usual plan in the great tobacco-producing countries is to sow the seed in seed-beds of rich soil, and as the seed is extremely minute, it is first mixed largely with sand or wood-ashes, to assist in spreading it thinly. In Virginia, which may be taken as one of the best tobacco-growing districts, this is usually done in the first week in January. After the seed-beds have been carefully prepared and sown, small branches of trees are laid over, to protect the seed, when it germinates, from the effects of frost; but these are removed as soon as can be done with safety, and the plants then grow rapidly, and are ready for transplanting into the fields about the beginning of June.

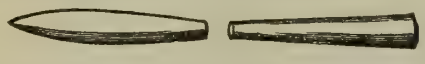
The land in the fields is very carefully prepared, and small hillocks are raised up in rows; each is about a foot in diameter, and flattened at the top. With the first appearance of rain, the plants are carefully raised from the seed-beds, and carried usually by children, who deposit one on each hillock, on which it is carefully planted by experienced men, who follow after the children. Only wet weather will do for planting, so that this operation often lasts until the end of July. When planted, the tobacco-crop requires much careful attention to weeding, and a watchful eye to prevent the ravages of various insect enemies. Much of this latter work is done by flocks of turkeys, kept on purpose by the planters. As soon as the plants begin to throw up the flower-shoot, it is nipped off; otherwise it would weaken the leaves; but this process is neglected in some countries, especially in Turkey and Greece, where small leaves are preferred, and where, in some cases, as in the celebrated Latakia tobacco, both leaves, buds, and flowers are used. The time generally chosen for cutting it is mid-day, or when the sun is powerful, and the morning and evening dews absent. The cutting is done by hand, and only such plants are chosen as are ready, which is known by a clammy exu-

dation which forms over the leaf, often giving it a spotted appearance. If the plants are very large, the stalk is often split down, to facilitate the drying. They are then removed from the field to the tobacco-house, around which are erected light scaffolds, to which the plants are suspended, generally by passing a thin stick through a split in the stalk of each, and so placing a number of plants on each stick, just near enough to prevent them touching each other. After some time hanging in the open air, the plants on the sticks are removed, and suspended in a similar way inside the curing-house, until the drying is completed. The leaves are next removed from the stalks, and all bad ones rejected. The chosen ones are tied up in bundles called hands, and these are packed in hogsheads, enormous pressure being applied in the packing. These hogsheads are very large casks, which must not contain less than 950 lbs. net in the United States, where the government exercises a very strict surveillance over the weight and quality of all tobacco grown and cured there.

Previously to the late disastrous war with Brazil, a large tobacco-export had been carried on by Paraguay. The quality, though not equal to that grown in the United States, was, however, fair, and had been improving. Turkey has also, for several years past, been steadily increasing her exports of tobacco to Great Britain. The quality of Turkish tobacco is very peculiar: it is small in the leaf, and of a light color—either a bright yellow, a yellowish green, or a yellowish brown. Being extremely mild, it is a favorite with many smokers.

Tobacco, owing to the high rate of duty when in any manufactured form, is mostly imported in the leaf; but small quantities are brought in, chiefly for re-export, in various states of manufacture. The chief of these is called Cavendish, which is made by stripping the blades of the leaves from the midribs, and after sprinkling them with an infusion of tobacco made from the stalks and other waste parts, laying them in heaps to heat or ferment. This darkens their color; and whilst still moist and flaccid, they are laid smoothly upon each other, so as to form cakes about nine inches in length by three in breadth, which are pressed by powerful machinery until they are very compact and hard. Another kind is called Negrohead, which is formed into sticks about an inch thick, and eight or nine in length, which are laid across each other equally, and are then pressed into cakes. When the sticks are pulled apart, the rounded depressions caused by pressing them into one another gives them a slight resemblance to the wavy locks of a negro's hair, whence they receive their name. The leaf simply twisted into a rope, as in the kind called Varinas Roll and other similar sorts, as well as that which is merely cut small for smoking, is all held to be 'manufactured,' and charged with the highest duty, so that very little indeed is imported.

Cigars and *Cheroots* are also forms of manufactured tobacco; but so much in favor are these with smokers, that the exorbitant duty is very little check upon their importation. The island of Cuba supplies not only the best but also the largest quantity, the Havana tobacco being exceedingly well cultivated and cared for, and being especially well adapted for cigar-making. More than half of all the cigars imported into Great Britain are from Cuba; and the cheroots are chiefly from Manilla. The Philippine Islands also send us about 100,000 lbs. per annum of cigars, and other countries about 1,300,000 lbs. The total amount sent to Great Britain in 1880 was 1,472,116 lbs., equal in value to about £1,008,841. Cigars and cheroots are essentially the same; they only differ in form, as represented in the diagrams.



Cigar. Cheroot.

The tobacco received in the leaf is all more or less manufactured in this country. It is either cut finely, so as to be convenient for use in pipes, or made into Cavendish, Negrohead, or Twist; the last is often called *Pig-tail;* and is a continuous string of tobacco about the thickness of a quill, many yards in length, made by twisting and spinning the leaves when flaccid from being wetted and heated as before described; this string is then made up into balls, and is the kind chiefly used by those who chew tobacco.

Snuff is another form of manufactured tobacco largely made in Great Britain. It is formed by grinding the leaf either with or without the leafstalks and midribs. The grinding is generally effected in wooden mortars, with pestles also of wood; and some kinds of snuff are prepared from kiln-dried tobacco, whilst others are made from the soft leaves. The varieties are numerous, and fortunes have been made by manufacturers who have been fortunate enough to make a snuff which has become a favorite.

Tobacco is subject to a higher rate of duty, in proportion to its intrinsic value, than any other article. The value of the best sorts in the leaf only ranges from 3*d.* to 9*d.* per pound; whilst the duty is as follows: Unmanufactured, containing 10 per cent. or more of natural moisture, 3*s.* 6*d.* per pound; and if containing less than 10 per cent. of moisture, 3*s.* 10*d.* per pound. The various kinds of manufactured tobacco range from 4*s.* 1*d.* to 5*s.* 6*d.* per pound. In consequence of this disproportion between the value of the material and the duty paid upon it, its importation is fettered with numerous conditions, which should be well understood by those who import either for trade or for private use. The chief regulations are as follows: It is prohibited to be imported at any other ports in the United Kingdom than Aberdeen, Belfast, Cork, Cowes, Drogheda, Dublin, Falmouth, Fleetwood, Galway, Glasgow, Greenock, Hartlepool, Hull, Lancaster, Leith, Limerick, Liverpool, London, Londonderry, Newcastle, Newry, Plymouth, Port-Glasgow, Portsmouth, Preston, Sligo, Southampton, Swansea, Waterford, Wexford, and Whitehaven; or in original packages of less than 80 pounds weight. This does not apply to the small quantities which passengers may wish to bring with them in their baggage; in which case they may pay duty on any quantity of manufactured tobacco or cigars under 3 pounds, if from the continent (except in the case of frequent visitors), and any quantity not exceeding 7 pounds if from the East and West Indies, and other distant voyages; and of unmanufactured tobacco, passengers may pay duty, and import as surplus stores any quantity not exceeding 9 pounds. Of cigars unconsumed on the passage, the passenger is only allowed 8 ounces free of duty. The penalties for any evasion of these regulations are very heavy, in addition to which the goods are always forfeited to the crown.

The quantity of manufactured tobacco, that is, cigars, cigarettes, and cavendish, which was imported into the United Kingdom in 1880 was 3,502,466 lbs., and its value £1,130,235; of unmanufactured, 59,571,973 lbs., and its value £1,746,919. The gross amount of revenue collected by the Custom House, for tobacco and snuff, in 1880–81, after deducting repayments and drawbacks, was £8,658,947. The revenue from this article has upon the whole kept steadily increasing for a considerable number of years. It had prior to that been greatly affected by the civil war in America. The smallest value of manufactured tobacco between 1857 and 1876 was imported in 1859; of unmanufactured, during the same period, the smallest value was imported the following year.

Tobacco is used as a sedative or narcotic over a larger area, and amongst a greater number of people than any similar substance, opium being the next to it in these respects, and the hemp-plant the third. Tobacco-leaves, when submitted to chemical analysis, yield Nicotine (q. v.), which is its most characteristic constituent, albumen, a gluten-like substance, gum, resin, malic and citric acids, and a large amount of inorganic constituents, 100 parts of the dry leaf yielding from about 19 to 27 per cent of ash, in which potash, lime, and silica preponderate. In a physiological and medical point of view, the analysis of the smoke of tobacco is of far more importance than that of the leaf. From the researches of Dr. Richardson, it appears that although 'the widest differences prevail in respect to the products arising from differing cigars, differing kinds of tobacco, and differing pipes,' there are certain substances which are common to all varieties of tobacco-smoke. Firstly, there is in all tobacco-smoke a certain amount of *watery vapor*, impregnated with various substances, from which it may be separated. Secondly, a small quantity of free *carbon* is always present; it is to the presence of this constituent that the blue color of the smoke is due.

'It is this carbon,' says Dr. Richardson, 'which in confirmed and inveterate smokers settles on the back part of the throat, and on the lining membrane of the bronchial tubes, creating often a copious secretion, which it discolors, and which is coughed up of a dark coaly appearance.'—*For and Against Tobacco*, Lond. 1865, p. 5. Thirdly, there is a certain quantity of *ammonia* present. The presence of the ammonia gives to the smoke an alkaline reaction. Moreover, 'it is the ammonia that bites the tongue after long smoking; it is the ammonia that makes the tongue and throat of the smoker so dry, and induces him to quaff as he smokes, and that partly excites the salivary glands to secrete so freely. The ammonia also exerts an influence on the blood.' Richardson, *op. cit.*, p. 6. Fourthly, *carbonic acid* is always present, as may be shown by its action on lime-water. The amount differs extremely in the smoke from different kinds of tobacco, but, according to Dr. Richardson, it may be fairly inferred that the sleepiness, headache, and lassitude which follow the prolonged inhalation of tobacco-fumes, are largely due to this agent. Fifthly, tobacco-smoke yields a *product having an oily appearance*, and possessing poisonous properties. It is popularly known as *oil of tobacco;* and on further analysis, it is found to contain three substances—viz., a fluid alkaloid, *nicotine;* a *volatile substance* having an empyreumatic odor; and an *extract* of a dark resinous character, having a bitter taste. The symptoms of tremor, palpitation, and paralysis which ensue after excessive smoking, especially in persons unaccustomed to indulgence in this practice seem to depend upon the nicotine, which is known by experiment to be highly poisonous.

'The peculiar smell of stale tobacco-smoke, which hangs so long on the breath of the smoker, and on articles of clothing, is derived from the volatile empyreumatic substance; and the exceedingly nauseous sharp taste which is recognized by every unpractised smoker, when he takes a foul pipe into his mouth, is due to the bitter extract. It is apparently this extract which creates vomiting in persons unaccustomed to tobacco, and of which the body after a time becomes tolerant.'—Richardson, *op. cit.*, p. 8. Hence it appears that the more common effects are due to the carbonic acid and the ammonia; while the rarer and more severe are due to the nicotine, the empyreumatic substance, and the resin.

It is unnecessary to enter into details regarding the symptoms of slight tobacco-poisoning, because they are well known to the great majority of the male population. Fortunately, the effects produced by tobacco are very transitory, as the poison finds a ready exit from the body. The system, after being subjected for a few times to the poisons of tobacco-smoke, becomes accustomed to their influence, the distressing symptoms no longer occur, and a condition of 'tolerance' is established. From the extensive investigations of Dr. Richardson, it appears that there are no grounds for believing that smoking can produce any organic changes. It may, however, produce various functional disturbances: (*a*) On the stomach. (*b*) On the heart, producing debility and irregular action. (*c*) On the organs of the senses, as dilitation of the pupil, confusion of vision, subjective sounds, &c. (*d*) On the brain, suspending the waste of that organ, and oppressing it if it be duly nourished, but soothing it if it be exhausted. (*e*) On the nerves, leading to over-secretion of the glands which they control. (*f*) On the mucous membrane of the mouth, causing what has been described as the 'smoker's sore throat.'

'The disease consists of an irritable state of the mucous membrane at the back of the throat, redness there, dryness, a tendency to cough, and an enlarged soft, sore condition of the tonsils, rendering every act of swallowing painful and difficult.' It may exist without detection for a long time; but if a damp, cold, foggy state of the air comes on, the throat becomes troublesome and painful, enlargement of the tonsils is detected, and the symptoms become much aggravated by any attempt to smoke. This condition is more readily induced by the use of cigars than of pipes; it is quite incurable so long as the patient continues to smoke, but soon disappears when the use of tobacco is entirely suspended. In association with this condition of the throat, the gums are usually abnormally pale and firm. (*g*) On the bronchial surface of the lungs, sustaining any irritation that may be present, and increasing the cough. There is no evidence that tobacco-smoke can cause specific diseases, such as insanity, epilepsy, St. Vitus's dance, apoplexy, organic disease of the heart, cancer, consumption, or chronic bronchitis. If, as is universally allowed, tobacco possesses, like alcohol, arsenic (in minute doses), opium, tea, coffee, &c., the power of arresting the oxidation of the living tissues, and thus checking their disintegration, it follows (1) that the habit of smoking must be 'most deleterious to the young, causing in them impairment of growth, premature manhood, and physical degradation' (Richardson, *op. cit.*, p. 73); and (2) that the habit may be conducive to the physical well-being of the individual, provided he cannot supply himself with sufficient nourishing food to supply the daily tear and wear of the muscular and nervous systems.

For a long controversy on the question, *Is Smoking Injurious to Health?* in which Sir Ranald Martin, Mr. Solly, Dr. Ranking, and other medical men took a part, the reader is referred to the 1st volume of *The Lancet* for 1857. The whole matter is very fairly summed up by Dr. Richardson in the excellent pamphlet from which we have so freely borrowed in this article—a memoir which we can cordially recommend to all who take an interest in this subject. Before the full maturity of the system is attained, even the smallest amount of smoking is hurtful; subsequently, the habit is, in most instances, only prejudicial when it is carried to excess. We cannot honestly say more against tobacco than can be urged against any other luxury, and of nearly every luxury it is the least injurious. 'It is innocuous as compared with alcohol; it does infinitely less harm than opium; it is in no sense worse than tea; and by the side of high living altogether, it contrasts most favorably.'—Richardson, *op. cit.*, p. 75. In conclusion, a word or two may be said regarding the kind of pipe that should be used. A long, perfectly clean pipe, composed of an absorbing material like clay or meerschaum, which can suck up the oily matter before it reaches the mouth, is always to be preferred; and M. Melsens, to whom the scientific world is indebted for many ingenious applications of chemistry to hygiene and the treatment of diseases, has recently suggested, that if a plug of cotton, saturated with a strong solution of citric or tannic acid, were placed in the stem, so as to filter the smoke before it reached the mouth, all the nicotine would be seized by and combine with the acid. The different kinds of tobacco exert a different influence on the smoker according to the amount of noxious ingredients which they contain. Thus, cavendish, pigtail, and coarse shag yield the oily matters in much more abundance than Latakia or Turkish, which are hence termed mild tobaccos. Cigars produce dyspepsia much more rapidly than pipes, for in smoking them, unless with a long mouth-piece, nicotine is necessarily absorbed.

Snuffing is probably the least injurious form in which to take tobacco, and chewing the most deleterious; yet sailors, who chew more freely than any other class in this country, are usually men in vigorous health, and after prolonged practice, the quantity they can consume is enormous. Dr. Arrott mentions the case of a harbor-superintendent, formerly a sailor, aged 64, in the almost uninterrupted enjoyment of good health, who chewed tobacco for upwards of 50 years, and at length *ate* it, swallowing every particle of leaf and juice. For many years, he had been in the constant practice of 'eating a quarter of a pound of the strongest negrohead every five days.'—*The Lancet*, 1847, vol. i. p. 440.

The effects which tobacco produces in large doses, when taken by persons unaccustomed to its use, in the form of powder, infusion, or excessive smoking, are 'faintness, nausea, vomiting, giddiness, delirium, loss of power of the limbs, general relaxation of the muscular system, trembling, complete prostration of strength, coldness of the surface, with cold, clammy perspiration, convulsive movements, paralysis, and death. In some cases, there is purging, with violent pain in the abdomen; in others, there is rather a sense of sinking or depression in the region of the heart, creating a sense of impending dissolution. With the above-mentioned symptoms, there is a dilatation of the pupils, dimness of the sight, a small, weak, and scarcely perceptible pulse, and difficulty of breathing.'—Taylor's *Principles and Practice of Medical Jurisprudence*, p. 321. Although thre are two recorded cases of poisoning by nicotine, poisoning by tobacco has rarely given rise to medico-legal investigation. There is, however, reason to believe that porter is often drugged with tobacco or Scotch snuff, for the purpose of stupefying persons with a view to robbery. In all cases of poisoning with tobacco, if it has been swallowed, an emetic of a scruple of sulphate of zinc should be at once administered, and the most powerful stimulants, both external and internal, should be employed. Professor Haughton has shown that nicotine and strychnine antagonize one another; on this assumption, strychnine, carefully administered, would be the proper antidote.

Tobacco has been used in medicine in the form of an enema, with the view of relaxing the muscular fibres, in cases of strangulated hernia, stricture of the bowel or urethra, tetanus, &c.; but in such cases, it has now been generally superseded by chloroform. If it continue to hold a place in the Pharmacopœia, it will probably be as an antidote to strychnine.

It must be recollected that *Indian Tobacco* has nothing in common with the subject of this article, and is a synonym for *Lobelia inflata*.

TOBACCO-PIPES are made of various materials, the commonest in Europe being a fine white clay, which has consequently received the name of *pipe-clay*. Their usual form is too well known to need description, but the manufacture of a clay tobacco-pipe is by no means a simple affair. The first part of the operation is performed by trained children, who, with nice skill, roll out upon a board a small piece of clay into a long slender cylindrical rod, at the end of which is then attached a lump of clay, just enough to form the bowl. These rudimentary pipes are arranged by dozens on a board, until they have become sufficiently hardened. They are then handed to the pipe-maker, who takes a pointed iron wire, and first dipping it into oil, pushes it into the end of the thin column of clay, and having passed it through, forms the bowl with a folding brass mould. The wire is then withdrawn; and after a slight dressing with a knife, the pipes, now complete, are slightly curved in the stem, and are laid by to dry for a few days, when they are removed to the kiln, which is of a peculiar construction, and consists of an interior chamber, with a number of small stages, so that the pipes can be conveniently arranged in circles without touching each other. This interior chamber can be closed so as to exclude smoke, and, in fact, is only a *seggar* on a large scale, such as is used in making Pottery (q. v.). The fire acts all round it, and fires or burns the pipes without smoking them. When thoroughly baked, they undergo a kind of polishing or dressing, and are fit for sale. Finer and more expensive pipes are made of Meerschaum (q. v.).

Under the head of PIPE-STICKS will be found an account of the various materials used for making the tubes of these and other pipe-bowls. *Brier-root pipes*, now very common, have the bowl and stem made of one piece of wood; and although the stem is short, they partially absorb the oil produced in smoking, which, however, is perhaps as much the case with the common clay-pipe when it is new.

Various opinions have been entertained as to the antiquity of the practice of smoking, and consequently of the use of pipes. That pipes for smoking herbs for medicinal and other purposes were in use in England and elsewhere long before the introduction of tobacco, is tolerably certain, and the custom is still prevalent in some places. Colt's-foot, yarrow, mouse-ear, lettuce,

and other plants are occasionally smoked, and no doubt have been so for centuries. A primitive kind of pipe, doubtless such as has been made generation after generation, is still in use in some remote districts. It consists of a stick of elder, from which the pith has been removed, with a bowl formed of common clay, and dried by the kitchen-fire. However much the habit of smoking herbs might obtain in Britain before that time, it is certain that to the introduction of tobacco is to be traced the rise of the trade of the pipe-maker. Pipes have been found in situations near the Roman wall in Northumberland, and other Roman stations in Britain, suggesting the idea that they were used by the Roman soldiers. But this opinion was relinquished by Dr. Bruce, the antiquary, who first propounded it; and very few now imagine that any of the pipes to be seen in the antiquarian museums of Europe are many centuries old. The names Danes' Pipes, Celts' Pipes, Elfin Pipes, Fairy Pipes, Old Man Pipes, &c., are popularly given to these old pipes, but afford no evidence as to their real antiquity. Many of them are remarkable for their very small size, whence, perhaps, some of the names; but this is easily accounted for by the consideration of the very high price of tobacco when first introduced into Europe, and the manner in which it was used, the smoke inhaled by the mouth being expelled through the nostrils, so that the narcotic power of the herb was enjoyed to the utmost.

Similar very small pipes have also been found in North America, and the same mode of using tobacco has always prevailed amongst the American Indians. See Wilson's *Prehistoric Man*, vol. ii. Stone pipes, or pipe-bowls, have also been found in Britain, cut in rude forms, and which apparently were used by the insertion of a tube, perhaps a straw. Such pipe-bowls, but elaborately carved, are amongst the most remarkable American antiquities. They continue, however, to be made by the American Indians to the present day, often of stones, which are not cut without great difficulty, and are adorned with figures of men and animals. Some of them are adapted for the insertion of two tubes, that two smokers may inhale the fumes of the tobacco at once. Among some of the American tribes, the greatest care is bestowed on the ornamenting of the pipe-stem; by others, on the bowl.

The clay-pipe, much the same as is now used, probably came into use very soon after the introduction of tobacco in Britain. Aubrey, writing in 1680, says that tobacco-smokers at first used silver pipes, 'but the ordinary sort made use of a walnut-shell and a straw.' In the reign of William III., pipes were occasionally made of brass and of iron. Examples of these are preserved in various collections. The pipe was, in the earlier days of smoking, passed round the table—one man taking a whiff or two, and then handing it to his neighbor; thus, one pipe of tobacco would 'suffice three or four men at once.' The annexed cut (fig. 1) represents one of the earliest forms of the clay-pipe, undoubtedly of the Elizabethan period. It has been supposed by some writers that the smaller the pipe, the more ancient is its date; but this is decidedly an error. The better criterion of age is the *form*, and the following examples will show the most pre-

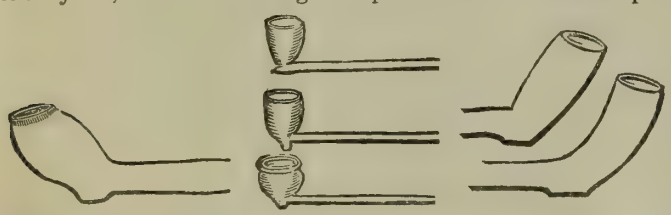


Fig. 1.—Pipe of the time of Queen Elizabeth. Fig. 2. Fig. 3.

valent shapes at different periods. The barrel-shaped bowl was most usual during the Commonwealth and the reign of Charles II., although it was made in many various shapes, which are well known from representations of them in prints of the time and on traders' tokens.

The annexed cut (fig. 2) represents English tobacco-pipes of the 17th century. In the reign of William III., a more elongated form of bowl (fig. 3) began to be prevalent, probably introduced from Holland, although the barrel-shaped bowl still continued to be used. In the middle of the 18th c., the wide-mouthed bowl, now so universal, became the prevalent form, and the spur, which had hitherto been flat, to rest the pipe upon when in use, was elongated, after a fashion supposed also to have originated in Holland. The Scottish *cutty-pipe* and Irish *dudeen* are short clay-pipes.

The most celebrated seat of the pipe-manufacture in Britain is Broseley, in Shropshire, where it appears to have been established in the middle of the 16th c., and has continued uninterruptedly to the present day. Many hands are employed, and many gross of pipes 'turned out' daily. Pipes are, however, made in many places, the clay being obtained from Purbeck.

The pipe-makers of London, as early as 1601, had privileges which gave them a monopoly. In 1619, the craft of pipe-makers was incorporated in England. Holland has long been famous for pipe-making. The Dutch manufacturers were very jealous of rivalry. In the middle of last century, a pipe-manufactory was established in Flanders, and the Dutch makers determined to ruin it. The duties were too high to admit of a large importation, and they therefore freighted a large ship entirely with tobacco-pipes, set sail to Ostend, and purposely wrecked her there. In accordance with the maritime laws of that city, the pipes were landed from the wreck, and sold at such 'ruinous prices' as defied competition; and the new manufactory at once sunk, and was closed.

TOBA'GO, one of the Windward Islands (see ANTILLES) belonging to Britain, lies 60 miles south-east of Grenada, and 18 miles north-east of Trinidad, is 32 miles long, from 6 to 9 broad, and has an area of 97 sq. miles. The island was discovered by Columbus in 1498, and named by him Assumption; the name of T. is supposed to have arisen from the free use of tobacco by the Caribs when first visited by Europeans. It came into British possession in 1764. From its gloomy-looking mountains, dense forests, and abrupt precipices, descending to the sea, T. has been called the 'Melancholy Isle;' but, on a nearer approach, the aspect becomes more pleasing, though still rough and irregular, being extensively occupied with conical hills and spurs, all connected by a ridge running through the interior, the greatest elevation of which is 1800 feet above the level of the sea. From the high ridge descend deep and narrow ravines, which terminate in small alluvial plains. Scarborough is its chief town, pleasantly situated on the shores of Rochley Bay, and at the base of a conical hill rising 422 feet in altitude, crowned by Fort King George. Plymouth, another town, is situated opposite Scarborough, on the leeward shore, about six miles distant, and is the landing-place for passengers, &c., from the royal mail-steamers. Two-thirds of the island is still covered with primitive forests, comprising many varieties of hard-woods and ornamental trees. The geological formation of the island is, on the whole, similar to that of Trinidad. The climate is considered salubrious; the thermometer ranges from 75° to 90°. The pop. in 1880 was 19,324. The island produces sugar, rum, molasses, cocoa-nuts, cotton, coffee, and indigo; pimento also grows wild. The quantity of sugar exported for the ten years preceding 1862, averaged 58,598 cwts. The value of sugar exported fluctuates from £40,000 to £85,000. In 1880 the total value of the exports was £77,615; of the imports, £45,138. The number of public schools has recently increased, and about 13 per cent. of the population were receiving education; a much higher average than in the other West India Islands. The island is governed by a lieutenant-governor, under the governor of Barbadoes as chief.

TOBERMO'RY. See MULL, ISLAND OF.

TOBIT, BOOK OF, one of the most curious and interesting of the Old Testament apocryphal books. It exists at present in Greek, Latin, Syriac, and Hebrew MSS., the texts of which differ considerably, yet not materially from each other. The oldest and most valuable is the Greek Septuagint; indeed, where the others depart from it, they possess little claim to our respect, although the *original* text was certainly not Greek. When and where the book was written, are questions to which various answers have been given; but the opinion of Ewald, who selects Persia as the scene, and the middle of the 4th c. B.C. as the date of its composition, agrees best with its internal character. The author he imagines to have been a Palestinian Jew who wrote in Hebrew, and conjectures that a translation of the work was made into Alexandrian Greek in the 1st c. B.C. That the contents of Tobit are not historical, scarcely requires proof in modern times; yet up to the period of the Reformation, no serious difficulty was felt in receiving it as such. Luther was the first to speak of it as a 'poetical,' i. e., an imaginary, didactic production; and since his time biblical critics have been pretty unanimous on the point; although some contend for what they call a historical basis. The leading incidents of the story do not differ by a hairbreadth in grotesque and puerile *miraculousness* from the fantastic extravaganzas of the Arabian Nights. Tobit, sleeping outside the wall of his courtyard one night, is blinded by sparrows 'muting warm dung into his eyes;' his son Tobias is attacked on the Tigris by a fish, which leaps out of the water to assail him; and marries a Jewish maiden called Sara, seven of whose betrothed lovers had been successively carried off by an evil spirit called Asmodeus. Asmodeus is driven off by an angel—who first appears under the name of Azarias, but subsequently turns out to be Raphael—and then flies to the uttermost parts of Egypt, where he is bound. Old Tobit is cured of blindness by an application to his eyes of the gall of the fish that had tried to devour his son. The sentiments are often very pious and didactic, the descriptions of social life are picturesque, and apparently true, but no excellence of that kind can reconcile us to the childish absurdities of the story.

TOBO'LSK, a government of West Siberia, occupies the north-west angle of the country, and is bounded on the N. by the Arctic Ocean, on the W. by the Ural Mountain, and on the E. by the governments of Yeniseisk and Tomsk. Area, 564,825 sq. m.; pop. (1870) 1,086,848, mostly Russians, but including also Ostiaks, Tartars, Bokharians, and Samoiedes. Branches of the Ural and Altaï Mountains form a hilly region in the west and south-east; but the government is for the most part an extensive plain, sloping to the banks of the principal rivers and to the shores of the Arctic Ocean. The chief rivers are the Ob (q. v.), and its great navigable affluents, the Irtish, Tobol, Om, and Toura. The soil is fertile in the southern and middle districts; marshes covered with forests occupy the land north of lat. 57°, and frozen marshes border the Arctic Ocean. See TUNDRA. The climate, mild in the middle districts, is severe in the north, and warm in the south. Dogs, martens, ermines, silver and blue foxes, bears, deer, &c., eider-ducks, geese, ducks, &c., are the principal animals. The chief crops are rye, oats, and barley. Agriculture employs the great mass of the inhabitants, except in the north, where hunting and fishing are the general occupations. The luxuriant meadows of the south are taken advantage of for cattle-breeding. Timber, furs, and fish are the chief articles of commerce.

TOBOLSK, a town of Western Siberia, capital of the government of the same name, stands at the confluence of the Irtish and the Tobol, 1976 miles east of St. Petersburg. It is well built, with timber houses and wide and regular streets and its position on the two great rivers is picturesque; but its lower part is subject almost annually to inundation from the high floods of the Irtish in spring. Its situation, considerably north of the great commercial highway between Russia and Siberia, and at a distance from the more productive regions of the country, is unfavorable for the development of commerce. T. contains a large prison, capable of accommodating 3000 prisoners; and the convicts condemned to exile in Siberia are first assembled at this town, and thence deported to various parts of the country. Several regiments are stationed here. Pop. (1880) 18,500.

TOCANTI'NS, an important river of Brazil, South America, rises in the province of Gojas, flows north through the province of Para, and joins the waters of the Para (q. v.), the southern branch of the estuary of the Amazon, 130 miles from the Atlantic. Its principal affluent is the Araguay, which joins it in lat. 6° S., and has a longer course, and bears along a greater volume of water than the stream to which it is tributary. The T., at its junction with the Araguay, is 5500 feet wide; at its mouth, it is 8 miles wide. Total length, 1100 miles. The navigation, which is carried on by trading-boats resembling floating houses, is dangerous, on account of the numerous falls, sandbanks, and rapids. Boats descend from Porto Imperial (lat. 10° 30′ S.) to the mouth of the T. in from 20 to 30 days; the upward voyage to the same port occupies from four to five months.

TOCHER, in the Law of Scotland, is an ancient name for the marriage-portion given by a father on the marriage of his daughter. It is settled according to the wish of the father, or as may be agreed with the intended husband of the daughter. Where the father by will leaves a legacy to his daughter, and afterwards during his lifetime gives her a like sum as a tocher, this is not presumed to be a satisfaction of the legacy, though it is otherwise in England. See MARRIAGE.

TOCQUEVILLE, ALEXIS CHARLES HENRI CLEREL DE, a French statesman, and the most eminent writer of this century on the science of politics, was born at Verneuil, in the department of Seine-et-Oise, 29th July 1805. His father was the representative of an old family, the Clerels, proprietors of Tocqueville in Normandy. The Clerels, although in the direct line *noblesse d'épée*, had been closely connected with the magistracy, and, indeed, might be considered to belong more properly to that order, which in France has produced so many distinguished men. The mother of De T. was a grand-daughter of Malesherbes, the academician, political writer, and magistrate, who defended Louis XVI. at the bar of the Convention, and whose fearless intrepidity was punished by the execution of himself and all the most distinguished of his relations. Madame de Tocqueville and her husband narrowly escaped the guillotine by the fall of Robespierre; but they did not emigrate, like other royalist families, and they preserved their property. At the Restoration in 1815, the father of De T. reassumed the title of Count, which belonged to the family before the Revolution. Young T. was called to the bar at Paris in 1825; and after a short tour in Italy, entered the magistracy as *juge auditeur*, at Versailles. In this situation, he carefully studied the administrative system of France; and struck by the perpetual recurrence of revolution, devoted much thought to political questions. In 1831, he threw up his appointment at Versailles, and with his colleague there, M. Gustave de Beaumont, accepted a government mission to America, to report on the working of the penitentiary system. The commissioners, after their return to Europe, published their report (*Du Système pénitentiaire aux Etats-Unis*, 1832; Eng. transl., Philadelphia, 1833)—an admirable work, which modified all the ideas previously entertained in France regarding prison-discipline. But this was not the most important result of their inquiries.

In 1835, De T. published his great work, *De la Démocratie en Amérique* (English transl. by Reeve, London 1835). In his introduction, he sought to show that a great democratic revolution has for centuries been going on in Europe. There is a general progress towards social equality, which must be looked on as a providential fact. In France, it has always been borne on by chance, the intelligent and moral classes of the nation never having connected themselves with it, in order to guide it. In America, he found that the same revolution has been going on more rapidly than in Europe, and has indeed nearly reached its limit in the absolute equality of conditions. There, accordingly, he thinks we may see what is about to happen in Europe. He points out that the people in America may be strictly said to govern. They make the laws and administer them. He draws from what he has observed the conclusion, that democracy may be reconciled with respect for property, deference for rights, safety to freedom, and reverence for religion. He does not propose the laws and manners of the Americans for the imitation of other democratic peoples. He merely seeks, by a faithful picture of an existing democracy, to allay the dread of democratic progress, and to induce those at the head of affairs to recognize it as irresistible, and to seek to control it by wise concessions. *The Democracy* made at once a great sensation. The accuracy of the statements, the skill with which the matter had been digested, and the beauty of the style, were loudly praised by critics. The author was described as the continuator of Montesquieu, and the greatest political writer of his time. He became successively a member of the Academy of Moral Sciences, and of the French Academy.

In 1835, De T. visited England, where his work had made him known, and where he received an enthusiastic welcome from the leaders of the Whig party. In the same year, he married Miss Mottley, an Englishwoman. He shortly afterwards, by a family arrangement, entered into possession of Tocqueville. He stood, in 1837, as candidate for the representation of Valognes in the Chamber of Deputies. His opponent was a retired mill-spinner, who raised the cry of 'No nobles' against him. Alluding to the great dovecot of Tocqueville, his opponent said: 'Prenez garde! Il va vous remener les pigeons.' De T. was defeated; but two years after, he had become a great favorite with his neighbors, the Norman farmers, and they returned him to the Chambers by an overwhelming majority. As a speaker, De T. did not succeed, but he exercised great influence on the legislature. Immediately after the revolution, he was the most formidable opponent of the Socialists and extreme Republicans. He opposed Louis Napoleon, as a man who believed in his right to the throne as firmly as Charles X. He became, however, in 1849, Vice-president of the Assembly; and from June to October in the same year, Minister of Foreign Affairs. At this time, he vindicated the policy of the expedition to Rome, on the ground, it must not be forgotten, that it would secure liberal institutions to the States of the Church. After the *coup d'état*, he returned to Tocqueville, where he devoted himself to agricultural pursuits. He there wrote *L'ancien Régime et la Révolution* (Par. 1856; Eng. transl., London and New York, 1856), a work worthy of his fame. In June 1858, he broke a blood-vessel, and was obliged to leave the bleak coast of Normandy for a warmer climate. He took up his abode at Cannes, where Lord Brougham and Chevalier Bunsen spared no effort to soothe his lingering illness. He died there, 16th April 1859. T.'s *Œuvres et Correspondance Inédites* were published in 2 vols. (1860), by his friend M. de Beaumont, who prefixed a biographical notice. The Eng. transl. of this work appeared at London and New York in 1861.

TOD (derivation unknown), a weight for wool, now unused; it was fixed at 28 lbs. avoirdupois in 1671.

TODARS, TODAWARS, or TUDAS,* a remarkable race inhabiting the upper part of the Neilgherry Mountains (q. v.), in Southern Hindustan. They are rapidly diminishing in number, chiefly owing to the practice of Polyandry (q. v.), and their not allowing intermixture with other races; in 1871, there were 405 men and 288 women. They are tall, well proportioned, and athletic, with finely moulded limbs, and bold, independent carriage; the nose aquiline, with black, bushy hair and beard. The dress of the men consists of a single toga, worn so as to leave the right arm free, not unlike the plaid of the Scottish Highlander. Both sexes are of a dull copper color, but the women are rather fairer than the men, and are often tall and handsome in feature and person. They have no occupation except tending their herds of buffaloes, and converting the milk into butter. The buffalo, indeed, is so important to them, that they look on the pen where the herd is cooped up at night with superstitious veneration. They

* 'Written also *Toda*, *Thoda*, *Thodaurur*. The name of a pastoral people inhabiting the Nilghiri Mountains, and claiming to be the original occupants and proprietors of the whole of the hilly country.'—Dr. H. H. Wilson's *Glossary of Indian Words*.

never attempt the cultivation of the land around them, as they obtain what grain they require from the Burghers and other agricultural tribes, who pay it in the shape of tribute (*goodoo*) for the lands they cultivate, over which the T. assert an imaginary right. The T. hold that their ancestors were the aboriginal inhabitants of these regions (see INDIA, *Inhabitants*); that the Kothers, and afterwards the Burghers, came among them; and that they allowed these tribes to cultivate land on condition of paying a goodoo of one-sixth of the harvest. The Burghers continue to pay this tribute of grain, but only in such amount as suits their own wants and inclinations, and rather in the shape of charity than otherwise.

The only use the T. get of the buffaloes, besides their milk, is to furnish sacrifices to the manes of the dead. They are wont to salute the sun at his rising and setting, and believe that the soul after death goes to the 'great country.' They have no distinct places of worship, except the hut in which they keep their milk, where they pour out in libations to their deities what remains after their daily consumption. They have never been known to steal the smallest article. Their language is of the Dravidian stock, and is either a separate language lying between Kanarese and Tamil, or a jargon compounded of these two. It has no written character. Their mode of collecting the goodoo is singular enough: 'As soon as harvest is over, and the goodoo collected in Todanaad, the Toda men of that division pay visits to the munds (villages, or groups of huts) in Meyleanaad and Paranganaad, and take up their abode with the women of the community (to the temporary exclusion, as is the custom, of the legitimate husband). They then pay visits to the surrounding Burgher villages, and demand in their right, as temporary husbands of the women of the naad, the goodoo, which, strange to say, is paid, and thus the same man, perhaps, who has laid a whole village in his own naad under contribution, goes the round of the other two naads, appropriating the fruits of the Burghers' labor and industry; and carrying off enough grain to support his whole community in idleness and plenty until the arrival of the next year's harvest-time, and to produce by sale in the nearest bazaar sufficient money to pay the tax which is levied yearly on their tribe. I should have refused credence to such a statement, had I not received it on the best authority, that of the tahsildar of the district.'—See *Statistical Memoir of a Survey of the Neilgherry Mountains*, 1861; Harkness's *Description of a Singular Aboriginal Race*, 1832; Burton's *Goa and the Blue Mountains*, 1861; the researches of Ochterlony, Caldwell, Oppert, and Shortt; Marshall's *Phrenologist among the Todas*, 1873; Tyler in *Nature*, 1873.

TODDY, the name given in the East Indies to the fermented juice of various palms from which Arrack (q. v.) is distilled. The name has been adopted in Britain for a mixture of whisky, sugar, and hot water, which forms a popular drink in Scotland. See SPIRIT.

TODLEBEN, FRANZ EDWARD, Russian general of Engineers, was born at Mitau, Russian province of Courland, in 1818. After studying at Riga, he was admitted as a student in the College of Engineers at St. Petersburg. He was second-captain in the engineer corps when the Russian army entered the Danubian Principalities in 1853, and served in the campaign of the Danube under General Schilders. His genius as a military engineer was discovered before the Russian army crossed the Pruth, on its retreat from the Principalities; and when the French and English troops undertook the siege of Sebastopol, Colonel T. was sent to assist in its defence. It was in the middle of April when he arrived, and the fortifications were soon placed under his direction. The principle on which he acted was to watch the works of the allies, and to establish against them on every point a superiority of fire, by multiplying the number and increasing the calibre of his guns. The prodigious activity displayed by the Russians in making good the damage sustained by the heavy fire of the enemy, filled the allied army with astonishment. Everywhere, massive ramparts of earthworks, mounted with formidable batteries, rose up as if by magic at each threatened point within the line of defence. According to T., the defence was rapidly asserting an engineering superiority over the attack. The Malakoff, however, was carried by assault, and the allies entered Sebastopol (see the story of the war in Kinglake's work, *The Invasion of the Crimea*).

At the battle of Inkermann, T., who was on the spot by chance, seeing that the Russian artillery was in danger of being taken, promptly halted a regiment, caused four guns to open fire on the allies, and gave time to the artillery to retreat. At the latter part of the siege, he was wounded in the leg, but all his great defences had then been completed. Since the conclusion of peace, he has expanded what was at first a mere engineer's report into a history of the war in the Crimea. It is entitled *Défense de Sebastopol: ouvrage rédigé sous la Direction de Lt.-Gen. E. de Todleben, aide-de-camp général de S.M. l'Empereur*. In this work, he writes a thoroughly Russian account of the Crimean war. In all that relates to the Russian army and its labors, and especially in regard to the work of the siege, the author may be accepted as an unimpeachable authority; but where the British and French armies are concerned, he is too often careless and inexact, and sometimes his statements are absolutely untrue. For services in the siege, he was created a general and decorated. In 1865 he visited England, and was cordially received. He performed distinguished service in the war with Turkey in 1877–78.

TODMO'RDEN, a market-town of England, in the county of Lancaster, on the border of Yorkshire, 8 miles north-north-east from Rochdale, on the Manchester Railway. The town is well built, has several churches and schools, and manufactures of cotton. Coal abounds in the vicinity. The town proper of T. is composed of houses belonging to three townships, pop. (1871) 11,998; (1881) 23,861.

TO'FFEE, or TOFFY, a sweetmeat made of sugar, melted with about half its weight of butter. Much care is required in making it, to insure its being crisp when cold. It should be kept over the fire and slightly simmered for a quarter of an hour, when small drops are taken and let fall on a marble slab to cool quickly for trial; if they become brittle, it is complete. Everton, near Liverpool, has a name for its toffee.

TO'GA (from Lat. *tego*, to cover) was the principal outer garment of the Romans, and originally, perhaps, the only one. Subsequently, an under-garment, the *tunic*, was added. It was probably of Etruscan origin, and yet it came to be considered the distinctive badge of the Roman citizen, whence the Roman people are called *togati*, or *gens togata;* and consequently, when the Cisalpine Gauls received the rights of citizenship, their country was spoken of as *Gallia togata*, in opposition to Transalpine Gaul, or *Gallia braccata* (breeched). At first, it was apparently semicircular in shape—so, at least, say Dionysius, Quintilian, and others—but afterwards, when it came to be an elaborate and complicated dress, it must have been a smaller segment than a semi-circle. The mode of wearing the toga is difficult to describe, and required considerable art to make the folds fall gracefully. The toga was made of woollen cloth, and except in the case of mourners, was of a white color. Accused persons sought to excite sympathy by going about in a soiled (*sordida*) and unsightly toga; while those who were seeking office were wont to dress themselves out in garments which had been made artificially bright by the help of chalk, hence their name of *Candidati* (lit. shining ones), candidates.

Roman Toga.

The *toga prætexta* had a broad purple border, and was worn by children, and most though not all of the magistrates. The *toga picta*, so called from being ornamented with embroidery, was worn by generals when enjoying their 'triumphs.' Under the emperors, the toga, as an article of common wear, fell into disuse, the Greek *pallium* and other garments being used instead; but it continued to be used by officials on solemn or festive occasions.

Toggel.

TO'GGEL, on Shipboard, a short bar of hard wood, *a*, tapering from the middle towards each end, placed in an eye at the end of a rope, as a convenient obstacle to the rope passing through a loop or knot.

TO'GGENBURG, or TOCKENBURG, a district in Switzerland, within the canton of St.Gall, formed by the long and fertile valley of the Thur. It was formerly governed by counts of its own, who ranked as the richest and most powerful land-proprietors in the country. On the extinction of their line in 1436, the possessions passed to the Barons of Rasen, who sold them in 1469 to the Abbot of St. Gall. Since 1803, T. has formed part of the canton of that name. The valley is thickly peopled by an industrious race, who carry on the manufacture of muslin and cotton. The most interesting spot in the whole region is Wildhaus, in the Johannisthal, a little mountain village more than 2000 feet above the level of Lake Zürich, where Ulrich Zwingli, the Swiss reformer, was born.

TOISE, in the ancient French system of measures, was the unit of linear dimension, and was divided into 6 feet, each foot (*pied*) into 12 inches, and each inch (*pouce*), into 12 lines (*lignes* or *points*). It is equivalent to 1·94903659 French mètres, or to 6·3946 English feet.

TOKA'T, a tow of Turkey in Asia, west from Trebizond, and 60 miles from the south shore of the Black Sea, stands at the mouth of a defile, on the banks of a small stream. It is enclosed by mountains on three sides, so that in summer the heat is intol-

erable. Gardens and vineyards extend along the slopes of the valley to the distance of three miles above the town. The town consists principally of wooden huts, disposed in narrow and dark streets. It was formerly a place of considerable trade, but its importance as a commercial mart has declined. Extensive copper-furnaces, however, in which copper ore, brought from near Diarbekir, by means of mules and camels, is smelted, still exist, and give employment to many persons. Cotton-printing and dyeing are also carried on. Pop. 35,000.

TOKA'Y, a species of wine obtained from the vines which grow on the Hegyallya Mountains, a group stretching north and north-east of Tokay. The T. wine-district comprises about 15,000 English imperial acres, the produce from the Mezesmali, a detached rounded eminence near Tokay, being most esteemed. Great care is bestowed on the proper assortment of the grapes (which are never gathered till fully ripe); and also on the preparation of the wine—of which about 34 sorts are reckoned; but all of these may be grouped into the two classes of sweet and dry. The wine is brownish yellow while new, changing to a greenish hue as it grows older. The average annual produce of the T. vineyards is 1,500,000 imperial gallons of the dry, and 50,000 gallons of the sweet, wines. T. wine enjoys an immense reputation on the continent for its great restorative and tonic qualities; and so much is it esteemed in Hungary, that every considerable proprietor for miles round makes it a point to acquire some property in this vine-district, that he may be able to procure his wine from his own vineyards. On this account, genuine T. is obtainable by wine-merchants only in small quantity (and this is especially the case with the more valuable sort, the sweet or imperial T.), and is largely mixed with inferior wines, to increase the amount.

The vine-gathering is celebrated at Tokay, Maad, and Tallya, the chief places of the district, as a national fête, to which the magnates of Hungary with their families flock from all quarters; and during the season of festivity, many times more than the whole value of the vintage is expended. The crowd of visitors is swelled largely by the wine-dealers and medical agents, who eagerly buy up such lots as are for sale, and sometimes give the most extravagant prices for imperial or other good qualities of wine. Large quantities of 'imitation' T. are made by French and German chemists, and sent to all parts of Europe, not excepting Hungary itself, so that purchasers require to guard against imposition by dealing only with the grower or his accredited agent.

TO-KEI, or TOKIO. See YEDO.

TOKEN, the name given to a kind of money which was at certain periods current in Britain, by sufferance, and not by royal authority. Tokens first came into use in England in the reign of Henry VIII., in consequence of the want of any authorized coins

Fig. 1.—Token of the Triumph, or Pageant Tavern, Charing Cross, 1661.

to represent the fractions of a penny; and in the reign of Elizabeth, stamped tokens of lead, tin, and even leather, issued by vintners, grocers, and other tradesmen, passed largely from hand to hand, and were payable at the shops where they were issued. The corporations of Bristol, Oxford, and Worcester, had also their tokens. In 1613, a royal proclamation authorized Lord Harrington to issue

Fig. 2.—Token of the Mermaid Tavern, Cheapside, London, about beginning of 17th century.

farthing tokens, and prohibited the use of private tokens under penalties. This prohibition was renewed by Charles I., who granted to the Duchess of Richmond, Sir Francis Crane, and others, the exclusive right of coining authorized farthings for seventeen years; but the farthings made by these patentees were the subject of much discontent, as they were greatly below the intrinsic value of the metal. In the face of these prohibitions, private tokens, principally of brass, continued to circulate, and were especially abundant during the Civil War. Numerous tradesmen's tokens, mostly of copper, were again struck during the scarcity of money, at the close of last century. On account of the scarcity of current silver money, previous to the new coinage of 1817, silver pieces known as Bank Tokens, of the respective values of 5*s*., 3*s*., and 1*s*. 6*d*., were issued by the Bank of England: they were called in on the revision of the coinage.—See Chambers's *Book of Days*, vol. i. p. 535.

TOLAND, JOHN, a well-known deistical writer, of the 17th and 18th c., was born near the village of Redcastle, in the county of Londonderry, Ireland, November 30, 1669 (or 1670). His parents were Roman Catholics, and he was brought up in that religion. His baptismal name was James Junius; but the ridicule which it drew upon him at school, led him to change it into John, by which he is now known. He was educated at Redcastle, and entered the university of Glasgow in 1687, but removed to that of Edinburgh, where he took the degree of Master of Arts in 1690. Thence he passed to Leyden, where (having abandoned at Edinburgh the Roman Catholic faith) he entered upon theological studies with a view to orders as a nonconformist minister. One of his masters at Leyden was the celebrated Spanheim. He remained there about two years, during which time he made the acquaintance of Leibnitz and some other distinguished men; and on his return to England, he resided for some time at Oxford, where his extravagant vanity, and the reckless boldness of his opinions on religion, drew on him much notice. In the Bodleian Library, he collected the materials of more than one of his later publications, and prepared in great part the work entitled *Christianity not Mysterious*, which he published in London in 1696, and in which he fully avowed his unbelieving principles. The work created a great sensation in the theological world. It was censured by Convocation, and led to several replies (among which, those of Payne and Stillingfleet may be specially noticed); and in the following year, T. resolved to return to Ireland, sending before him a large number of copies of his work; but he was received no less unfavorably than in England, and his book was burned publicly by the common hangman, in virtue of an express vote of the Irish parliament. Finding it necessary to flee from Ireland, T. returned to London, where he published a defence against this judgment of the Irish parliament; but he soon afterwards turned his pen from theological to political and literary subjects. A pamphlet entitled *Anglia Libera*, on the succession of the House of Brunswick, led to his being received with favor by the Princess Sophia at the court of Hanover; and to his being sent on a kind of political mission to some of the German courts.

During his residence abroad, he published in 1702 a vindication of his book against the judgment of the Convocation, the tone of which was considerably more moderate; but again, in 1705, he out-stripped the boldness of his former opinions and with still less of disguise, openly avowing himself a pantheist. In this course he was emboldened by the patronage of Harley, in whose service he had engaged as a political pamphleteer, and by whom he was sent abroad to Holland and Germany in 1707, in a capacity which, however he disavowed it, was plainly that of a political spy. He returned to England in 1710; and having forfeited the favor of his patron, or at least having separated from him, he engaged as a partisan pamphleteer on the side of Harley's adversaries.

His after-life was that of a literary adventurer, and was checkered by every variety of literary conflict and pecuniary struggle. It forms one of the most curious and painful chapters in D'Israeli's *Calamities of Authors*. He resided from the year 1718 at Putney, where he died, March 11, 1722, in his 52d or 53d year; and it is observed by Disraeli, that on his table was found an *Essay on Physic without Physicians*, which he was writing, in revenge for the unskilful treatment which he himself had suffered in his malady.

Of his works, which were very numerous, but have never been collected into a uniform edition, the following are the most remarkable: *Christianity not Mysterious: a treatise showing that there is nothing in the Gospel contrary to Reason, nor above it*, (Lond. 1696); *Apology for Mr. Toland* (1697); *Life of Milton*, prefixed to Milton's works, 3 vols. folio (1698); *Anglia Libera, or the Limitation and Succession of the Crown explained and asserted* (1701); *Vindicus Liberius, or Mr. Toland's defence of Himself against the Lower House of Convocation* (1702); *Socinianism truly stated* (1705); *Reasons for naturalizing the Jews* (1714); *State Anatomy of Great Britain* (1714); *Nazarenus, or Jewish, Gentile, or Mahometan Christianity* (1718). A detailed account of these works would be out of place, but they all exhibit in a general way the characteristics described above. His Posthumous Works were published in 2 vols. 8vo., in 1726, with a life by Des Maizeaux. An *Account of Toland's Life and Writings*, ascribed to Curle, had previously appeared in 1722. It should be added that the above list is far from containing all the writings of this now little known, but once active and notorious polemic.

TOLE'DO, a famous city of Spain, capital of the province of the same name, and long the capital of the whole country, stands

on the north bank of the Tagus, by which it is encompassed on three sides, 55 miles south-south-west of Madrid by railway. It is situated on a number of hills at the height of about 2400 feet above sea-level; and the climate, excessively hot in summer, is bitterly cold in winter. The Tagus is the great fortress of the town. Rushing round it, on the east, south, and west, between high and rocky banks, it leaves only one approach on the land-side, which is defended by an inner and an outer wall, the former built by the Gothic king Wamba, in the 7th c.; the latter by Alfonso VI. in 1109, and both remarkable for the number and beauty of their towers and gates. Seen from a distance, the city has a most imposing appearance; within, it is gloomy, silent, inert, and its narrow streets are irregular, ill-paved, and steep. In the middle of the city, rises the lofty, massive cathedral, surrounded by numerous churches and convents, mostly deserted, for here the churches are without congregations, and the streets and walks are almost destitute of people. The cathedral, completed in 1492, and built on the site of a former mosque, is a large edifice, in simple, pointed Gothic. It was ransacked and plundered in 1521 and 1808, but previous to these events, its interior was of the most magnificent description. The stained glass that remains is superb; the choir is a perfect museum of high-class sculpture; and there are two pulpits of metal, gilt, the workmanship of which is as fine as that of the richest plate. The cathedral is 404 feet long, and 204 feet wide; and has 5 naves, supported on 84 piers. Connected with the cathedral are an extraordinary number of chapels, of great interest, alike from their architectural beauty, their decorations, and their historical associations. The Zocodover, 'square market,' thoroughly Moorish in its architectural character, is a fashionable promenade, and was for years the site on which heretics were burned, and bull-fights took place.

The *Fabrica de Armas*, or manufactory of Toledan swords, a huge, rectangular, unsightly building, standing on the right bank of the Tagus, was erected in 1788, though long before that time the Toledan blades had become famous, and the fondness of the Iberians for their weapons, as well as the weapons themselves, were written about both by Livy and Polybius. The temper of the best Toledan blades is such, 'that they are sometimes packed up in boxes, curled up like the mainspring of a watch.' The buildings of the town also include a theological seminary, military school, female college, hospitals, and manufactories of coarse woollens, paper, guitar-strings, and leather. Pop. (1877) 21,297.

T., the *Toletum* of the Romans, is of very early origin, and was taken by Marius Fulvius in 193 B.C. It was the capital of the Goths during their dominions; in 714, it fell into the possession of the Moors, who retained it till 1085, when it was permanently annexed to the crown of Castile. In the days of its highest prosperity, it is said to have contained 200,000 inhabitants.

TOLEDO, a city of Ohio, U. S., finely built on the estuary of the Maumee River, near the western extremity of Lake Erie, 92 miles west of Cleveland, and 53 miles south-west of Detroit. It has a fine harbor, and very extensive railway connections; and is the terminus of the Miami-and-Erie, and Wabash-and-Erie canals, together 700 miles in length. The local and transit trade is immense. It has 45 churches, a convent, 3 asylums, 3 daily and 9 other newspapers, large warehouses, machine-shops, foundries, flour-mills, &c. Its commerce in 1870 was in exports, 1,836,782 dollars; imports, 283,329. Its 10 grain elevators can store 4,017,000 bushels. Pop. (1870) 31,731; (1880) 50,143.

TOLENTI'NO (*Tolentinum*), a city of Central Italy, province of Macerata, 11 miles south of Macerata, on a rising ground, left bank of the Chienti. It has a fine cathedral dedicated to St. Nicholas, and a town-hall with ancient inscriptions, a statute of Agrippina, and several good paintings. T. has been a bishop's see from the 5th century. In the Parisani Palace at T., Pius VI. signed a treaty with Bonaparte in 1797, by which the pope ceded Bologna, Ferrara, and the Romagna to the Cisalpine Republic. Under the French Empire, it formed part of the department of Musone. Here Murat was defeated by the Austrians (1815). Pop. 5,000.

TOLERA'TION is the liberty which, in some countries where a particular form of religion is established by law, is allowed to nonconformists to publicly teach and defend their theological and ecclesiastical opinions, and to worship whom and how they please, or not at all. But no permission is thereby given to violate the rights of others, or to infringe laws designed for the protection of decency, morality, and good order, or for the security of the governing power. The enforcement of this class of laws, which have merely civil and political objects in view, is indispensable to the public welfare, and must proceed without regard to the notions of religious duty which their contraveners may entertain or profess. In Britain, there are still in force certain statutes imposing penalties on opinions and practices generally regarded as impious, and which were thought to be criminal because of their offensiveness to God (see BLASPHEMY); but these laws are seldom executed now, the opinion having become prevalent, that, except when the religious feelings of the public are so wantonly outraged as to make the perpetrator a nuisance, theological error is best opposed by refuting it, and that when those accused of Heresy (q. v.) are men of piety and earnest conviction, any degree of severity short of extirpation tends rather to diffuse than to suppress their tenets.

Besides, the right of private judgment in matters of faith and worship is now more generally recognized *in practice* than it used to be, though such is human pride that even yet many resent the exercise, by their neighbors who differ from them, of the freedom which they claim for themselves. They seem to forget the maxim that we should do to others as we would have others to do to us —a principle admirably applied by St. Paul to the case of religious differences (Rom. xiv.), and which indeed is the only one that has been found to work well in all circumstances for every sect: it condemns not only political disabilities and restraints unwarranted by the exigencies of the state, but still more, that uncharitable treatment through which, almost exclusively, the spirit of intolerance can now find a vent in free Protestant countries. Were it not for the inconsistency thus displayed in our own day by many professing advocates of the right of private judgment, it might seem wonderful that the Reformers, by whom that right was first asserted, and who on no other ground could justify their separation from the church of Rome, became in their turn the persecutors, not only of the Romanists, who had persecuted them, but of such fellow-Protestants as had drawn from Scripture conclusions that differed from their own. Instances of such inconsistency on the part of the reformers and their successors will be found in the articles CALVIN SERVETUS, SOCINUS, BIDDLE, and JEWS. In a church claiming Infallibility (q. v.), and believing that salvation is unattainable beyond her pale, it is not only consistant, but to her most earnest members must seem a duty, to prevent by force the spread of what is accounted a fatal heresy; and, in fact, toleration has never been either professed or practiced by the church of Rome. See ALBIGENSES, WALDENSES, DOMINICANS, INQUISITION, HUGUENOTS, BARTHOLOMEW'S (ST.) DAY, NANTES (EDICT OF), CEVENNES, DRAGONNADES. But even the Puritans (q. v.), though long oppressed themselves, were so blind to the right of others to differ from them, that in their own brief day of power they eagerly repudiated, by word and deed, as a monstrous and impious error, the principle of a universal toleration.

In the Assembly of Divines (q. v.) held at Westminster in 1643 —1646, the Presbyterian members fought successfully against the proposal of the Independents that all sects should alike be tolerated. 'We hope,' wrote Baillie to his Presbyterian friends in Scotland, 'that God will assist us to remonstrate the wickedness of such a toleration . . . . For this point, both they and we contend *tanquam pro aris et focis*' (Baillie's Letters, ii. 328, 350; Bannatyne Club ed.: see also the strong expressions of George Gillespie, another member of the Assembly, in his *Propositions concerning the Ministry and Government of the Church*, prop. 41 and 42). We accordingly find in the 23d chapter of the *Westminster Confession* an assertion of the duty of the magistrate to promote the true religion, and to restrain and punish heterodoxy—a principle which, soon after the Restoration, was found to work very inconveniently for the Presbyterians themselves, the magistrate being then one who differed from them as to what the true religion was. The Independents, on the other hand, had learned the lesson of toleration in Holland—that nursery of liberty in modern Europe—whither they had fled from oppression in the reign of James I.; and it is a mistake to suppose, as some have done, that they were the first to understand and practise the principles of religious freedom.

In the 16th c., Zuinglius and the Hungarian reformer Dudith, disclaimed, by word and action alike, the notion that any man is entitled to assume, in his dealings with others, that his own interpretations of Scripture are true, and those of other men, if different, false and culpable. 'You contend,' wrote Dudith to Beza, 'that Scripture is a perfect rule of faith and practice. But you are all divided about the sense of Scripture, and you have not settled who shall be judge. You say one thing; your opponent, Stancarus, says another. You quote Scripture; he quotes Scripture. You reason; he reasons. You require me to believe you: I respect you; but why should I trust you rather than Stancarus? You say he is a heretic; but the papists say you are both heretics. Shall I believe them? . . . . You say that your lay hearers, the magistrates, and not you, are to be blamed, for it is they who banish and burn for heresy. I know you make this excuse; but tell me, have not you instilled such principles into their ears? . . . . Do you not daily teach that they who appeal from your Confessions to Scripture ought to be punished by the secular power? . . . . When you talk of your Augsburg Confession, and your Helvetic Creed, and your unanimity, and your fundamental truths, I keep thinking of the sixth commandment—"Thou shalt not kill."' In the history of England, also, from the Reformation to the Commonwealth, there is, as Bishop Heber has ob-

served, 'abundant proof that (much as every religious party, in its turn, had suffered from persecution, and loudly and bitterly as each had, in its own particular instance, complained of the severities exercised against its members) no party had yet been found to perceive the great wickedness of persecution in the abstract, or the moral unfitness of temporal punishment as an engine of religious controversy. Even the sects who were themselves under oppression exclaimed against their rulers, not as being persecutors at all, but as persecuting those who professed *the truth;* and each sect, as it obtained the power to wield the secular weapon, esteemed it also a duty, as well as a privilege, not to bear the sword in vain.'—*Life of Jeremy Taylor*, p. 27.

It is chiefly to the many keen discussions in Holland and England during the century which followed the Restoration (aided, no doubt, by that moderation or indifference which characterized the Protestant churches a hundred years ago—by the ever-increasing number and power of the dissenters—and by that wider mental culture which enables men not only to see that diversity of mental gifts and acquirements naturally leads to diversity of opinion, but, in Cromwell's language, to 'think it possible they may be mistaken'), that we must ascribe the tolerant spirit now actuating most of the statesmen of England and the United States, and which has lately made rapid progress among the people at large. Not only is the *right* of free thought and discussion now generally recognized, but its *necessity* to the well-being of mankind is asserted by eminent thinkers. Mr. John Stuart Mill, in his able treatise *On Liberty*, thus sums up the grounds on which the necessity of such freedom is affirmed by him: '(1) If any opinion is compelled to silence, that opinion may, for aught we can certainly know, be true. To deny this, is to assume our own infallibility. (2) Though the silenced opinion be an error, it may, and very commonly does, contain a portion of truth; and since the general or prevailing opinion on any subject is rarely or never the whole truth, it is only by the collision of adverse opinions that the remainder of the truth has any chance of being supplied. (3) Even if the received opinion be not only true, but the whole truth; unless it is suffered to be, and actually is, vigorously and earnestly contested, it will, by most of those who receive it, be held in the manner of a prejudice, with little comprehension or feeling of its rational grounds. And not only this, but (4) the meaning of the doctrine itself will be in danger of being lost, or enfeebled, and deprived of its vital effect on the character and conduct; the dogma becoming a mere formal profession, inefficacious for good, but cumbering the ground, and preventing the growth of any real and heartfelt conviction, from reason or personal experience' (p. 95).

See Jeremy Taylor's *Liberty of Prophesying;* Milton's *Areopagitica*, his *Treatise of Civil Power in Ecclesiastical Causes*, and his treatise *Of True Religion, Heresy, Schism, Toleration, &c.;* Dr. John Owen's *Indulgence and Toleration Considered;* Barclay's *Apology for the Quakers*, prop. 14; Locke's *Letters concerning Toleration*, and treatise *On the Conduct of the Understanding;* Bishop Hoadly's *Sermons*, and *Dedication to Pope Clement XI.;* Ibbot's *Boyle Lectures on the Right, Duty, Benefits, and Advantages of Private Judgment;* Paley's *Moral Philosophy*, b. 6, ch. 10; Sydney Smith's *Letter to the Electors on the Catholic Question;* D'Israeli's *Curiosities of Literature*, article 'Toleration;' Hallam's *Literature of Europe* (Part iii. ch. 2); Whately's *Essays on the Errors of Romanism, &c.;* J. Blanco White *On Heresy and Orthodoxy;* Brook's *History of Religious Liberty;* James Martineau's *Rationale of Religious Enquiry;* Samuel Baley's *Essay on the Formation of Opinions* and *On the Pursuit of Truth;* Tayler's *Retrospect of the Religious Life of England;* Edgar Taylor's *Book of Rights, or Constitutional Rights and Parliamentary Proceedings affecting Civil and Religious Liberty in England, from Magna Charta to the Present Time;* and *The Edinburgh Review*, vol. 76, p. 412.—In regard to the manner in which the early Christians became liable to punishment under the Roman laws, see Neander's *History of the Christian Religion and Church*, vol. i. p. 118, Bohn's ed.; Gibbon's *Decline and Fall of the Roman Empire*, ch. 16, compared with ch. 2; Dr. Taylor's *Elements of Civil Law*, App.; and the articles ANTONINUS (MARCUS AURELIUS), DECIUS, and PERSECUTIONS, in the present work.

TOLERATION, ACT OF. See ACT OF TOLERATION.

TOLL (Gr. *telos*, a public tax; Gr. *telonion*, Lat. *telonium*, a toll-house; Ang.-Sax. *tol*, Ger. *zoll*, seem related to the root Ger. *zahl-*, Eng. *tell*, to count, to pay), a payment exacted under a royal grant, or some prescriptive usage, or by express statute; such as by the owner of a port for goods landed or shipped, by the owner of a market or fair for articles sold, or by those charged with the maintenance of roads, streets, bridges, &c., for the passage of persons, goods, or cattle. It is essential in a toll that it be for some reasonable consideration; otherwise, it is void. In modern times, the right to take toll is always created by statute, and nothing short of statutory authority will authorize its levy, for it is a species of tax.

Many tolls receive special names, as dues, customs, &c.; and the term toll is now mostly used in connection with turnpike roads (so called from the turnpike or gate turning on an upright axis or pike, at which the tolls are collected) and bridges. See HIGHWAY.

The first express authorization of a road-toll on record bears date 1346, when a commission was granted by King Edward III. to lay a toll on carriages passing from St. Giles to Temple Bar, and also on carriages passing towards Portpool, now Gray's Inn Lane, London, the roads in those places having become impassable from want of other provision for their maintenance. From that small beginning, the turnpike system gradually spread itself over all England, and latterly over Scotland and Ireland. The earliest Scottish Turnpike Act was passed in 1750. Previously, by statutory enactments in 1617, 1661, and 1669, the Scottish highways were made and maintained by what is called the 'statute-labor' system, under which the laboring population could be called on to give six days' work yearly upon the roads in their parishes. This poll-tax, either in the shape of personal labor, or of conversion-money in lieu of it, remained in force, in regard to all but turnpike roads, till 1845, when the General Statute-Labor Amendment Act (8 and 9 Vict. c. 41) abolished it, and substituted assessments on land.

Beginning with 1750, turnpike roads gradually spread over Scotland, under authority of about 400 separate acts of parliament, till there was a very considerable mileage; and in Ireland, the turnpike system extended over all the kingdom. According to a parliamentary Report in 1840, there were in England and Wales 104,772 miles of turnpike roads; and a similar Report for Scotland in 1859 gives 5768 miles of turnpike roads in that kingdom, with 1060 toll-gates thereon. The original erection of toll-gates excited violent opposition in many parts of the country, and their maintenance has frequently led to popular violence and rioting.* Even those who are sensible that good roads are worth paying for at any reasonable cost, have all along felt the toll-system to be an annoyance and obstruction to traffic, from the continual stoppages to pay or exhibit tickets; often unjust in its application; and unnecessarily expensive. The wastefulness of the turnpike system is astonishing to think of. The local acts of parliament, and the constantly recurring litigation, is a serious expense, to begin with; but the chief waste is in the machinery for collecting the revenue. Besides the erection and maintenance of toll-houses and gates (one for every 6 to 8 miles), there were, at the census of 1871, about 5000 persons employed in England and Scotland as toll-collectors; and assuming these to be heads of families with five persons in each, there are (or were) 25,000 individuals to be maintained, which must absorb a high percentage of the revenue levied on the public.

In 1845, Mr. William Pagan of Cupar-Fife published a plan of 'Road Reform,' in which he directed public attention to the evils of the toll-bar system, and advised its discontinuance, the substitute proposed by him being a rate on horses, or an assessment on the lands and heritages in each county and burgh, for the support of all roads (statute-labor roads included) and bridges within the respective counties and burghs.

Ireland, which was studded all over with gates on its turnpike roads, took the lead in toll-bar abolition. The roads in the south of Ireland were the first cleared of gates; Dublin and its environs followed; and an act was passed in 1857, abolishing the whole of the remaining toll-bars; and by April 5 following, the toll-bar system, and all its costs and charges and vexations, disappeared from Ireland. There, the supporting of the roads by land-assessment is much preferred to the defunct toll system. The Isle of Man also is overspread with excellent roads, with no tolls upon them. The financial management of roads by turnpike trustees in England and Scotland has proved eminently unsuccessful, there being some years ago a debt on the turnpike roads in England to the amount of about four millions sterling, and in Scotland, to the amount of two millions and a half.

The question of toll-bar abolition has been much agitated in England—the inconvenience of the system becoming every day more sensibly felt since the introduction of railways. The efforts of the Anti-toll Association of London have succeeded in freeing the suburbs of the metropolis, and a considerable space on both sides of the Thames, from 153 toll-gates. In recent years, annual acts of parliament have passed in England, gradually effecting the extinction and winding up of many turnpike trusts which have been long insolvent in all parts of the country. Various acts of parliament empower the highway authorities, 'turnpike trusts and highway boards,' to abolish tolls and charge the cost as an improvement of the highways. In Scotland, several attempts were made after 1859 to obtain a general act, compulsory or permissive, for the abolition of tolls. Various counties obtained acts for themselves, for maintaining their roads and bridges by assessment on

* Notably in South Wales, in 1843, where a band of conspirators, calling themselves Rebeccaites (in allusion to Gen. xxiv. 60), carried on the systematic demolition of toll gates and houses for nearly a year.

lands and heritages—the rule usually being, that the proprietors should clear off any debt on the roads, and that the maintenance should be divided between proprietors and tenants.

The counties which obtained abolition acts, were: Aberdeen, Banff, Caithness, Cromarty, Elgin, Dumfries, Haddington, Kirkcudbright, Nairn, Peebles, Ross, and Wigton. Argyle, Bute, Orkney, Sutherland, and Shetland never adopted the toll-bar system. The Roads and Bridges Act, 1878, provided that tolls should be altogether abolished in Scotland in 1883, and any time before then in such counties as voluntarily adopt the Act, whose main provisions are similar to those adopted by the counties which had previously abolished tolls. Toll revenues have diminished from the diversion of the through-traffic to railways; while the chief costs, and notably that of collection, remain as great as before. Notwithstanding the prejudices, and narrow mistaken views of personal and local interests, which continue to resist this, as they have resisted most other important reforms, the remainder of the toll-bar system must give way, and the word 'toll,' as applied to collection of moneys at gates on public roads, become obsolete.

TOLLENS, HENDRIK, the most popular Dutch poet of modern times, was born at Rotterdam, September 24, 1780. At the early age of 14, his father, a merchant in dyestuffs, placed him in his counting-house, and first looked favorably upon, but afterwards discouraged the boy's poetical efforts. The sympathies of young T. were at that time with what was called the patriotic party, who thought that the entrance of the French, in 1795, would be the cure for all political evils, and he made many verses in the spirit of the times. In his 17th year, he began to study English, German, and Latin; but French literature was his favorite study, and translations of French tragedies his chief work. At 19, he published translations from the French poets, under the title of *A Nosegay of Fragrant Flowers, culled on French Ground.* Three years later, appeared his *New Songs and Idyls*, in which he first came out as an original poet. Shortly after, followed another collection of miscellaneous poems, which showed more marked progress; in 1805, his tragedy of *Lucretia;* and in 1806, that of the *Hoekschen and Kabeljaauwschen*, or the Contest between the Nobility and the Towns in Holland, in the olden time—both original pieces of great merit.

In 1804, Loots carried off the first prize, and T. the second, for a poem on Hugo de Groot; and in 1806, the order was reversed, when both again sung the death of Counts Egmont and Hoorn. There flowed from his pen an uninterrupted series of songs and poems, in which the warmest feelings were expressed in the most natural and chaste language. Of these may be mentioned, as a few gems, 'William I.,' the 'Victory at Nieuwpoort, the 'Four Days' Naval Fight,' the 'Cry to Arms in 1815,' the 'Wintering of the Dutch in Nova Zembla,' and the 'National Song of the Netherlands,' which is an echo of the calm but patriotic spirit of the people. His deep fellow-feeling with his countrymen is seen in the poems which he wrote during the Belgian revolution in 1830—1831, as in the heart-stirring poems, 'The Evening Prayer,' and 'The General Prayer-day.' The popularity which T. attained, his poems reaching the fifth edition in 1831, arose chiefly from his singing of subjects always dear to the heart of the nation—of family-life, country, religion, and love—and that in simple, unartistic language, and pure Dutch style. The people loved the poet because they understood him, and his words touched their hearts. T. published *Romances, Ballads, and Legends* (1818); *New Poems* (1821—1829); *Songs of Claudius* (1832); *Poetical Flowers gathered from Neighboring Nations* (1839); *Scattered Poems* (1840); two volumes (1850), in which, though advanced in life, the tone of his lyre was more beautiful, powerful, and rich than ever. T. died at Rijswijk, October 21, 1856.

Of modern Dutch poets, T. stands in the first rank. The Wintering in Nova Zembla is the most wonderful piece of descriptive poetry in the Dutch language. T. was an excellent man, distinguished for his sincere piety and benevolence. His compassion for the poor comes out in his *Bedelbrief*, or Begging-letter, which he published for the benefit of the distressed in the severe winter of 1844—1845. While the people's poet, he was also God's priest for spreading Christian love among men. In early life, T. belonged to the Roman Catholic Church, and in 1827 joined the Protestant Remonstrants; but both before and after the change, he was essentially a religious man.

TOLO'SA, a town in the north of Spain, capital of the province of Guipuscoa, 15 miles south of the seaport of San Sebastian. It stands in a deep valley watered by two streams, and abounds in old family mansions. There is a royal factory for arms, and in the vicinity are zinc and lead mines. Pop. about 8000.

TOLU. See BALSAM.

TOLU'CA, a town of Mexico, capital of the state, and 20 m. S.-W. of the city of Mexico, about 8800 feet above the sea; is handsomely built; with fine arcades lining the streets. The plain on which it stands is fruitful in maize and other products. Pop. 12,000. Near the town is the volcano of the same name.

TO'MAHAWK, a light war-hatchet of the North American Indians. The early ones were rudely made of stone, ingeniously fastened to their handles by animal sinews, or cords of skin. European traders supplied hatchets of steel, the heads of which

Tomahawk.

were made hollow, for a tobacco-pipe; the handle of ash, with the pith removed, being the stem. These hatchets are used in the chase and in battle, not only in close combat, but by being thrown with a wonderful skill, so as always to strike the object aimed at with the edge of the instrument. The handles are curiously ornamented. In the figurative language of the Indians, to make peace, is to bury the tomahawk; to make war is to dig it up. The engraved figure of a tomahawk is from George Catlin.

TOMA'TO, or LOVE-APPLE (*Lycopersicum esculentum*), a plan of the natural order *Solanaceæ*, formerly ranked in the genus *Solanum*, and known as *S. Lycopersicum*. The genus *Lycopersicum* is distinguished by a 5—6-parted calyx, a wheel-shaped 5—6-cleft corolla, five stamens, and a 2—3-celled berry, with hairy seeds. The T. is an annual, from two to six feet in height, requiring support when tall. The leaves are unequally pinnate, the leaflets cut; the flowers numerous, followed by berries, which are very various in shape and color—generally red and yellow—in different varieties. The plant is a native of the tropical parts of America, but is now much cultivated in all parts of the world suitable for it, as the south of Europe and the United States. In Britain, it requires a hot-bed in spring. The fruit is much used for sauces, ketchup, preserves, confectionary, and pickles. The unripe fruit makes one of the best of pickles. Tomatoes appear with almost every dish in Italy. The use of them is rapidly increasing in Britain and other countries.

TOMB (Gr. *tymbos*), a monument erected over a grave, in order to mark the resting-place, and preserve the memory of the deceased. In early ages, and among eastern nations, it sometimes became the practice to place the remains of the dead in excavated sepulchres, whose interior was often decorated with painting or otherwise. Where the usage was to burn the dead, their bones and ashes were placed in urns in these receptacles. Some of the most remarkable rock-tombs were those of Egypt, belonging to the 18th and following dynasty of the Theban kings. The monarch's burial-place began to be excavated as soon as he ascended the throne, and the excavation went on year by year, the painting and decoration progressing till the king's death, when it was suddenly broken off, the tomb thus becoming an index both of the king's magnificence and of the length of his reign. The most costly articles are often found in these sepulchres. The decoration was almost entirely reserved for their interiors, the façades being comparatively unobtrusive. On the other hand, the rock-tombs of Persia and Lycia, less rich and elaborate internally, have imposing architectural façades, those of the Persian kings being copied from their palaces; and during the Roman period, this species of magnificence prevailed at Petra (q. v.) to an extent that gives that now deserted valley the aspect of a city of the dead. See also ETRURIA.

Tombs, in more modern times, have generally been mounds or masses of building raised over the remains of the dead. In the Homeric poems, heaps or cairns of stones are placed as honorary memorials above the graves of departed heroes. The Sepulchral Mound (q. v.) or tumulus of rude ages is found over the greater part of Northern Europe, and is probably older than the subterranean tomb. The Pyramids (q. v.) were the sepulchres of the Egyptian monarchs from the 4th to the 12th dynasty. The tombs of Greece, and still more those of the Greek colonies in Asia Minor, were sometimes pillars, or upright stone tablets, sometimes small buildings in the form of temples. The most celebrated was the *Mausoleum* (q. v.). The Roman tombs were not unfrequently important architectural structures, varying in form, but oftenest consisting of a circular tower resting on a square basement; familiar examples being the tomb of Cæcilia Metella, and the yet larger and more solid tomb of Hadrian, on the banks of the Tiber, best known as the Castel St. Angelo, which is about 220 feet in height, and of immense solidity. In Rome, Latium, and Magna Græcia, tombs were generally erected outside the tows, and along the principal roads leading into the country, as in the Via Appia at Rome, and the Street of Tombs at Pompeii. A form of excavated tomb, without external architecture, called *Columbarium* (q. v.), was also in use in Rome, whose walls were pierced with cells to receive cinerary urns. The prevalent circular tomb became in the later period of the Roman Empire polygonal; and the

central chamber, at first small, was gradually increased, till, in the age of Constantine, it became something like a miniature representation of the Pantheon, generally with a crypt below the principal apartment.

In the earlier centuries of Christianity, the burial of the dead in churches was prohibited. The first step which led to its adoption was the custom of erecting churches over the graves of martyrs; then followed the permission to kings and emperors to be buried in the church porch. The most important tombs of the middle ages are generally within churches or cloisters. There is much variety in the form and enrichment of medieval tombs. The earlier examples consist of a simple stone coffin, or sarcophagus, often with a low gabled lid and a sculptured cross. An altar-tomb, or tomb in the form of a table, followed; and in the 13th c., a species of tomb was introduced, consisting of a sarcophagus, on which rests a recumbent figure of the deceased, the whole being surmounted by a canopy, often of exquisite symmetry and richness. In the renaissance period of art, the tombs became more and more complex. The sarcophagus was disguised, or made the least important part of the monument; the representation of the deceased was confined to a medallion likeness, and the most prominent part of the tomb was composed of sculptured upholstery, and groups of symbolical and eventually mythological figures. In some of the 16th c. examples, as Michael Angelo's tombs of Giuliano and Lorenzo di Medici, at Florence, the inappropriateness of the design is partly redeemed by the beauty of the figures; but in the succeeding centuries, the vicious taste of these monuments rapidly increased, till it culminated in some of the hideous tombs that disfigure Westminster Abbey and St. Paul's.

TO'MBAC, or WHITE-COPPER, is an alloy formed of about 75 parts of copper and 25 parts of arsenic; it is used in the manufacture of buttons, and is a very beautiful metal.

TOMSK, a government of Western Siberia, bounded on the E. and N.-E. by the government of Enisei or Yeneseisk, and on the N.-W. and W. by that of Tobolsk. Area, 324,275 sq. m.; pop. (1879) 1,032,599. T., more than any other government of Siberia, abounds in lakes and rivers. Of the latter, most of which flow northward from the foot of the Altaï Mountains, the principal are the Ob, Tom, Chulim, and Irtish. The largest lakes, which are both sweet and brackish, occur in the Barabinsky Steppes. The climate is mild in the middle and southern districts, but severe in the north. Sandy and clayey soils prevail; but there are patches of good mould on which abundant crops of grain of various kinds, as well as hemp, flax, and tobacco, are raised. The extensive mountain-slopes and plains are covered with luxuriant forests, in which the most common trees are the broad-leafed oak, the cedar, and the pitch-tree. The natural products of the country are numerous. In the south and east parts, droves of wild horses and herds of horned cattle are a source of considerable wealth. But the mineral products of the country are its chief source of riches. Manufactures are not extensively carried on; there is a large barter-trade with China, and the commerce of the country is maintained for the most part by means of fairs.

TOMSK, a trading town of Siberia, capital of the government of the same name, on the Tom, a tributary of the Ob, 2809 miles east of St. Petersburg, in lat. 56° 30′ N., and long. 84° 58′ E. Situated on the great trading highway of Siberia, it is the seat of an important transit-trade, chiefly with the Kalmucks and Mongols; but the goods that pass to and from Irkutsk also go by way of this town. There are upwards of 50 manufactories, chiefly for soap, leather, and distilled liquors, and the most important commercial article is furs. It is said to be the richest town in Siberia; and its commercial importance, its extent, and the number of its handsome buildings, are increasing annually. A university is being instituted. Pop. in 1880, 33,795.

TON, a suffix of frequent occurrence in the names of Anglo-Saxon settlements. It seems to be from the same root as the Gothic *tains*, meaning a twig (allied to which are the *tine* of a fork, the *tines* of a stag's horns, the *tines* of a harrow), the Ang.-Sax. *tynan*, to hedge, and the Ger. *zaun*, a hedge. 'Hence, a *tun* or *ton* was a place surrounded by a hedge, or rudely fortified by a palisade. Originally, it meant only a single homestead or farm, and this use of it is still common in Scotland. In modern English, in the form of *town*, it is applied to a collection of houses. Similarly with *ton*, the terminations *worth*, *fold*, *garth*, *burgh*, and others also convey the notion of enclosure, protection.'—See I. Tayler's *Words and Places*.

TON, the same word as TUN (q. v.), denotes a weight of 20 hundred weight (*cwt.*). In Britain, the hundred-weight contains 112 lbs., so that the ton contains 2240 lbs. In the United States the hundred-weight is usually reckoned at 100 lbs., and the ton at 2000 lbs. In both countries, 40 cubic feet of rough or 50 of hewn timber constitute a ton or load of the same. The hundred-weight (*centner*) in Austria, Prussia, Denmark, Germany, and Switzerland, contains 100 lbs.; in Hamburg, 112; in Bremen, 116; its representative in France, Spain, and Portugal, is the Quintal (q. v.); in Italy, the Centinajo; in Turkey, Egypt, Northern Africa, and the Balearic Isles, the Kantar (124 lbs.).

TONE, in Music, the name given to the larger intervals in the diatonic scale, so called in contradistinction to the *Semitones* (q. v.), or smaller intervals. Theoretically, some of the intervals called tones are larger than others, and none of them are equal to two semitones; thus, in the scale of C, the intervals CD, FG, and AB, are all equal; but DE and GA, which are also called tones, are smaller; and the semitones, EF and BC, are larger than half even of the larger tones. In instruments, however, which are tuned according to the equal temperament (see TEMPERAMENT), all the tones are made equal, and each equivalent to two semitones.

TO'NGA BAY, a small inlet on the east coast of Africa, bounded on the N. by Cape Delgado, and extending inland in a north direction. Cocoa-nut trees and jungle line the shores of the bay, and at its head is the village of Tonga, small and insignificant, but important from its frontier position. Cape Delgado is the northern limit of the Portuguese colonnial possession of Mozambique; and the village of Tonga, which is situated north of the parallel of latitude of the Cape, is in the possession of the Seyyid of Zanzibar, and is the most southern possession of that sovereign.—*Despatches from Her Britannic Majesty's Consul and Political Agent, Zanibar*, 1863.

TONGA ISLANDS AND TONGATABU. See FRIENDLY ISLANDS.

TONGRES, a very ancient city of Belgium, in the province of Limbourg, 13 miles south-south-east of Hasselt. Its church of Notre Dame, the first dedicated to the Virgin north of the Alps, dates from 1240; and the cloister attached, the oldest in the country, was built in the 10th century. The mineral spring in the vicinity, of which Pliny wrote: '*Purgat* hic corpora, tertianas febres discutit, calculorumque vitia,' still retains its ancient virtues. Various manufactures are carried on. Pop. 7200.

TONGUE, THE, is a symmetrical muscular organ, extending from the hyoid bone backwards and downwards, to the lips in front, and occupying the buccal cavity. The superior surface, borders, and anterior third of the inferior surface, are free; while the remaining parts are attached to adjacent parts by the investing mucous membrane and subjacent structures. At certain points, this membrane, on leaving the tongue, forms distinct folds, containing fibrous or muscular tissue, which act to a certain extent as

The upper surface of the Tongue, showing the Papillæ:
1, the raphe or mesial line; 2, 2, the lateral parts; 3, the tip; 4, 4, the sides or edges; 5, 5, the V-shaped mass of circumvallate papillæ; 6, the foramen cæcum; 7, the mucous glands at the root of the tongue; 8, the epiglottis; 9, 9, 9, the fræna epiglottides; 10, 10, the greater horns of the hyoid bone.—From Sœmmering.

ligaments to the tongue. The most considerable of these folds is termed the *frænum* (or bridle) of the tongue, and connects its anterior free extremity with the lower jaw. It acts as a strong ligament, and limits the backward movement of the tip of the tongue. In rare cases, this ligament extends abnormally to the tip, so as to interfere with speech and mastication, and the child is said to be *tongue-tied*; recourse must be then had to division of the frænum, popularly known as *cutting the tongue*. Other folds of mucous membrane (the *glosso-epiglottid* folds) pass from the base of the tongue to the epiglottis; while from the sides of the base, passing to the soft palate, are seen two folds on either side, known as the *pillars of the fauces*. See PALATE. The *superior surface*

of the tongue is divided into two symmetrical lateral parts by a median longitudinal furrow, commencing at the tip, and extending back about two-thirds of the tongue's length. The various kinds of papillæ which are seen on their surface are described in the article TASTE, ORGAN AND SENSE OF. At the back of the surface, just behind the circumvallate papillæ, are large mucous glands, extending into long and capacious canals, and helping to secrete the fluid that moistens the tongue.

On the *inferior surface*, the longitudinal furrow, which extends from the tip to the frænum, is deeper than on the upper surface; on each side of it, veins are seen running forwards; and immediately beneath the tip is a cluster of mucous glands, known as the glands of Nuck (their discoverer in 1690). The *posterior extremity*, or *base* is flattened and extended laterally before it is inserted into the *hyoid bone* (known also as the *lingual* or *tongue bone*), which, with certain ligaments, must be regarded as the basis or framework of the tongue. The muscles of the tongue are usually divided into two groups—viz., the *extrinsic* muscles, which attach the tongue to certain fixed points external to it, and move it on them; and the *intrinsic* muscles, which pass from one part of the tongue to another, constitute its chief bulk, and move it on itself. These intrinsic muscular fibres run vertically, transversely, and longitudinally, and are so interlaced as mutually to support one another, and to act with the greatest advantage. By the action of the various muscles, the upper surface of the tongue may be made concave or convex, or may be pressed against the roof of the mouth; the tip may be protruded straight out or laterally, upwards and downwards, and to any recess (as, for instance, a hollow tooth) within the mouth where food might lodge; and the whole organ may be drawn back. The organ is freely supplied with blood, mainly by the lingual artery, which is given off by the external carotid. With regard to the nerves, the glosso-pharyngeal and certain branches of the third division of the fifth nerve are concerned in the special sense of Taste (q. v.); other branches of the fifth nerve are concerned in ordinary sensation, while the hypoglossal nerve on each side is the motor nerve of the tongue.

The various uses or functions of the tongue cannot be thoroughly understood without a brief reference to its comparative anatomy. The tongue in mammals does not differ very materially from that of man; but in general there is a close coincidence both in size and form between this organ and the lower jaw. In the rodents, the tongue has a wedge-like shape. In the giraffe and the ant-eater the tongue is much prolonged, being an important prehensile organ in the former; while in the latter, it is driven into ant-hills, and the victims are secured by its viscid secretion. In the feline races, the conical papillæ are converted into recurved spines of great size and strength, which the animal uses in scraping bones and in combing its fur. Except in mammals, the tongue is probably not an organ of taste. For a good description of the tongue in birds, reptiles, and fishes, the reader is referred to Professor Owen's *Anatomy of the Vertebrates*, vols. i. and ii. Amongst the Mollusca, the Gasteropoda are provided with a very singular apparatus known as the tongue, and consisting generally of a thin membrane, long and narrow, and rolled, except at its anterior extremity, into a tube. This membrane is covered on its upper surface with transverse rows of minute teeth, or more commonly with plates having tooth-like siliceous projections. These teeth present a great variety of patterns, which are constant in the different genera, and even characterize the species. Two eminent naturalists, Messrs. Loven, a Swede, and Troschel, a German, have independently made the teeth of the Mollusca a basis of classification. The Articulata do not present anything like a true tongue, although in insects a certain oval appendage is described as a *lingua*.

The functions of the tongue are gustation, prehension (in man and monkeys this function is supplied by the hand), mastication, insalivation, deglutition, and speech; to which may be added, spitting and whistling, and in the case of the Gasteropoda, the trituration of the food.

Amongst the diseases of the tongue may be mentioned INFLAMMATION or GLOSSITIS. The most marked characteristics of this affection are great swelling, tenderness, and difficulty in speaking and swallowing. It rarely occurs as an idiopathic or spontaneous affection, but often accompanies severe salivation. It must be treated by purgatives and low diet, and by gargling, as in ordinary Salivation (q. v.). Incisions are sometimes useful, both to relieve tension, and by the depletion that ensues. Cases occasionally occur in which the tongue suddenly enlarges to an immense size, so as almost to cause suffocation, without any true sign of inflammation.—See Druitt's Surgeon's *Vade-mecum*, 8th ed., p. 454, foot-note.

Hypertrophy, or *persistent enlargement* of the tongue, sometimes results from an imperfectly cured case of inflammation; but is probably in most cases congenital, although perhaps not noticed for a year or two. Bertholin (*Hist. Centur.* iii. p. 85) mentions the case of a male child born with the tongue protruding out of the mouth as large as a filbert; and as the child grew, the tongue increased to the size of a calf's heart. For a reference to various cases, and for the mode of treatment, we may refer to a Memoir by Dr. Humphry in vol. 36 of the *Medico-Chir. Transactions*. One of the most common forms of disease of the tongue is *ulceration*, which may arise (1) from the irritation of a decayed tooth with a sharp jagged edge; or (2) from constitutional syphilis; or (3) from a disordered condition of the digestive organs. In the first case, the tooth must be removed; in the second, iodide of potassium with sarsaparilla should be tried; and in the third, the complaint generally yields to regulation of the diet and of the digestive organs, and sedatives at bedtime. M. Lawrence recommends a mixture of compound decoction of sarsaparilla with compound decoction of aloes, three times a day, and four grains of extract of hyoscyamus at bedtime, with advantage. *Cancer* of the tongue occurs either in the hard or in the epithelial variety. There is a popular belief that this terrible disease may be excited by the irritation caused by a broken tooth, or by smoking a clay-pipe; but on comparing the prodigious numbers of jagged teeth and of clay-pipes with the rare cases of cancer of the tongue, we must at once reject this hypothesis. All that such sources of irritation can effect is to determine the exact seat of development of cancer in persons predisposed to it.

A typical case of epithelial cancer of the tongue occurred in the person of Professor Reid of St. Andrews, the eminent physiologist. In December 1847, his age being then 39, and his health good, he noticed a small ulcer on the right side of the tongue; it slowly extended, and acquired hard everted edges, but caused little inconvenience. In July 1848, it had attained the size of a five-shilling piece; its surface and edges were ragged, and it caused considerable pain, especially at night. A hard ridge could be felt all round the ulcer, and the glands beneath the jaw became enlarged. The health by the end of August had completely given way from the pain, when the diseased part of the tongue was removed by the late Sir William Fergusson. In less than a month, the wound had healed, and the health was re-established. In November, the enlarged glands were removed; but the disease returned in their scars, and spread till it caused death in July 1849. The only treatment which can be adopted with any chance of success is full and early extirpation. Prof. Syme succeeded in removing the whole organ, without even—strange to say—much affecting the patient's speech or power of deglutition. *Tongue-tie* is an affection for which infants are often brought to the surgeon, and which is often operated on when this might be dispensed with. The division of the *frænum* with a blunt-pointed pair of scissors, with their point directed downwards, is very easily performed, and fortunately does no harm to the child. Children who do not speak so soon or so clearly as is expected by their mothers, are always supposed to have tongue-tie.

TONGUES, GIFT OF, a gift of the apostles and other Christians in the first ages of the church. The main passages in the New Testament relating to it are Acts ii. 3—21; 1 Corinthians xii. 10, 28; xiii. 1, and particularly xiv. Allusions to it will also be found in Mark xvi. 17; Acts x. 46, and xix. 6. The only allusion to the possession of the gift in later times is in Irenæus, *Adv. Hær.* vi. 6: 'We have many brethren in the church having prophetical gifts, and by the Spirit speaking in all kinds of languages.' From these data, the following conclusions have been drawn by one of the most recent and intelligent expositors of the Epistles to the Corinthians. The gift in question is represented as something entirely new in the apostolical age: 'They shall speak with new tongues,' Mark xvi. 17. The effect on the spectators at the day of Pentecost is of universal astonishment. It is represented as a special mark of conversion, immediately preceding or following baptism. It is a gift 'of the Spirit': 'They began to speak with other tongues, as the Spirit gave them utterance'—Acts ii. 4. It was, moreover, closely connected with the gift of 'prophesying'—1 Corinthians xii. 10, 28; xiv. 1—6. It appears to be distinguished from prophesying by consisting not of direct warning, exhortation, or prediction, but of thanksgiving, praise, prayer, singing, and other expressions of devotion. It was an utterance of the heart and feelings, rather than of the understanding, so that the actual words and meaning were generally unintelligible to the bystanders, and sometimes to the speakers themselves: 'He that speaketh with a tongue speaketh *not to men, but to God;* for no one heareth; and in the Spirit he speaketh mysteries'—1 Corinthians xiv. 2, 4, &c. So far, the account of the gift seems intelligible.

It was, as Dean Stanley says, 'a trance or ecstacy, which in moments of great religious fervor, especially at the moment of conversion, seized the early believers; and this fervor vented itself in expressions of thanksgiving, in fragments of psalmody or hymnody, and prayer, which to the speaker himself conveyed an irresistible sense of communion with God; and to the bystanders, an impression of some extraordinary manifestation of power, but not necessarily any instruction or teaching, and sometimes even having the appearance of wild excitement, like that of madness or in-

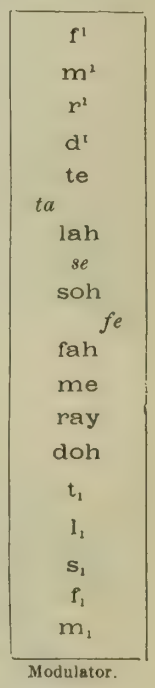
toxication.' The special difficulty, however, remains, viz., as to the character of intelligibility which, on one prominent occasion, seems to have belonged to the gift. *Glossa*, or the word translated 'tongue,' does not necessarily imply a distinct language of a people; this is usually expressed in the New Testament by *dialektos*. But in the description in the Acts ii. 6, 8, it is expressly said: 'Every man heard them in his *own language*' (*te idia dialekto*). 'How hear we every man in *his own language*' (the same phrase in the original) 'wherein we were born.' The plain meaning of this account seems to be, that the gift of tongues, on this occasion, at any rate, assumed the form of intelligible communications in foreign languages. But there is no evidence that the apostles then, or at any subsequent time, enjoyed the ability, supernaturally imparted, of speaking a variety of languages, with a view to the more adequate discharge of their apostolic functions, as has sometimes been inferred from the passage in the Acts. 'Probably,' it has been said, 'in no age of the world has such a gift been less needed. The chief sphere of the apostles must have been within the Roman Empire, and within that sphere, Greek or Latin, but especially Greek, must have been everywhere understood. Even on the day of Pentecost, the speech of Peter, by which the first great conversion was effected, seems to have been in Greek, which probably all the nations assembled would sufficiently understand; and the speaking of foreign dialects is nowhere alluded to by him as any part of the event which he is vindicating and describing.' Dean Stanley (*Corinth.* p. 250).

TONIC, or KEYNOTE, in Music, the note which forms the basis of any scale or key, and on which a piece of music written in that key naturally closes. See KEY.

TONI'CITY, MUSCULAR. The contractility of muscles shows itself under two distinct forms—*Irritability* and *Tonicity*, which are alike distinct in the mode of their action and in the conditions requisite for their exhibition. Irritability is most manifest in the voluntary muscles and in the heart, which, when in activity, exhibit powerful contractions alternating with relaxation; while Tonicity is shown in a moderate and permanent contraction, which, instead of being consequent upon stimulation through the nerves, as in irritability, is especially excited by change of temperature in the tissue itself, and is mainly shown in the involuntary or non-striated muscles. Like irritability, it is an inherent property of muscular tissue during life. 'It manifests itself,' says Dr. Carpenter, 'in the retraction which takes place in the ends of a living muscle when it is divided (as is seen in amputation); this retraction being permanent, and greater than that of a dead muscle. But its effects are much more remarkable in the non-striated form of muscular fibre; and are particularly evident in the contractile coat of the arteries, causing the almost entire obliteration of their tubes, when they are no longer distended with blood.' It is to the moderate action of the tonicity of arteries that their contraction upon the current of blood passing through them is due. If the tonicity be excessive, the pulse is hard and wiry; but if it be deficient, the pulse is very compressible, though bounding, and the flow of blood is retarded. From the experiments of John Hunter and many subsequent physiologists, it is established that *cold* is the most efficient agent in inducing tonic contraction; while the application of moderate warmth causes a relaxation of this contraction. Thus, cold and heat are of extreme value as remedial agents, when the tonicity of the blood-vessels is deficient or excessive.

TONICS are medicines which, in cases of want of *tone* or *tonicity* in the muscular fibres, are employed to restore strength and vigor to the system. Tonics, to a certain degree, are stimulants; but while the latter produce a rapid but transitory excitement, the former slowly induce a certain degree of excitement, and the effect is permanent. Most tonics, in which category we must place the shower-bath, cold sea-bathing, open-air exercise, friction, &c., as well as actual medicines of this class, act primarily through the nervous system (iron being, perhaps, the only exception); and secondarily produce their effects upon the muscular system at large. It is not only in general muscular debility that tonics are to be employed, but in all the numerous complaints which follow in its train, as palpitation, convulsions, epilepsy, chorea, neuralgia, and all forms of periodic disease. Amongst the chief medicines of this class are the dilute hydrochloric, nitric, nitro-hydrochloric, and phosphoric acids, various salts of bismuth, copper, iron, silver, and zinc, and various kinds of cinchona bark, with their alkaloids and their salts, cusparia, calumba, cascarilla, chiretta, gentian, quassia, salix, simaruba, and taraxacum. Although nux vomica and its alkaloid strychnine are placed by writers on Materia Medica amongst the 'special stimulants,' when given in very small doses they have a well-marked tonic action; and there is probably no tonic medicine of more general utility than the *Syrup of Iron, Quinine, and Strychnine*, a non-officinal but widely-used preparation, of which every drachm (the ordinary dose) contains $\frac{1}{25}$th of a grain of strychnine.

TONIC SOLFA. Various attempts have been made at different times to introduce a musical notation in which the staff with its lines and spaces is dispensed with. Jean Jacques Rousseau suggested, but afterwards discarded, a notation where the notes of the scale were indicated by the Arabic numerals. A system similar to Rousseau's in its leading features, called the Tonic Solfa, has, through the influence of its principal promoter, the Rev. John Curwen (who obtained his main principles from the writings and practice of Miss Glover of Norwich), been brought into use to a considerable extent in singing-schools in this country. It proceeds on the principle of giving the chief prominence to the fact, that there is in reality but one scale in music, which is raised or lowered according to the pitch of the key. The seven notes of the diatonic scale are represented by the Solfeggio (q. v.) syllables, or rather Miss Glover's modification of them—*Doh, Ray, Me, Fah, Soh, Lah, Te; Doh* standing for the keynote in whatever key the music is written. In the early exercises, the pupils are accustomed to a scale or diagram, called the Modulator, representing pictorially the exact intervals of a key, with the semitones in their proper places. In written music, only the initial letters of the solfeggio syllables are used—d, r, m, f, s, l, t; the higher octaves of a given note being distinguished by a ' above, as d^1, r^1; and the lower by a , or $_2$ below m_1, m_2. The name of the key is prefixed to a tune as its signature, as 'Key A,' 'Key B flat'—the keynote being, in all the major keys, *doh*. To indicate rhythm, a perpendicular line | precedes the stronger or louder accent, a colon : the softer accent, and where necessary, a shorter perpendicular line | the accent of medium force. Preparatory to writing the notes, the accent-marks are placed at equal distances along the page—thus, | : | : or : | : : | : : | : or | : | : | : | : A note immediately following an accent-mark, is supposed to occupy the time from that accent to the next—thus, | d : d : d | d : d : d | d, or | d : r | m : d.

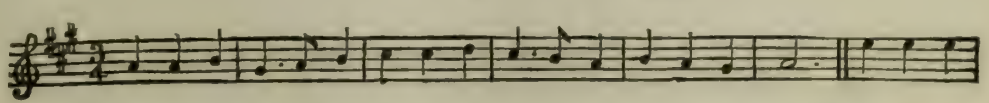


Modulator.

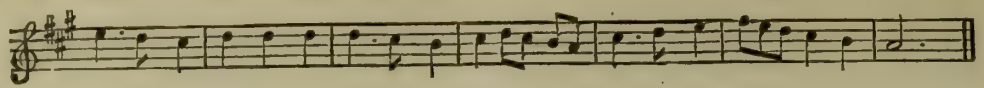
A horizontal line indicates the continuance of the previous note through another *aliquot* (the term used by Mr. Curwen for the distance of time between any accent and the next)—thus, d : — | d : d. A dot divides an aliquot into equal subdivisions, d : m.r | d. A dot after a mark of continuance indicates that the previous note is to be continued through half that aliquot—thus, | d :-. f | m : d.

A comma indicates that the note preceding it fills a quarter of the time from one accent to the next—thus, | d : r.m,f | ; a dot and comma together, three-quarters—thus, | f.,m : r.,d. An inverted comma ‚ is used to denote that the note preceding it fills one-third of the time from one accent to the next, thus, : d | s : l‚s‚f | m : r | d. An aliquot or part of it unfilled, indicates a rest or pause of the voice. A line below two or more notes signifies that they are to be sung to the same syllable. We subjoin an example of the tonic solfa shown alongside of the ordinary notation:

KEY A. GOD SAVE THE QUEEN.



| d :d :r | t_1 :-.d :r | m :m :f | m :-.r :d | r :d :t_1 | d:—:—|| s :s :s



| s :-.f : m | f :f :f | f :-.m :r | m:f.m :r . d | m :-.f :s | l, s, f :m :r | d :—:—||

In modulating into a new key, the note from which the transition is taken is indicated by a combination of the syllabic name which it has in the old key with that which it has in the new—*me lah*, for example, being conjoined into *m'lah;* and in writing this note, the initial letter of its syllable, as a member of the old key, is placed in small size before and above the initial of the syllable of the new, as ^{m}l, ^{d}s. In the case, however, of an accidental, where the transition is but momentary, a sharpened note changes its syllabic vowel into *e*, and a flattened note into *aw*, spelled *a*, as *fah, fe; soh, se; te, ta.* In the minor mode, *lah*, is the keynote; the sharp sixth is called *bah*, and the sharp seventh *se*. The signature of the key of A minor is 'Key C, minor mode.'

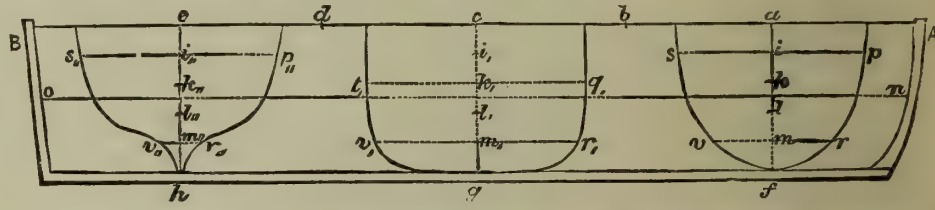
For a full explanation of this system see Curwen's *Grammar of Vocal Music*, or the periodical called the *Solfa Reporter*. The advocates of this notation maintain that it possesses advantages over the common system, particularly from the distinctness with which it indicates the keynote and the position of the semitones; the cheapness with which it is printed; and the manner in which, they say, it develops the proper mental effects of notes in key-relationship, and employs them in teaching. It has, however, been objected to by others, from its withdrawal of the direct indication of pitch to the eye which exists in the common notation, from its limited applicability to instrumental music, and from its acquirement not being, like that of the ordinary notation, an introduction to the world of musical literature.

TONKA BEAN, or TONGA BEAN, the seed of *Dipteryx odorata*, a large tree, of the natural order *Leguminosæ*, sub-order *Papilionaceæ*, a native of Guiana, having pinnated leaves and axillary racemes of purplish flowers. The fruit is an oblong, dry, fibrous drupe, containing a single seed, which has a strong agreeable odor, owing to the Coumarin (q. v.) which it contains, and which is sometimes found crystallized between the cotyledons. Tonka beans are used for flavoring snuff, for which purpose one is carried in the snuff-box; and are put amongst clothes, to preserve them from insects, and to communicate an agreeable odor.

Tonka Bean.

TONNAGE, in regard to ships, is the measure of capacity, the ton being one not of weight, but of cubic content—i. e., 40 cubic feet. Very early in the history of navigation, some scale must have been established by which the relative capacity of different vessels could be determined. In England, there are early laws upon the subject, settling the data upon which the calculation should be made. The present system, called 'New Measurement,' dates from 1835; but the prior system, established in 1719, and now known as O. M. (Old Measurement), still subsists among yachts and some other vessels. The Old Measurement was greatly erroneous, for the actual depth of the ship was not taken into account, but was assumed to be equal to her breadth. The tonnage was then obtained by multiplying together length, breadth, and assumed depth in feet, and by dividing the product by 94. As harbor-dues and such-like taxes were levied according to each vessel's tonnage, it naturally followed under such a system that traders built their ships with as little beam and as great depth as they possibly could. The ships thus became highly dangerous in rough weather, and, moreover, every principle of correct naval architecture was set at nought, to produce deep wooden boxes capable of carrying a maximum of cargo with a minimum of beam. The absurdity of a law by which, in consequence of an inch more beam, a two-decked vessel might appear of greater capacity than a three-decked ship of like length, was so palpable, that many efforts were made at improvement. By the Act of 1835 (and the more perfect Merchant Shipping Act of 1854), the new system established the depth of hold as a necessary ingredient of the calculation. As, however, the section cross-wise of a ship varies so considerably at different points in her keel both in superficies and shape, more than an approximation to her cubic content cannot be obtained.

To arrive at this approximation, the total length of the upper deck, or, if the ship be not wholly devoted to cargo, of the upper portion of the space for cargo, is taken, and divided into 6 equal parts at the points *a, b, c, d, e*. From the foremost, center, and aftmost of these points, the depths to the bottom of the hold are measured as *af, cg, eh*. Each depth has to be divided into 5 equal parts; at the fore and after depth, the width inboard of the ship is measured at $\frac{1}{8}$th and $\frac{4}{8}$ths the depth from the top; and the center-depth at $\frac{2}{8}$ths and $\frac{4}{8}$ths from the top. These lateral measurements at i, i_u, k, m, m_u, and m_{uu}, are developed on the plan, and curves drawn representing cross sections of the ship at the given points. All dimensions are supposed to have been taken in feet and decimal parts, and they are thus used in computing the tonnage. The 'length,' *no*, is measured from stem (internal side) to stern-post, at half the height of the center-depth from the keel. To twice the depth amidships (*cg*), add the depths forward and aft (*af, eh*). The result is the 'sum of the depths.' Add together the two breadths taken at the foremost depth: of the breadths taken at the center-depth (*cg*), add together three times the breadth at $\frac{2}{8}$ths, and twice the breadth at $\frac{4}{8}$ths: of the after-breadths, add together the breadth at $\frac{1}{8}$th, and twice the breadth at $\frac{4}{8}$ths. The sum of these three totals is the 'sum of the breadths.' Having obtained these quantities, the tonnage is approximated to in a somewhat arbitrary manner by the following formula:



$$\text{Tonnage} = \frac{\text{Sum of depths} \times \text{sum of breadths} \times \text{length}}{3500};$$

or, if expressed in terms of the figure:

$$\text{Tonnage} = \frac{\{2cg + af + eh\} \{(ps + rv) + (3t_i q_i + 2r_i v_i) + (p_{uu} s_{uu} + 2r_{uu} v_{uu})\} \times no}{3500}.$$

In computing the measurement of a steamer, the same system is followed, but the tonnage of the engine-room (which is supposed to be capable of floating engines and boilers) is deducted from the total to express the tonnage of the ship.

TONNAGE (more properly TUNNAGE) AND POUNDAGE, certain duties on wine and other merchandise, which began to be levied in England in the reign of Edward III. They were at first granted to the crown by the vote of parliament for a limited number of years, and renewed on their expiry. The object of these imposts was said to be, that the king might have ready-money in case of a sudden emergency demanding it for the defence of the realm and the guarding of the sea. Originally fluctuating in amount, tonnage and poundage came to be fixed at 3*s.* on every ton of wine, and 5 per cent. on all goods imported. In the reign of Henry V., they were first conferred on the king for life; and the same course being followed with his successors, the sovereign began gradually to consider them as his proper right and inheritance, and the vote of parliament as but a formality expressive of the popular recognition of his prerogative. Though these duties were not voted to Henry VIII. until the sixth year of his reign, he, notwithstanding, levied them from the date of his accession; and parliament, in voting them, took occasion to blame those merchants who had neglected to make payment. It was, in fact, usual to levy these duties during the period intervening between a sovereign's accession and his first parliament, and this was done by Charles I., as by his predecessors. The Commons, however,

in Charles's first parliament, accorded these imposts not for life, but for a year only; and the House of Lords objecting to this departure from previous usages, and rejecting the bill, tonnage and poundage were attempted to be levied by the royal authority alone, a proceeding which raised the opposition of the Commons. Charles was, in 1629, induced to pass an act renouncing the power of levying these or any other imposts without parliamentary sanction. On the Restoration, Charles II. obtained a grant of tonnage and poundage for life; and the same course was followed on the accession of James II. and of William III.; but by three statutes of Anne and George I. these imposts were made perpetual, and mortgaged for the public debt. The Customs Consolidation Act in 1787 swept away tonnage and poundage, and similar charges, and substituted a new and single duty on each article See CUSTOMS DUTIES.

TONQUIN (better *Ton-kin* or *Tong-king*), a region in the north-east of the Indo-Chinese Peninsula, bordering on South China. It is mountainous in the north; but the greater part of its area is the fertile basin of the important river Song-ka or Songcoi. Formerly an independent state, it has been for more than one hundred years a dependency of Annam (see COCHIN-CHINA), forming its richest province. The French, moved by the hope of finding access into China by the head-streams of the Song-ka, have repeatedly intervened in the affairs of T.; and in 1874 forced the Annamese to recognize their protectorate over T., and open its ports to trade. To enforce this claim, France occupied the delta of the Song-ka in 1883, but met with difficulties; China insisting on its suzerainty over Annam, and still declining to recognize the treaty of 1874. The capital of T. is Hanoi, Ke-sho, or Cachao (q. v.).—The Gulf of T., lying between T. and the island of Hainan, is a branch of the China Sea, 300 miles long by 150 wide.

TONSILS. See PALATE.

TO'NSURE (Lat. *tonsura*, a shaving, from *tondeo*, I shave), a religious observance of the Roman Catholic and oriental churches, which consists in shaving or cutting the hair, as a sign of the dedication of the person to the special service of God, and commonly to the public ministry of religion. By some writers it is represented as of apostolic origin; but that it did not prevail in the early ages, is sufficiently plain. It would appear that the usage first arose in reference to the monastic rather than the clerical life. Paulinus of Nola, in the end of the 4th, or beginning of the 5th c., alludes to it as then in use among the western monks; and it speedily passed from them to the clergy, the crown-like figure being regarded partly as a symbol of our Lord's crown of thorns, partly as an emblem of the 'Royal Priesthood' of the Christian dispensation.

The form of the tonsure was different in different churches, and the varieties of it are of some historical interest. That of the Roman Church, called 'the tonsure of Peter,' consisted in shaving the crown as well as the back of the head, so that there remained a circular ring or 'crown' of hair. This was the form in use in Italy, Gaul, and Spain. In the 'Scottish (or Irish) tonsure,' which was in use in Ireland, in North Britain, and in those parts of Germany in which the Irish missionaries had preached, the entire front of the head was shaved, leaving the front bare as far back as the line from ear to ear. This tonsure was called 'the tonsure of James,' and sometimes of 'Simon the Magician.' The Greeks and other orientals shaved *the entire head*. The supposed derivation of the Irish form of tonsure from the apostolic times, led to its being held both in Ireland and in Britain, as well as other churches of Irish foundation, to be of the most vital importance, insomuch that the introduction of the Roman form was almost the occasion of a schism. Originally, the tonsure was merely a part of the ceremonial of initiation in orders, and was only performed in the act of administering the higher order; but about the 7th c., it came to be used as a distinct and independent ceremonial; and a question has been raised whether it is to be considered as itself an order, and to be added to the list of what are called the 'minor Orders' (q. v.). The now received opinion of Catholic writers is that tonsure is not an 'order,' but only a 'preparation for orders.'—See Wetzer and Welte's *Kirchen-lexicon*, art. 'Tonsur.'

TONTI'NE. This term is derived from the name of Tonti, a Neapolitan, who seems to have been the first propounder of a scheme for a financial association of which the prize or prizes were to accrue to the longest liver or livers. Generally, in an association on what is called the tontine principle, a payment is made by each member of the association, and with the capital so formed, an annuity, payable at the same rate until all the lives forming the association are extinct, is bought from some company or individual. This annuity is divided among the members according to age and premium paid by each; and on the decease of any member, the surplus thence arising is divided among the survivors; and on the death of the last member of the association, the total annuity reverts to the source from which it has hitherto emanated. There are, however, various kinds of tontines; and the designation of tontine may, with propriety, be applied to any financial scheme by which it is proposed that gain shall accrue to survivorship. In England, tontines have rarely been resorted to as measures of public finance. The last for which the government opened subscriptions was in 1789.—See Hamilton's *History of Public Revenue*, p. 210. Schemes on the tontine principle seem generally to be acceptable to the public, owing, probably, to the sort of sentimental faith which most persons have in their own prospects of longevity; and to the prudent desire for ease and affluence in old age. The application of the principle by Life Assurance Companies in their mode of distributing 'bonus,' or surplus profits, has long been a subject of controversy among these valuable institutions. It would be impossible here to go into the argument with any degree of nicety. It may, however, be broadly stated as follows:. A company formed for the purpose of life assurance means a company in which the members who are lucky in having long life, are to pay for those who are unlucky in dying prematurely. But over and above the net mathematical premium payable by each member of an assurance society, or by each person assured at the risk of a company, a percentage, or 'loading,' as it is technically called, is added, to cover expenses of management and other contingencies.

Where the funds of the company or society have been invested with average success, the loading is generally found, at the periodical actuarial investigations, to have been in excess of actual requirements; and the question then arises: How are 'profits,' or, in other words, the overcharges on premiums to be divided? The question is plainly one of great intricacy. The argument used by the offices favoring the younger policy-holders is, that those which favor the older are really acting on a tontine principle, which is the very converse of what ought to prevail in life assurance; on the other hand, it is said that the fulfilment of the insurance contract is provided for by the net premium, and that the distribution of over-payments, as 'profits' really are, is to be determined on principles wholly independent of insurance. See 'Notes on the Early History of Tontines,' by J. Hendricks, in the *Assurance Magazine* for July 1862; and an article in *Chambers's Journal*, 1880.

TOOKE, JOHN HORNE, a celebrated etymologist and political adventurer, was the son of John Horne, a London poulterer, and was born in that city, June 1736. He was educated first at Westminster and Eton, and afterwards at St. John's College, Cambridge, where he took the degree of B.A. in 1758. After spending some time as an usher in a school at Blackheath, he entered the church (to please his father, and strongly against his own wish), and in 1760, became curate at New Brentford. The disgust he entertained for the sacred profession led him to indulge (by way of revenge) in a license of speech and life, which appears to us to have fatally affected the honesty of his character. It is impossible, for instance, to read a passage like the following (from one of his letters to Wilkes), without feeling a deep distrust of the whole man: 'It is true I have suffered the infectious hand of a bishop to be waved over me; whose imposition, like the sop given to Judas, is only a signal for the devil to enter; but I hope I have escaped the contagion; and if have not, if you should at any time discover the *black* spot under the tongue, pray kindly assist me to conquer the prejudices of education and profession.'

When Wilkes (whose acquaintance he had made during a trip to Paris) stood as a candidate for the county of Middlesex, T. zealously aided him, pledging his credit for Wilkes' expenses, and declaring that, 'in a cause so just and holy, he would dye his black coat red;' but he afterwards quarreled with his dubious associate, and in 1770—1771, the two had a rasping epistolary controversy, which appears to have hugely gratified their enemies. He still, however, continued to meddle in political affairs, and even ventured to encounter (not without success) the formidable Junius. In 1773, he resigned his living at New Brentford, and commenced the study of law, a profession in which he was really fitted by nature to excel. About this time, he rendered some important private service to a Mr. Tooke of Purley in Surrey, who designed to make him his heir, but altered his mind, and only left him a legacy of £500. Altogether, however, he is said to have received from this gentleman about £8000, and, in consequence, adopted the surname of Tooke, by which he is now known. In 1775, he was fined and imprisoned in the King's Bench for publishing an advertisement in which he accused the king's troops of barbarously murdering the Americans at Lexington. While in prison, he penned his celebrated *Letter to Mr. Dunning*, in which are to be found the germs of his *Diversions of Purley*. It excited a good deal of attention at the time, and even Dr. Johnson, who detested T.'s political sentiments, expressed his intention—should he publish a new edition of his *Dictionary*—to adopt several of the 'dog's' etymologies. On his release from confinement, T. made an attempt to gain admission to the bar, but was refused, on the ground of his clerical orders. Soon after, he reverted to political writing, at once the pleasure and the poison of his life, and in a

Letter on Parliamentary Reform, advocated universal suffrage. In the struggle between Pitt and Fox, he pamphleteered on the side of the former, but soon got to hate Pitt too, as he had learned to hate most other public men.

In 1786, appeared his famous *Epea Pteroenta, or the Diversions of Purley*, a work on the analysis and etymology of English words, which, amid much that is erroneous, both in principle and detail, contains still more that is acute, original, and true. In particular, he has demonstrated, says a *Quarterly Reviewer* (No. 14), that 'all words, even those that are expressions of the nicest operations of our minds, were originally borrowed from the objects of external perception.' See PHILOLOGY. But T.'s passion for politics soon drew him from the calm pursuit of literature into the vortex of public life. In 1790, and again in 1796, he stood as a candidate for Westminster, but was unsuccessful on both occasions. At length, in 1801, the great enemy of rotten boroughs entered parliament for the most notorious rotten borough in England—Old Sarum; but he made no figure there. He died at Wimbledon, March 19, 1812. T. was never married, but had several natural children, to whom he left his property. The best edition of the *Diversions of Purley* is that of Taylor (Lond. 1840).

TOOMBU'DRA (correctly, TUNGA-BHADRO), an important tributary of the Kistnah or Krishna, rises in the south-west of Maisur (Mysore), and after a north-east course of from 350 to 400 miles, joins the Kistnah, 25 miles below Karnul.

TOON, or TOONA (*Cedrela Toona*), a tree of the natural order *Cedrelaceæ*, one of the largest timber trees of India. Dr. Hooker mentions one which he measured which was 30 feet in girth at five feet above the ground. The leaves are pinnate, the flowers small, in panicles, with a honey-like smell, the petals erect, and approaching each other so as to form a sort of tube. The tree ascends to the height of 4000 feet on the Himalaya Mountains, and is found to the furthest south of the East Indies. It is sometimes called *Bastard Cedar*. The wood is soft, but is used for furniture. The bark is a powerful astringent, and is used in dysentery, diarrhœa, &c.

TOOTHACHE. See TEETH.

TOOTHACHE-TREE. See ARALIA and XANTHOXYLUM.

TOOTH-ORNAMENT, much used in the Early English style.

TOP, in a Ship, is the platform at the head of each lower-mast. It is supported on the trestle-trees and cross-trees, and serves to give a wider base to the top-mast shrouds. It is also used for working the upper sails. In a well-ordered ship, there is a captain and crew for each top. Formerly, in vessels of war, the top was fortified with hammocks all around, and in action was made to do duty as a sort of redoubt, whence a fire of small-arms, or even light swivel-guns, was poured upon the deck of the enemy.

TO'PAZ, a mineral, ranked by mineralogists amongst Gems (q. v.), and the finer varieties of which are much valued both for their lustre and the beauty of their colors. It is composed chiefly of alumina and silica, the former, in general, more than 50 per cent of the whole, with fluoric acid, and usually a little oxide of iron. It is found generally in primitive rocks, and in many parts of the world. A crystal 19 ounces in weight was found in the Cairngorm Mountains in Aberdeenshire, Scotland; and fine topazes are sometimes found in that part of Scotland, in Cornwall and in the Mourne Mountains in Ireland. Fine topazes are found in Ceylon, but those most prized by jewelers are generally from Brazil. The finer varieties of T. are in general found either crystallized, or as small rolled masses, which may have been formed from crystals, in alluvial soil.

T. is either colorless, or red, blue, green, or yellow, in great variety of shades. Its crystals are rhombic prisms, generally terminated by four-sided pyramids, but often variously beveled and acuminated. The prisms are finely striated. The cleavage parallel to the base of the prism is easy. The specific gravity is about 3·5. The lustre is vitreous. T. is translucent or almost transparent on the edges. It is harder than quartz. It is rendered very electric by heat or friction, and by this property a T. may at once be distinguished from a diamond or ruby, for which otherwise, when cut and set, it might readily be mistaken. A coarse variety of T., called *Pyrophysalite*, occurs near Fahlun, in Sweden, which is not crystallized. It is greenish white. When reduced to powder, it can be used as emery for grinding and polishing.—T. derives its name from the *Topazion* of the ancients, which, however, seems to have been a totally different mineral.

TOPE (*Galeus canis*), a small species of shark, of the family *Galeïdæ*, which has two dorsal fins and one anal, spout-holes, and the eyes furnished with a nictitating membrane, the first dorsal situated over the space between the pectorals and ventrals. The T. is very abundant on the southern coasts of Britain, but becomes more rare towards the north. The name T. is said to be originally Cornish. Other local names are *Miller's Dog* and *Penny Dog*. It attains a length of about six feet. The T. is extremely troublesome to fishermen, robbing their lines of the fish which are attached to them, and biting off the hooks, or, if it happens to be

Tope (*Galeus canis*).

itself hooked, often winding the line round its body in many coils and with tangled knots.

TOPE is the vernacular name of Buddhistic monuments intended for the preservation of relics. In Ceylon and elsewhere, they are also called *Dagops;* and another of their designations is *Chaitya*. The difference between these terms results from their meaning. Tope is the Pâli *thûpa*, and the Sanscrit *stûpa;* it means therefore literally 'accumulation,' and conveys a sense analagous to that of the Latin *tumulus*. *Dagop* is a corruption of *dhâtu-gopa*, i. e., relic-preserver; and *Chaitya* applies generally to objects of worship, as images, temples, sacred trees, &c. *Tope* is therefore the name of those monuments in regard to their shape; *Dagop*, in regard to their purpose; and *Chaitya* the general term. Though the shape of the topes underwent many changes according to time and locality, it is possible to distinguish its oldest type from its later development. The oldest topes are in the shape of cupolas, generally spherical, but sometimes elliptical, resting on a cylindrical or quadrangular, or polygonal base, which rises either in a straight or inclined line, or in terraces. The top of the cupola, surrounded by a balcony of pillars of a peculiar kind, is crowned by a structure generally quadrangular, but sometimes in the shape of a reversed pyramid of a few steps; and over this structure is a roof in the shape of an extended parasol (Sanscrit, *chhattra;* in Pâli, *chatta*). This was the form, for instance, of the topes of Sanchi, of the dagops of Ceylon, and the oldest monuments of this kind in the Punjab and Afghanistan; though in most of them the parasol, being of wood, is either completely destroyed, or merely recognizable in its fragmentary condition (see art. BUDDHISM, where, in the section of the cave-temple at Karli, the tope is seen still surmounted by the wooden umbrella). The cupola was sometimes ornamented with more than one parasol; in some of the topes of Sanchi there are three, and even five parasols side by side, the middle one exceeding the rest in height.

The different arrangement of these parasols, especially when their number increased, led to a different shape of the topes, such

Fig. 1.—View of principal Sanchi Tope.
(From Fergusson's *Hand-book of Architecture.*)

as occurs, for instance, in China and Tibet. This arrangement consists in placing them one *over* the other; and not only three or five, but even seven, nine, or more are so placed. The height of the structure thus became naturally greater than it originally was, and the topes, instead of having the character of cupolas, now assumed that of pyramids resting on a cupola base, the parasols gradually giving way to a real pyramidal form. In some monuments of this class, however, the cupola was placed above, when the base consists in round or quadrangular towers rising in a spiral form, or in several stories. The Chinese, on the contrary, rejected the cupola altogether, and merely retained the succession of parasols extended one over the other, converting them into a many-storied tower; and the same is the case with the topes of the Mongols, the *Ssuvurghans*, which are pyramids erected on a low quadrangular base. The top of the pyramidal topes always carries some metal ornament, frequently gilt, resembling a parasol, or a needle, or a trident, or a rising flame. The height of these buildings varies from a few feet to 300, and even more; there are also topes of a few inches only, but they serve merely as orna-

ments in temples or buildings, or as symbols of the real topes. If erected in cave-temples, the tope generally stands at the end of a long hall especially cut out for it, but sometimes also in the sanctuary of the cave-temple itself; if erected over-ground, it stands always in the vicinity of a temple or convent.

Fig. 2.
Rock-cut Tope at Ajunta (from Fergusson), in which the three umbrellas have become a spire.

In the interior of the tope is the cell or chamber (*dhâtugarbha*) where the box containing the relics and 'the seven precious things' was placed. This cell consists of six slabs of stone, firmly closed after the box with the relics, &c. had been placed in it; and it was immured into the tope after its structure had, in the course of building, attained a certain height; the building then being brought to its completion, so that the cell enshrining the relic was enclosed on all sides with solid brickwork. The 'seven precious things' referred to, with which the relics were ornamented, are differently enumerated; according to one account, they are gold, silver, lapis lazuli, crystal, red pearl, diamond, and coral; others mention ruby and emerald; and others, again, omit gold and silver. In several cells which have been opened, the box contained, besides the relics, precious stones of various kinds, golden ornaments, and coins; and the box itself generally consisted of an outer casement of stone, clay, or bronze, which enclosed a silver cylinder, and within this, a golden cylinder, which was the real receptacle of the relics. Both cylinders had generally a convex lid, representing the shape of the cupola, and the box exhibited inscriptions commemorating the name of the saint to whom the ashes or other relics contained in it had belonged. It seems that there are also topes which had the relics placed, not within, but under them—or, in other words, in the ground on which they were erected; for, in some which were opened, neither a cell nor any relic was found; and though it is possible that such monuments were merely erected in commemoration of some personage, there are, on the other hand, accounts which relate that relics were also placed under the dagops. Whether these accounts be correct, it is at present impossible to say, as no foundation on which such dagops stand has as yet been explored.

It has been supposed by some authors that the topes contained some secret passage leading to the relic-cell, known only to the priests or the initiated, who thus might gain access to the relics; for legends relate that during night such relics occasionally shed light, and that some pious king was deigned worthy of being favored with their sight; but none of the topes hitherto explored —and some of these are of the greatest dimensions—yielded any confirmation of this theory; they proved to be nothing but solid masses of brick and stone, without any chambers or passages—merely containing the relic cell, of generally one foot in diameter. That the cupola of the topes was intended to represent the water-bubble, the Buddhistic symbol of the hollowness and perishability of the world, is borne out by a legend in the *Mahâvans'a* (q. v.). The purport of the parasol may seem more doubtful; but as the parasol is the emblem of Hindu royalty, and as S'âkyamuni, himself the son of a king, replied to the question how he wished to be buried, by answering: 'Like an emperor,' it is not unlikely that the parasol of the topes was intended to imply the royal dignity possessed by a Buddhistic saint. When the topes became pyramids or towers consisting of terraces and stories, the number of the latter had likewise a symbolical import. Thus, only the topes of the most accomplished Buddhas had thirteen terraces; three terraces imply the three worlds; five, the five steps of Mount Meru; and so on.

TOPEKA, the capital of the State of Kansas, U. S., on both banks of the Kansas River. It is very handsomely built, and the state capitol is a magnificent edifice. T. is connected by rail with the ports of the Gulf of Mexico, and by the Atchison, Topeka, and Santa Fe (Southern Pacific), completed in 1882, with San Francisco. T., incorporated in 1857, and made state capital in 1861, had 5790 inhabitants in 1871, and 15,451 in 1881.

TOP-GALLANT, in a Ship, the name applied to the third mast or sail above the deck, i. e., to the mast and sail above the topmast and topsail.

TO'PHANÉ (correctly, TOP-HANEH), a suburb of Constantinople (q. v.).

TOPICS (the Greek term *topike*, from *topos*, a place) was the name given by the Greek and Roman rhetoricians and grammarians to the art of discovering arguments. It consisted in the eliciting out of the series of particulars certain general conceptions and propositions, which, in the elaboration of oratorical discourses, served as guides in the invention and choice of suitable arguments. Any one such general conception was called in Greek *topos;* in Latin *locus communis* (a 'common place'). The Greeks bestowed much attention on this art; among the Romans, Cicero composed *Topica*, and various other treatises of a kindred nature. During the middle ages, it was proposed to apply it to the whole circle of human knowledge, and even to the solution of the most difficult intellectual problems; but in general, these efforts only resulted in empty exhibitions of mental vivacity (*jeux d'esprit*); and in modern times, the so-called 'art' has sunk so low, that by the term 'topic' one understands nothing more than a theme or subject for discussion and talk.

TOPKNOT, the popular name of some small fishes of the same genus with the Turbot (q. v.) and brill. MULLER'S T. (*Rhombus hirtus*) is not uncommon on some parts of the British coast, particularly the west coast of England. BLOCH'S T. (*R. punctatus*) is more plentiful in more northern parts. They are very similar, brown and mottled with very dark brown or black on the upper surface, white below. They live among rocks, where they are not easily distinguished by the eye from the sea-weed. Although very delicate fish, they are little regarded, the largest being seldom more than 7 or 8 inches in length. The breadth is about half the length.

TO'PLITZ, or TEPLITZ, a watering-place of Bohemia, one of the most celebrated of the German spas, is pleasantly situated on the Saubach (Pig's Stream), 16 miles north-west of Leitmeritz. The chief building is the palace of Prince Clary, to whom the town in great part belongs; and behind this building are a park and gardens which are the principal places of resort. Within their limits are the theater and the Gartensaal, the latter of which serves the purposes of reading, dining, and ball room. On the hill behind the palace is the Schalckenburg, a sort of tavern, built in imitation of a castle, and which commands a wide view from its prospect-tower. The baths are supplied from 11 hot alkalo-saline springs, the chief of which has a temperature of 120° F. They are taken exceedingly hot, and have great virtue in restoring persons afflicted with gout, rheumatism, &c. Pop. of T., with Schönau, (1880) 16,750. Between 7000 and 8000 strangers annually visit the baths.

TOPO'GRAPHY is literally a description of places (Gr. *topos*, a place), as rivers, hills, woods, but more especially cities, roads, bridges, streets, and even particular buildings. It differs from ordinary geography only in being more special and minute. The copious topographical literature of Great Britain will be found carefully indexed in a special work, Anderson's *British Topography* (1881), which is a catalogue of works on this subject in the British Museum.

TOPOGRAPHY, MILITARY. Among the first necessities of a military commander is a thorough knowledge of the physical conformation, the obstacles, and the resources of the country in which he has to operate. It frequently happens that the field of warfare is one of which no careful survey is procurable. It devolves, then, on the officers of the staff to make their chief acquainted with all the particulars he requires; hence, topographical drawing is made a principal ingredient in the course of study at the Staff College. These surveys devolve, in the field, on the quarter-master-general's department. An officer of this service is ex-

pected to traverse a country with rapidity, to measure distances by eye or intuition, to note them roughly down as he rides, to obtain a rough knowledge of hills and valleys, of roads and ravines, rivers and the means of crossing them. He must at the same time make himself acquainted with the means of sustenance produced by the country, with the feelings of the people—whether friendly or hostile—with the transport which can be drawn from the villages, with the position and strength of fortified places, and, in short, with every particular which can be of service to his commandant. His reconnaissance finished, not without fatigue and danger, he is expected to sit down and produce an eye-map, or a full report of all he has seen and heard.

The *Topographical Department* is a department of the War Office under the 'Director of Surveys,' who is an officer of engineers. It comprises the 'Ordnance Survey,' which is charged with the various national surveys; and the Topographical Dépôt, a collection of maps, plans, descriptive-books, and journals of staff-officers from all parts of the globe. The officers of this dépôt always try to keep their information posted up to the latest date, that, on an army taking the field, the general may at once be put in possession of a competent knowledge of the country he is to pass through or occupy.

TOP-SHELL. See TROCHIDÆ.

TOR (Celtic), 'a projecting rock, is found in the names of Mount Taurus and the Tors of Devonshire (Yes Tor, Brent Tor, &c.) and Derbyshire (Mam Tor, Chee Tor, &c.). The higher summits of the *Tyr*-ol are called Die *Taur*-en.'—Taylor's *Words and Places*.

TORBANEHILL MINERAL, a name sometimes popularly given to a mineral substance also known as BOGHEAD COAL, found on the lands of Boghead and Torbanehill, near Bathgate, Scotland, and celebrated for its value as a source of Paraffin Oil or Naphtha (q. v.), of which it yields a much greater quantity than any other coal or shale found in Britain. Large quantities are exported to the continent of Europe. A famous litigation took place in 1853 concerning this mineral, between a landlord and the lessees, which turned partly on the question, whether it ought to be regarded as a coal or a shale, a point on which opposite opinions were expressed by eminent men of science.

TORCE, or WREATH, in Heraldry, a garland of twisted silk, by which the crest is joined to the helmet. A crest is always understood to be placed on a torce, unless where it is expressly stated to issue out of a coronet or chapeau.

TO'RGAU, a town of Prussia, and a fortress of the second rank, stands on the left bank of the Elbe, 70 miles south-south-west of Berlin, and 12 miles north of the frontier of the kingdom of Saxony. The river is here crossed by a bridge 500 paces in length, and supported upon 15 stone piers. Among the public buildings are the castle, now used as a barrack and magazine, and comprising a church consecrated by Luther in 1544; a town-church, with pictures by Cranach; a gymnasium, and other schools. Weaving and brewing were once briskly carried on at T., but the prosperity of the town has decayed. A battle was fought here in November 1760, in which Frederick II. of Prussia defeated the Austrians. Pop. (1880) 11,091.

TO'RGET, a small island off the north-west coast of Norway, in lat. 65° 30′ N. It serves as a land-mark to sailors, is the haunt of numerous water-fowl, but is chiefly noteworthy for its lofty rock called Torghatten (the Hat of Torget), which rises to the height of 756 feet above sea-level, and is pierced right through, near the top, by a cave or passage 80 feet wide, and 1300 feet long.

TORLONIA, a princely Roman family, remarkable for their wealth, and for their extraordinarily sudden rise from the very lowest condition, trace their origin to a poor 'cicerone,' Giovanni T. (born in 1754), who hung about the Piazza di Spagna in Rome, and gained a precarious living by showing visitors over the Colosseum. By steadiness and honesty, he obtained a reputation in his profession, became afterwards an agent of the French emissaries who were sent to excite the Roman populace to revolution, and on the failure of this project was left with considerable funds in his hands; he afterwards married a widow of means, and became a merchant, gradually rising, by dint of great intelligence, keen foresight, and enterprise, to the position of a stockbroker, usurer, and money-dealer; and by acquiring mortgages over the properties of the impoverished Roman princes, and by various other happy ventures, ultimately amassed an immense fortune. He was made a grandee of Spain, and Duke of Bracciano by the pope. His three sons allied themselves with princely families of the highest rank; the eldest succeeded to the dukedom, and the two others carried on their father's business. The youngest became Prince of Civitella-Cesi, and Duke of Ceri.

TO'RMENTIL (*Tormentilla*), a genus of plants of the natural order *Rosaceæ*, sub-order *Potentilleæ*, differing from *Potentilla* (q. v.) only in the 4-parted calyx and corolla, and now united with it by many botanists. The COMMON T. (*T. officinalis*, or *Potentilla tormentilla*) is a very common plant in moorish and heathy places in Britain and throughout great part of Europe. It has a large woody root, which has long been officinal, being an agreeable and efficacious astringent, useful in diarrhœa and other

Tormentil (*Potentilla tormentilla*).

complaints; and which contains tannin, gum, and a red coloring matter, not soluble in water, used by the Laplanders for staining leather red. The leaves are ternate, the leaflets lanceolate, and inciso-serrate; the stems ascending and forking, the flower-stalks axillary and terminal, and the flowers yellow.

TO'RMINA is the technical term for *griping* pains in the belly.

TORNA'DO. See WHIRLWIND.

TO'RNEA, a river, important as forming part of the boundary-line between Russia and Sweden, rises in Lake Tornea, in Sweden, and flows south-east and south between Russia and Sweden, entering the Gulf of Bothnia at its northern extremity, after a course of 250 miles. At its mouth is the small town of Tornea (q. v.).

TORNEA, a town in Finland, situated in 65° 50′ N. lat., and 24° 10′ E. long., on the peninsula of Svensar, at the mouth of the Tornea, in the government of Uleaborg. The pop., which in 1880 was 968, is principally engaged in the exchange-trade with the more northern and scantily-inhabited districts of Finland and Sweden, of which T. is the active center, as the most northerly town in the Russian Empire; deals, salt-fish, tar, hemp, rein-deer skins and other peltries being brought to T., to be exchanged for tobacco, spirits, manufactured goods, &c. T. is often visited in summer by travelers, anxious to witness the singular spectacle of the sun remaining above the horizon both night and day at the summer solstice. T. was several times taken by the Russians from Sweden before its final cession at the Peace of Frederickshamm, in 1809, when it was ceded, together with the whole of Western Finland, to Russia.

TO'RO, or TORRO, an ancient but decayed town of Spain, in the modern province of Zamora, stands on the right bank of the Douro, 21 miles east of Zamora. It contains numerous religious houses, most of which have been allowed to fall into a state of decay; there are brandy-distilleries and brick and tile works. Pop. 7000.

TORO'NTO, the capital city of the province of Ontario, Canada stands on the north shore of Lake Ontario, in lat. 43° 39′ N., long. 79° 23′ W., 165 miles from Kingston, and 323 miles from Montreal. It is over two miles in length between east and west, is bounded on the S. by the Bay of Toronto, a spacious inlet of Lake Ontario, and is a mile and a half broad from south to north. The scenery of the vicinity is somewhat tame, and the situation of the town is low and flat, the most elevated quarter—the Queen's Park, in the west, containing the university, observatory, and handsome private residences—being only from 100 to 200 feet above the level of the lake. The harbor or bay, about five miles long and a mile in width, is formed by a curving spit of land running into the lake in a south and west direction to the distance of three miles. It is capable of accommodating the largest vessels that navigate the lakes, and is defended at the entrance by a fort, which was thoroughly repaired in 1864 by the imperial government, and mounted with the most efficient modern ordnance. T. has much the appearance of an English town, and is distinguished for the number of its churches—many of which are surmounted by handsome spires. The principal are St. James's Cathedral (Anglican), a noble edifice in Early English, erected in 1852; St. Michael's Cathedral (Roman Catholic); Knox's Church and St. Andrew's (Presbyterian); the Metropolitan (Methodist); and the Unitarian chapel. T. is the fountain-head of the Canada school-system, and its educational institutions are numerous and well appointed. The university, charmingly situated in the well-wooded Queen's Park, was inaugurated in 1843, and is attended by 250 students; Trinity College has about 100 students; and the

Upper Canada College has 200. Knox's College, recently built, is the Presbyterian theological hall. The University Park, with its beautiful monument to the volunteers who fell at Ridgeway, and the Horticultural Gardens, are frequented by all classes of the community. There are also the Normal and Model Schools, in the first of which teachers exclusively are trained. Attached to the university is the observatory. There are many benevolent institutions, as hospitals, asylums, &c.; and handsome official buildings, including Osgood Hall, the seat of the supreme courts of the province; the legislative buildings; the Government House; the customs-house; and the post office.

There are two large theaters in T. T. is a station for five railways—the Grand Trunk, running east and west; the Great Western; the Northern; the Toronto, Grey, and Bruce; and the Toronto and Nipissing; while, during open navigation, magnificent steamers ply in all directions on the lake. Cabinet-ware and iron rails are manufactured, and foundries, distilleries, and flour-mills are in operation; the exports are manufactured lumber, flour, wheat. Pop. (1871) 56,092; (1881) 86,415, who return two members to the provincial parliament.

The name T. is supposed to be of Indian origin, but the meaning of the word appears to have been lost. The town was founded in 1794 by Governor Simcoe. It was incorporated in 1834, was burned by the Americans in 1813, and suffered severely in the insurrection of 1837, on which occasion it was the headquarters of the rebellion, as also from fire in 1849.

TORPE'DO, a genus of fishes of the order *Raiiæ* (see RAY), and family *Torpedinidæ*. All the *Torpedinidæ* were formerly included in this genus, itself originally formed from *Raia;* but it has been divided into a number of genera, as *Torpedo*, *Narcine*, *Astrape*, &c. The *Torpedinidæ* have a short and not very thick tail, cylindrical towards the end, keeled on the sides. The disc is rounded,

Torpedo (*Torpedo vulgaris*).

and has neither scales nor prickles. The most remarkable characteristic, however, is the galvanic battery, which all the species possess, and which is described and figured in the article ELECTRICITY, ANIMAL. The name T. is very commonly extended in a popular sense to all the *Torpedinidæ*. Two species of T. are occasionally found on the southern coasts of England—*T. vulgaris* or *marmorata*, which sometimes attains a large size, weighing 100 lbs.; and *T. Nobiliana*, which is apparently more rare. They are readily distinguished by the spiracles behind the eyes, which are round and fringed at the edges in the former, oval and perfectly smooth in the latter. These and other species are found more plentifully in the Mediterranean, and the *Torpedinidæ* generally belong to the warmer seas. The popular names *Numb-fish*, *Cramp-fish* and *Cramp Ray* are given to torpedoes by English fishermen. The electric shock which a large T. gives when seized is so severe, that no one who has experienced it desires to experience it again.

TORPEDO. During the war between Great Britain and the United States in 1812—1814, this name was applied to certain mysterious boats invented by Fulton and other Americans for the purpose of navigating beneath the surface of the water, and injuring the bottoms of hostile vessels. In those days of hand-to-hand naval war, these designs (which, by the way, were failures) were looked upon as little less than diabolical. The progress of destructive weapons during half a century has removed this aversion. The modern torpedo is of two kinds—first, the locomotive torpedo, which is in various ways projected against the side of a hostile vessel; secondly, the fixed torpedo, a kind of stationary bomb-shell intended to explode under the bottom of the enemy's ship. To these fixed torpedoes it is now more usual to give the appropriate name of submarine mines.

The weapon was first used by the Russians in the Baltic in 1854; but in the American War of Secession of 1861—1865 it was extensively and often successfully employed. The damage effected by a torpedo exploding beneath a ship is very great, but the failures are very frequent by the explosion happening at a wrong moment. In the Franco-German War of 1870—1871, the French fleet was effectually scared from the Prussian ports by the dread of torpedoes. Torpedoes were much employed in the Russo-Turkish war of 1877.

Of fixed submarine mines there are two classes—those which are self-explosive on a ship touching them, and those which are dependent on an electric current supplied from the shore. A torpedo of the self-acting class is shown in fig. 1: *abc* is a hollow iron cone, water-tight, with a ring at *b* by which to anchor it. The upper part, B, is left empty, for the sake of buoyancy, while the lower end, A, is filled with gunpowder, the charge varying from 100 to 300 lbs. At the top of the powder is an iron case, C, filled with lime, and in it a tube of thin glass, D, containing sulphuric acid. The upper part of the glass tube is enveloped by the ringed end of the iron rod, E, which passes through the top of the torpedo, and some distance above it; and has horizontal rods, G, called feelers, attached rigidly to its upper extremity. When a ship impinges on the feelers, the rod is deflected from the perpendicular; the ring at its lower end breaks the glass tube; the acid acting on the lime, generates great heat, and explodes the powder.

In the electric torpedo a wire insulated in a small cable is laid from a battery on shore to the submarine mine. It enters it by an insulated joint, and is then soldered to a small piece of platinum wire placed in the middle of the priming of the torpedo; from the other end of the platinum a second wire communicates

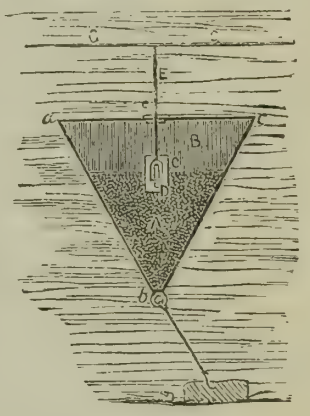


Fig. 1.

with the metal sides of the torpedo case. On closing circuit at the battery, the current passes by the cable into the torpedo, heating the platinum to incandescence, and exploding the mine. There is thus no need of a second cable; the water and the earth take its place. Submarine mines are usually charged with gun-cotton, which has the great advantage of being explosive by means of a fulminating fuse, even when wet through leakage of the torpedo case.

Submarine mines are usually moored or laid on the bottom in several lines, the mines of the second line being opposite the intervals of the first, so that it is difficult for a hostile ship to pass up a defended channel without coming within reach of one or more of them. As a ship approaches, her course is carefully watched so as to fire a mine at the right moment. In order to explain how this is done, let us take the case of the channel AB.

Two or more lines of mines are laid down across its mouth. For the sake of clearness we show only a few of those of the first line in the diagram. At C and D two stations are selected, commanding a view of the defended waters. At C is the voltaic battery, and the wires from the mines connect them with D, while a

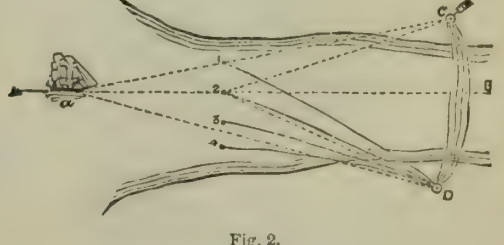


Fig. 2.

second series of wires, each corresponding with one of the first series, connects D and C. There are thus two breaks in the circuit of every mine, one at C, where a number of 'firing-keys' are arranged so as to place at will the battery in connection with any of the wires; the second break is at D, where similar firing-keys connect at will each wire of one series with the corresponding wire of the other. A ship is seen approaching on the course AB. When she is at *a*, the observer at C notices that her bearing is the same as that of mine No. 1. He therefore closes the break in the first circuit by means of the firing-key, but no current passes, for the observer at D sees her well to the left of the bearing of mine

No. 1, and therefore leaves his break open. Not until she is actually over No. 2 will both observers at the same moment see that her bearing corresponds to that of No. 2, and closing both breaks in the circuit, fire the mine. By means of a telescope combined with the firing-key, these bearings can be taken with great accuracy. In some cases the ship herself is made to close the circuit in striking a rather complicated apparatus called a circuit-closer, which floats above each of the mines arranged on this system.

Of locomotive torpedoes there are three classes: (1.) The Whitehead fish torpedo, which has a fish-shaped case, and is propelled in a straight line under water by means of a small screw-propeller driven by compressed air. It is discharged from a carriage on the deck of a man-of-war, and explodes on impact against the object aimed at. The secret of the construction has been sold by the inventor to the Austrian, Russian, and English navies. (2.) The Harvey 'towing torpedo,' which is towed out at an angle from the side of the attacking ship, and manœuvred so as to come in contact with the bottom of the ship attacked. It is exploded either mechanically on contact, or by means of an electric fuse, the wire being inserted in the towing line. (3.) Boom or outrigger torpedoes, which are carried on long booms in the bows of boats or steam-launches, and thus driven against the side of a hostile ship and exploded. Torpedo boats are becoming a special feature of European navies; they are swift steamers not more than 60 feet long, lying low in the water, and steaming up to 19 knots an hour. The *Polyphemus*, added to the English navy in 1881, is an armored ram, expressly and cunningly designed for torpedo warfare (carrying Whitehead torpedoes), and is a formidable vessel, 240 feet long. See *Fraser's Magazine*, 1872; illustrated articles in the *Popular Science Review*, 1873 and 1875; the illustrations in the *Illustrated London News*, June 16, 1877; and Sleeman's *Torpedoes and Torpedo Warfare* (1880).

TO'RQUAY, a watering-place on the south coast of Devon, occupying a cove on the north side of Tor Bay, 23 miles from Exeter, and about 210 from London. The name is derived from the Celtic 'Tor' (q. v.), a hill, which occurs in the appellations of the neighboring peaks of Dartmoor (Hey Tor, Rippon Tor, &c.), and thence is given to the bay, and to the ancient parish of Tormohun or Tormoham, in which T. is situate. The monastery of Tor Abbey was founded in the 12th c.; but the town of T. is of recent origin. The bay is noted in history as the place where William of Orange landed in 1688, and was often used as a naval rendezvous during the war with France; but till the beginning of the present century, T. was little more than an assemblage of fishermen's huts. About that time, the advantages of its climate —which are a peculiarly sheltered position, an equable temperature, and freedom from fogs—caused it to be resorted to by consumptive patients; and it soon attained a European celebrity, which is still almost unrivaled. The romantic hills and valleys of Tormohun and its environs are being rapidly overspread with villas, gardens, terraces, and rows of smaller dwellings. The original parish has been divided into four, and possesses six (English) churches, one Roman Catholic, one Scotch Presbyterian, and numerous dissenting chapels. A stone pier was built in 1803, and the port is resorted to by colliers and small traders. The geological formation consists mainly of a range of transition limestone cliffs in strata much contorted, containing beautifully-tinted marbles. There are also Old Red Sandstone and argillaceous shale. The scenery is of the most varied and picturesque description. Besides the mildness of the winter, the vicinity of the sea in front, and of Dartmoor in the rear, greatly moderates the summer climate, so that while the mean winter temperature is 44°, that of the summer is only 55°. The population has increased from under 1000 in 1801 to 32,946 in 1881. Kent's Cavern, discovered in 1824, and the Brixham Cave, discovered in 1858, are rich in fossils, and are among the earliest places in the kingdom in which prehistoric human remains have been found.

TORQUEMADA, THOMAS DE, the first inquisitor-general of Spain, was born at Torquemada in 1420, and died 16th September 1498. He became prior of a Dominican monastery at Segovia, and in 1483 was by Ferdinand and Isabella, and by the pope, made inquisitor-general for Spain. He thoroughly organized the system, established numerous tribunals, and promulgated a code of laws. See INQUISITION.

TORQUES (Celtic, *torc;* Lat. *torqueo*, I twist), a species of gold ornament, meant to be worn round the neck, which was much in use in ancient times, both among Asiatic and North European nations. It consisted of a spirally-twisted bar of gold, bent round nearly into a circle, with the ends free, and terminating in hooks, or sometimes in serpents. These ornaments seem to have formed an important part of the wealth of those who wore them, and of the plunder obtained by the Roman conquerors from a Celtic or oriental army. A monument erected to a Roman soldier not unfrequently specified the number of torques that had been conferred on him. Numerous examples of the torques have been dug up in Great Britain and Ireland, as well as in France, and are to be found in archæological collections. Both in Europe and in Asia, the torques resembled one form of Bracelet (q. v.) on a larger scale.

TO'RRÉ DEL GRE'CO, a city of Southern Italy, at the base of Vesuvius, 7 miles from Naples. Its pop., though often reduced after the eruptions, was 18,950 in 1871. The town is always new, being from time to time destroyed by the lava, and always raised again from its ruins, by the attachment of its inhabitants to their native soil. The soil is fertile, producing fruit and wines similar to those of Greece. Its inhabitants are engaged in the tunny, oyster, and sardine fisheries. Mention is made of the town under its present name (the origin of which is unknown) as early as 1324 A.D. It suffered much in the eruption of 1631, and in that of 1794 it was almost totally destroyed by the lava. The earthquke of 1856, and the eruption 1861, when the town was overwhelmed by vast showers of ashes, were equally destructive. But T. del G. has always risen again from its ruins.

TO'RRÉ DELL' ANNUNZIA'TA, a thriving town of Southern Italy, stands on the south base of Mount Vesuvius, 13 m. S.E. of Naples. A fishery and a coasting-trade are carried on. Pop. (1881) 20,060.

TO'RRENS, LAKE, sometimes a brackish lake, at others, merely a salt-marsh, in S. Australia; lat 30° 11′ to 32° S.; and long. 137° 30′ E. It lies 30 m. N. of Spencer Gulf. Length, 130 m.; breadth, 18 to 20 m.

TO'RRES STRAIT lies between North Australia and Papua or New Guinea, in lat. 9° 20′—10° 40′ N.; and long. 142° 30′ E. The channel is about 80 miles in width; and its navigation, though practicable, is rendered dangerous and difficult by the innumerable shoals, reefs, and islands with which it is strewn. It was discovered by Torres in 1606.

TO'RRES-VE'DRAS, a town of Estremadura, kingdom of Portugal, on the left bank of the Sizandro, about 30 miles north of Lisbon. It has a pop. of about 3300, and carries on some trade in wine; but derives its reputation solely from having given name to those famous lines of defence within which Wellington took refuge in 1810, when he found it impossible to defend the frontier of Portugal against the French armies; and from which, in the year following, he issued on that career of slow and hard-won victory, which ended in the expulsion of the French from the Peninsula. The *first*, or outermost of these lines, extending from Alhandra, on the Tagus, to the mouth of the Sizandro, on the sea-coast, and following the windings of the hills, was 29 miles long; the *second* (and by far the most formidable) lay from 6 to 10 miles behind the first, stretching from Quintella, on the Tagus, to the mouth of the St. Lorenza, a distance of 24 miles; the *third*, situated to the south-west of Lisbon, at the very mouth of the Tagus, was very short, being intended to cover a forced embarkation, if that had become necessary. The entire ground thus fortified was equal to 500 sq. miles.

TORRICELLI, EVANGELISTA, a celebrated Italian mathematician and philosopher, was born at Piancaldoli in the Romagna, Italy, October 15, 1608. He was brought up by an uncle who resided at Faenza, and who put him under the tuition of the Jesuits. When 20 years old, he was sent to Rome, and there devoted himself to mathematical studies. Galileo's theories on force and motion, which had been published a short time before, especially engaged his attention, and led to his publishing a *Trattato del Moto* (1643), a meritorious work, but containing few new discoveries of consequence. The publication of this work led to his being invited by Galileo to visit him; and on the old philosopher's death, three months afterwards, he was appointed to succeed Galileo in the chair of Philosophy and Mathematics at Florence. Here he resided till his death in 1647. The discovery which will preserve T.'s name through all ages was the interpretation of the previously known fact, that water will rise in a suction-pump only to the height of about 32 feet. The fact that water *could* be raised in a pump was expressed by the empirical law, that 'nature abhors a vacuum, and after the limit of 32 feet was ascertained, the law was modified accordingly by Galileo. T., wishing to perform this experiment more conveniently, employed mercury, and found that nature's abhorrence of a vacuum varied for different fluids, and was represented by a column of fluid in height inversely proportional to its specific gravity; here, then, was an additional fact of importance, containing the clue to the mystery, and T. was not long in hitting on the idea that the column of fluid was sustained by the pressure of the atmosphere on the open surface of fluid. See BAROMETER. T. also effected the quadrature of the cycloid, but in this was anticipated by Roberval.

TO'RRINGTON, a municipal borough and market-town of the county of Devon, on an eminence sloping to the Torridge, 10 miles south-south-west of Barnstaple. The inhabitants, who slightly decreased in numbers between the years 1851 and 1861, are employed for the most part in agriculture and glove-making;

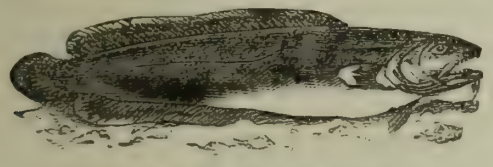
but the industry is inconsiderable. Pop. (1881) 3445. The name of T. emerges frequently during the great Civil War; and the capture of the town by Fairfax in 1646, on which occasion the church, with 200 prisoners, and those who guarded them, were blown into the air by gunpowder, proved fatal to the king's cause in the west.

TORSHO'K, one of the most acient towns in Russia, in the government of Tver, stands on the Tverza, in an undulating district, 309 miles south-east of St. Petersburg. Leather and malt are the most important branches of manufacture; but the gold and silk embroideries of this town are well known throughout the empire, and obtained much celebrity at the London Exhibitions of 1851 and 1862. There is an extensive trade in corn, which the merchants of T. purchase in the neighboring districts and at the landing-places of the Lower Volga, and thence transport to St. Petersburg by water. Much of this corn is ground at T., and the flour exported. The town was founded in the 11th century. Pop. (1880) 12,900.

TO'RSION is a method of common application in surgery for the purpose of checking arterial hæmorrhage in certain cases. The wounded vessel is drawn out and fixed by a pair of forceps a quarter of an inch from the end; the end of the artery is then twisted round till it will not untwist itself. It is especially useful when there are many small arteries wounded in an operation, as, for example, in the extirpation of a large tumor.

TORSION-BALANCE (Lat. *torsio*, twisting) is an instrument first invented by Coulomb, in which the force exerted by a twisted thread or filament to recover its original position, is made the means of measuring small degrees of electrical and magnetical attraction. See ELECTRICITY, fig. 9. It has also been used in determining the mass and density of the earth. See EARTH.

TORSK, or, by corruption, TUSK (*Brosimus vulgaris*) a valuable fish of the family *Gadidæ* (q. v.), abundant in the northern parts of the Atlantic Ocean. The genus is characterized by a single long dorsal fin, and by having the vertical fins separate. The T. is from 18 inches to 2 feet, rarely 3 feet long; the head small, the body moderately elongated, one barbule under the chin, the dorsal and anal fins distinct from the tail, although separated from it by a very short interval; the tail rounded; the head dusky; the back and sides yellow, passing into white on the belly. It lives in deep



Torsk, or Tusk (*Brosimus vulgaris*),

water, approaching the land in shoals only at the spawning-time, which is very early in the year. It spawns among the sea-weed of the coast. It is caught in the same manner as cod, ling, &c.; and although rather firm and tough when fresh, is generally esteemed, when dried and salted, to be the best of stockfish. It is occasionally caught in the Firth of Forth, but belongs to more northern regions, and is very abundant in the Shetland Isles, the Faroes, on some parts of the coast of Norway, and on the south and west coasts of Iceland.

TO'RSO (Ital.), strictly, signifies a trunk, e. g., the trunk of a tree, but is specially applied to an ancient statue of which only the body remains. Of such imperfect relics of classic art, the most famous is the *Torso of Hercules*, a masterpiece of manly beauty, discovered in the Campo del Fiore at the beginning of the 16th c., and placed, by order of Pope Julius II., in the Vatican.

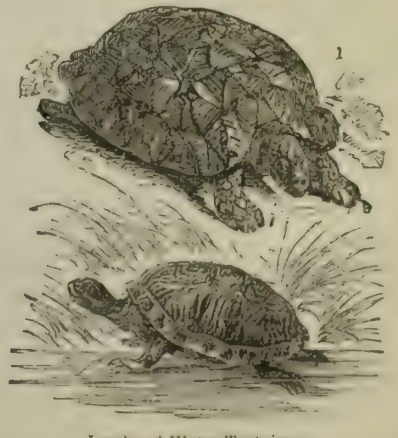
TORSTENSOHN, LEONARD, Count of Ortala, the most active, enterprising, and successful of the Swedish generals, who were engaged in the Thirty Years' War (q. v.), was born at Torstena, 17th August 1763, became one of the royal pages in 1618, and attended Gustavus Adolphus in most of his earlier campaigns. When Gustavus entered Germany in 1630, T. was captain of the body-guard; and the brilliant services he rendered at Preitenfeld, the Lech, and on other occasions, were rewarded with rapid promotion. Taken prisoner at the combat of Nuremberg (24th August 1632), he was subjected to rigorous treatment, which so ruined his health, that on his exchange six months after, he returned to his post in the Swedish army a confirmed invalid; yet a vigorous mind and energetic character so overmastered bodily infirmity, that though reduced to the necessity of being always conveyed in a litter, he proved himself a most able officer under Bernhard of Weimar and Baner, the successors of Gustavus. In 1641, on the death of his former chief, the able and chivalrous Baner, he was appointed to the command in chief of the Swedes in Germany. His military career was marked by a brilliancy of conception, fertility of resource, resolute daring, and above all, by an extraordinary rapidity of execution, which broadly distinguished it from those of his contemporaries, and set at naught all the precautionary and defensive measures of his opponents. Having recruited and equipped his army, he invaded Silesia, routed the Austrians at Glogau and Schweidnitz, reduced most of Moravia, and being pressed back into Saxony by the Archduke Leopold and Piccolomini, gallantly turned upon the multitude of his pursuers (2d November 1642), and on the field of Breitenfeld, where Tilly's reputation for invincibility was cast down in the dust by Gustavus, inflicted a bloody defeat on the same adversaries; he then resumed the execution of his plans of invasion, and laid Moravia and Austria under contribution. Ferdinand III., despairing of protecting his territories from T., negotiated with Christian IV. of Denmark to make a diversion by invading Sweden; but T., with characteristic promptitude, left Moravia in September 1643, traversed Saxony and the Upper Palatinate, burst into Holstein, and in less than six weeks subjugated the Danish mainland.

The Austrians under Gallas followed in pursuit of him, to aid their allies, but arrived too late; and in attempting to coop him up in Holstein, were routed, and driven into Saxony; and again totally defeated (23d November 1644) at Jüterbogk, in attempting to bar his return into Bohemia. Gallas was now deposed; but a combination of talented generals, as Montecuculi, Goertz, and others, was found to be equally ineffective against the resistless Swede, who, by a great victory at Yankovitz (14th February 1645), secured the navigation of the Danube, and the possession of the hereditary countries north of it. The emperor, empress, and principal nobility now deserted the capital; the Saxons again joined the Swedes, and the Danes, routed at sea as well as on land, besought peace, which was granted (13th August 1645). At this time, when a few more of T.'s weighty blows would have completely unseated the Hapsburg family, his gradually increasing ailments compelled him to resign the command to one very much his inferior, and retire to Sweden, where he experienced a most distinguished reception from Queen Christina, was created a count, and appointed to various high offices successively. He died at Stockholm, 7th April 1651.

TORT (Lat. *tortus*), in the law of England, includes all those wrongs for which a remedy by compensation or damages is given in a court of law, and which wrongs arise irrespective of any contract. Such are assaults, imprisonments, taking one's goods without title, injury to one's body or character. The general rule of law was, that the right of action for a tort died with the person who committed it; but this defect has been cured by statute to a certain extent. If the wrong was done within six months preceding the wrongdoer's death, an action may be brought against his executors within six months after they have assumed office. So if the injured party lived, he could always bring an action of damages; but if he died, his executors or relatives could not do so, until Lord Campbell's Act enabled the wife, husband, parent, or child of such deceased injured party to sue for damages; and in such case the jury may apportion the damages between the widow and children who sue. The right to bring an action for a tort is limited to two, four, or six years respectively, according to the nature of the wrong.—In Scotland, there is no time limited for bringing the action.

TORTEAU. See ROUNDLE.

TO'RTOISE (*Testudo*), a genus of Chelonian reptiles, which once included the whole order, but is now much restricted. The popular name T. is never given to the marine Chelonians, which



Land and Water Tortoises:
1, Common Land Tortoise (*Testudo Græca*); Lettered Tortoise (*Emys scripta*).

are called Turtles (q. v.), and although it is sometimes given—generally with a prefix, as Marsh T., River T., Fresh-water T.—to the kinds which inhabit fresh water (see EMYS and TERRAPIN)

yet when used by itself, it is commonly the designation of what are distinctively called Land Tortoises, which belong to the genus *Testudo* as now restricted, and the genera most nearly allied to it. In *Testudo*, the carapace is of a single piece, bulged, and soldered by the greater portion of its lateral edges to the *plastron* (see CHELONIA); the legs are very short; the toes are very short, and united to the nails, which are thick and conical, five on the fore-feet and four on the hind-feet. The species are numerous and widely distributed, inhabitants of the warmer temperate and of tropical countries. They all feed on vegetable food. None of them are found in Britain, but several in the countries around the Mediterranean. The most common of these is the GREEK T. (*T. Græca*), which attains a length of 12 inches, and has a broad and equally bulged carapace; the scales of which are granulated in the center, striated on the margins, and spotted or marbled with black and yellow. This is the species of an individual of which a most interesting account is given by White in his *Natural History of Selborne*. It lives to a very great age, 100 years or more, as probably do all the other species, and spends the winter in a dormant state, as do all those which are not inhabitants of tropical climates; selecting for itself a place of hybernation when cold weather begins to come on, or preparing it by scooping a hole in the earth. During the heat of summer, it feeds voraciously; but in colder weather, both before and after its hybernation, it eats little.

The love-season, which is in the beginning of summer, is one of great activity, and tortoises express their amorous desires by striking their shells against those of their mates. The Greek T. is used for food in some parts of the south of Europe. The flesh of all species of T. appears to be good for food, and the eggs of all are regarded as delicacies. A very large species is the Indian T. (*T. Indica*), if several species are not confounded under that name. It has been found on the coast of Coromandel, four feet and a half in length, its bulge being about fourteen inches. It is particularly abundant in the Galapago Islands, and has even been supposed by Darwin to be originally a native of them, and to have been diffused from them by the bucaneers over other tropical regions. It is known that the bucaneers often carried away tortoises alive from the Galapagos, but this fact does not seem probably to account for the abundance of the species in other places. The Galapago T. is often 200 lbs. in weight. Its flesh is of excellent quality, as are also its eggs. It forms tracks from the arid districts near the shore to the high districts of the islands, where there are springs for the purpose of drinking; and these tracks, which are broad and well beaten, are traversed apparently at irregular intervals, the animal swallowing a very large quantity of water at a time, so that its bladder is greatly distended, and the water contained in the bladder is at first almost pure, and is gradually absorbed. The numbers of tortoises in some tropical and subtropical countries are very great. Professor E. Forbes speaks with admiration of the numbers of *T. Græca* and *T. marginata* straying about the plains of Lycia, and browsing on the fresh herbage in spring. Darwin describes the tortoises of the Galapagos as very numerous; and Leguat, in his account of the French Protestant expedition to the island of Rodriguez, in the beginning of last century, declares that the tortoises often came out together in such numbers to feed, that a man might have walked for a considerable distance on their backs as on a pavement.

Tortoises exhibit very little intelligence; they are, however, capable of recognizing the hand that feeds them.

TORTOISE-SHELL, the large scales of the carapace, or shield, of a species of sea-turtle, the *Chelonia imbricata* and *Testudo imbricata* of several authors—*Caretta imbricata* of Dr. Gray. It is found in the Indian Ocean, Amboyna, New Guinea, Seychelles, Havanna, and the Red Sea. Tortoise-shell is so called because formerly the order of animals to which it belongs was little known, and all were confounded under the general name of Tortoises. A remarkable peculiarity in this species is the arrangement of the thirteen plates forming the carapace, which, instead of being joined together by their edges, so as to make apparently one piece, are thinned off at their edges, and overlap each other like the tiles of a roof. They vary in size according to the part of the shield they occupy. The larger are sometimes from a foot to 18 inches long, by 6 inches broad; the thickness rarely exceeds the eighth of an inch. The beautiful mottled color and semi-transparent characters of this material are well known. A remarkable quality is possessed by tortoise-shell, which very greatly increases its usefulness for the ornamental purposes to which it is generally applied—that is, its property of being easily softened by a heat equal to boiling water, and of retaining any form when cold which has been given to it when heated. Pieces can also be welded together by the pressure of hot irons properly applied. In Britain, the chief use of tortoise-shell is making combs for the hair; but it is also used for inlaying small pieces of ornamental furniture and various other fancy objects. In India, China, and Japan, its use is well understood, and some very beautiful articles are made of it, exhibiting great skill and taste. Great Britain alone consumes about 15½ tons, of the value of about £24,000.

TORTO'LA. See VIRGIN ISLANDS.

TORTO'NA (anc. *Antilia*, or *Dertona*), a town of Northern Italy, in the province of Alessandria, and situated on the right bank of the Scrivia (a small river which flows north to join the Po), and 13 miles east of Alessandria, with which it is connected by railway. Pop. (1871) 8620. The principal buildings are the *Duomo* and church of San Francisco. T. has manufactures of silk, leather, hats, &c. It was a notable place in the middle ages—the old walls, and the ruins of a castle in which Frederick Barbarossa lived, being a relic of those turbulent times.

TORTO'SA (anc. *Dertosa*), an old and fortified town of Spain, province of Tarragona, picturesquely situated on a sloping eminence overlooking the Ebro, from the mouth of which it is distant about 22 miles. The streets are narrow, and the place has altogether a dull look. Some inconsiderable manufactures are carried on, and the sturgeon and lamprey fisheries afford employment to considerable numbers. Pop. upwards of 20,000.

TORTU'GAS (Sp. Turtles), a group of ten islets or keys, also called the Dry Tortugas, belonging to the United States, at the entrance of the Gulf of Mexico, 120 miles west-south-west of Cape Sable, the southern point of Florida. They are low coral islets partly covered with mangrove bushes. There is a lighthouse on Bush Key; and on the same island stands Fort Jefferson, garrisoned by about 100 men. During the civil war, the fort was used as a penal station for Confederate prisoners.

TORTURE. Examination by torture, otherwise called 'The Question,' has been largely used in many countries as a judicial instrument for extracting evidence from unwilling witnesses, or confessions from accused persons. In ancient Athens, slaves were always examined by torture, and their evidence seems on this account to have been deemed more valuable than that of freemen. Any one might offer his own slave, or demand that of his opponent, to be examined by torture; and it was supposed to constitute a strong presumption against any one that he refused to give up his slave for that purpose. No free Athenian could be examined by torture, but torture seems occasionally to have been used in executing criminals. Under the Roman republic, only slaves could be tortured, and as a general rule, they could not be tortured to establish their masters' guilt. Under the Empire, torture, besides being much used in examining slaves, was occasionally inflicted even on freemen, to extract evidence of the crime of *læsa majestas*. Cicero and other enlightened Romans wholly condemned its use. Until the 13th c., torture seems to have been unknown to the canon law; about that period, the Roman treason-law began to be adapted to heresy as *crimen læsæ majestatis Divinæ*. A decree of Pope Innocent IV., in 1282, calling on civil magistrates to put persons accused of heresy to the torture, to elicit confessions against themselves and others, was probably the earliest instance of ecclesiastical sanction being adhibited to this mode of examination. At a later period, however, torture came to be largely employed by the inquisitors.

From the civil law, torture became a part of the legal system of most European countries. It was adopted early, and to a large extent, by the Italian municipalities. In Germany, elaborate apparatus for its infliction existed, not merely in the dungeons of the feudal castles, but in the vaults beneath the town-halls of Nürnberg and Ratisbon, where the various implements used are yet to be seen. It continued to be practiced in the prisons of Germany when they were visited by Howard in 1770. In France, it was part of the judicial system till 1789, and in Scotland it was still in frequent use after the Restoration, and was only abolished by 7 Anne, c. 21, s. 5.

The use of torture seems always to have been repugnant to the genius of the law of England: though occasionally used by an exercise of prerogative, it may be doubted whether it was ever recognized as lawful in the ordinary course of the administration of justice. The first instance we have of its use is in 1310, in aid of the ecclesiastical law, during the struggle between Pope Clement V. and the Templars. Edward II., when applied to to sanction the infliction of torture by the inquisitors in the case of certain Templars accused of heresy and apostasy, at first refused; but on a remonstrance by Clement, he referred the matter to the Council; and on the recommendation of the Council, the inquisitors were authorized to put the accused to the torture, but without mutilation or serious injury to the person, or effusion of blood. During the Tudor period, the Council assumed the power of directing torture-warrants to the lieutenant of the Tower, and other officers, against state prisoners, and occasionally also against persons accused of other serious crimes; and similar warrants were at times issued under the sign-manual. Under James I. and Charles I., torture was less resorted to, and only in state trials. In 1628, in the case of Felton, the assassin of the Duke of Buckingham, the judges declared the examination of the accused by

torture, for the purpose of discovering his accomplices, to be illegal. Torture was inflicted for the last time in England in May 1640. It is now disused in all countries of Europe, and is universally acknowledged to have been a most unsatisfactory mode of getting at the truth; often leading the innocent, from weakness of body, to plead guilty to crimes which he had not committed.

The instruments of judicial torture have been various. The most celebrated is the Rack, an oblong horizontal frame, on which the accused was stretched, while cords, attached to his legs and arms, were gradually strained by a lever or windlass, an operation which, when carried to extreme severity, dislocated the joints of the wrists and ankles. It is as old as the 2d c. in the south of Europe, but is said to have been unknown in England till introduced into the Tower by the Duke of Exeter, Constable of the Tower, whence it acquired the name of the 'Duke of Exeter's Daughter.' In Germany, the rack was sometimes furnished with a roller, armed with spikes, rounded off, over which the sufferer was drawn backwards and forwards. A vertical rack was also in use in that country. The person subjected to it was raised to the roof by a rope attached to his arms, which were bound behind his back; and two heavy stones having been attached to his feet, the rope was loosened so as to let him fall with a jerk to within a few inches of the ground. Among the lesser tortures may be mentioned the Thumbikins, Boots, Pincers, and Manacles; and in England, an instrument called the Scavenger's (properly Skeffington's) Daughter, the invention of Sir W. Skeffington, lieutenant at the Tower in the reign of Henry VIII.

TO'RULA CEREVI'SIÆ, or the YEAST-PLANT, is one of those fungi which are connected with the process of fermentation. The general history of this fungus will be noticed in the article YEAST, and we shall here only refer to the medicinal bearing of this subject. This plant, which is also known under the names of *Saccharomyces, Mycoderma cerevisiæ*, and *Cryptococcus fermentum*, may be readily observed by examining a little yeast under the microscope, when it will be seen in the form of round or oval corpuscles (cells), varying in diameter from the 800th to the 400th of a line, and many having smaller corpuscles in their interior. They grow by protusion of gemmules, and germinate sometimes on one, and sometimes on several spots of the primitive fungus cells. These shoots throwing off new gemmules, the yeast-plant gradually forms single or branching rows of oblong cells, connected together like beads. This peculiar arrangement of the cells, and the fact that they are not acted on by acetic acid, is characteristic of the plant.

The Yeast-plant, taken from a fluid ejected in large quantities from the stomach of a man suffering from stricture of the pylorus. Magnified 200 diameters.

In those cells marked ×, a young cell is seen growing in the interior; while in the large cell marked × ×, there is a simultaneous internal production and external gemmation of cells.

This fungus exists in the saccharine urine of *diabetis mellitus*, after it has been discharged for 24 hours or longer, and its appearance in urine within a day or two is sufficient to lead to the suspicion of the presence of sugar. It likewise is of not unfrequent occurrence in vomited matters and in fæcal evacuations; and wherever it is found, it is indicative that the fluid is in a state of saccharine fermentation.

As fungi more or less closely resembling the yeast-plant often occur in non-saccharine urine that has stood for some days, the assumed presence of the T. C. must not be taken as a proof of the presence of sugar, although it affords a strong hint for testing for that substance.

TO'RUS, the convex member of the base of classic columns. See COLUMN.

TOSHACH (Celtic, captain, the name which was given among Celtic nations to the military leader of a clan or tribe, whose functions were in early times always separated from those of the supreme judicial officer. When the office of toshach, originally elective, became hereditary, according to the principle of divided authority characteristic of Celtic communities, it remained permanently in the eldest cadet of the clan. See TANISTRY.

TO'TEM. The ruder races of men are found divided into tribes, each of which is usually named after some animal, vegetable, or thing which is an object of veneration or worship to the tribe. This animal, vegetable, or thing is the *totem* or *god* of the tribe. From the tribe being commonly named after its totem, the word is also frequently employed to signify merely the tribal name. Numerous tribes with totems exist in America, in Australia, the South Pacific Islands, and in Central Asia; and there are some reasons for thinking that such tribes were once numerous even in Europe among races belonging to what is called the Indo-European division of the human family.

Among the Red Indians of America, the following are totems of tribes existing or known to have existed: the Wolf, Bear, Beaver, Turtle, Deer, Snipe, Heron, Hawk, Crane, Duck, Loon, Turkey, Musk-rat, Sable, Pike, Cat-fish, Sturgeon, Carp, Buffalo, Elk, Reindeer, Eagle, Hare, Rabbit, and Snake; the Reed-grass, Sand, Water, Rock, and Tobacco-plant. Among the tribes of native Australians, the totems are similarly, for the most part, selected from the fauna of the country. The totems of the Kirghiz tribes of Central Asia are all of them animals to which (in explanation of their reverence for them) the tribes trace back their descent.

It has been suggested that the explanation of the crests and emblems of the now disrupted tribes and clans of our own country, and of Europe generally, is to be found in the supposition, that the creature or thing on the crest was originally the totem of the clan or tribe. On this supposition, the widespread clan Chattan or Cattan, for instance, which is represented in the Scotch Highlands, and can be traced in France, Germany, and Egypt, would fall to be recognized as the *Cat* tribe, the cat having once been its *totem*, as it is still its crest or emblem. It has also been thrown out, that many of the mythical traditions of ancient Greece admit of a reasonable meaning, if we suppose that there were anciently in Greece tribes with *totems*—bull, boar, and lion tribes; snake, ant, and dragon tribes. These suggestions have not yet been put to the test of a thorough investigation; but so far as inquiry has gone, the results are in favor of the conclusions to which they point as to the early condition of human tribes all over the world. A single instance may be given of success in tracing back a totem to old times and in widely separated countries. There are numerous existing Snake tribes both in America and the South Sea Islands, and there is something like *proof* that the snake was the totem of very many and powerful ancient races. Its worship can be traced among Semitic races; there are traces of it in the traditions of the Pelasgi; there are proofs of it among the Celts; and the most magnificent ecclesiastical architecture in the world is that of the Nagas—the serpent-worshipers of Cambodia—still existing, and only recently brought to light. We may believe that, in the period of primitive animal-worship, when the serpent was a creature of so much importance, other animals also had their worshipers, and that snake-tribes were not the only tribes with animal totems in those times, any more than they are among existing primitive peoples. See *Cambrian Journal*. vol. iii., 2d series, p. 149; *Grey's Journals*, vol. ii. chap. xi.; Mitchell's *Russians in Central Asia;* Latham's *Descriptive Ethnology;* Sydenham's *Baal Durstrigensis;* and foot-note to *Kinship in Ancient Greece*, by J. F. M'Lennan; *The Origin of Primitive Superstitions*, by R. M. Dorman (Philadelphia, 1881).

TOTIPA'LMÆ, Cuvier's name for a group of birds of the order *Palmipedes*, having the hind-toe connected with the other toes by a web. Pelicans, cormorants, frigate-birds, gannets, and darters belong to this group. All the T. are marine; they feed on fishes, molluscs, and other marine animals, and are excellent swimmers and divers. Many of them have long wings, and are birds of powerful flight.

TOTNES, or TOTNESS, a municipal borough and market-town of Devonshire, pleasantly situated on the slope of a steep hill, on the right bank of the river Dart, about 10 miles from its mouth. It is a place of great antiquity, has an interesting church of the 15th c., and some curious antique houses; the ruined keep of the ancient castle, on the summit of the hill, is said to have been built by Joel de Totneis, a Norman baron, on whom the manor was bestowed at the Conquest, and who founded here also a Cluniac priory. The river Dart is navigable for vessels of 200 tons up to the town, which is a place of some little shipping trade. The borough formerly returned two members to parliament, but was disfranchised for corrupt practices at elections by the Reform Bill of 1867. Steamers ply during the summer months between T. and Dartmouth. It is a station on the South Devon Railway. Pop. (1871) 4073; (1881) 4089.

TOU'CAN (*Ramphastos*), a Linnæan genus of birds, now forming the family *Ramphastidæ*, which belongs to the order *Scansores*, and contains nearly forty known species, all natives of tropical America, and remarkable for the magnitude of the bill. They are divided into two groups, the true Toucans (*Ramphastos*), and the Aracaris (q. v.) (*Pteroglossus*), of which the latter contains the greater number of species: the former has the largest bill, and the tail is shorter. There is a difference also in the prevalent colors, the aracaris generally exhibiting much green and yellow, whilst the true toucans have the ground color of the plumage usually black; the throat, breast, and rump often gaily adorned with white, yellow, and red. The colors, however, are not in general finely blended, but appear in strong contrast. The legs of toucans are short; the feet have two toes before and two behind. The form of the body is short and thick; the tail is rounded or even, varying in length in the different species from half the length to almost the whole length of the body, and is capable of being turned up over the body in a remarkable manner, which it

always is when the bird is at roost. The neck is short and thick; the enormous bill is at the base of the full width and depth of the head, and is in some species more than half the length of the body. It is arched towards the tip, irregularly toothed along the margins of the mandibles, and extremely cellular and light, yet strong in structure. The tongue is very long, narrow, and singularly feathered on each side, the processes which give it this feathered appearance probably adding much to its sensibility as an organ of taste. When a T. takes food between the points of the mandibles, the tongue is immediately applied to it, as if to test or enjoy it, and afterwards it is tossed into the throat by a sudden throwing back of the head.

Toucans may almost be described as omnivorous; they eat fruits with avidity, but they also seize and devour small birds. Their powerful bill enables them to kill a small bird by a single squeeze. They make a curious clattering noise with their great mandibles, and also emit at times a harsh cry. They live chiefly in the depths of the South American forests, in small flocks. They are easily tamed, and bear cold climates well. In captivity, they readily eat rice, bread, potatoes, eggs, and many other kinds of food. They are remarkable amongst birds for regurgitation of food, in order to a kind of mastication in the great bill, analogous to rumination in quadrupeds. The colors of the bill are, in most of the species, very brilliant during life, but disappear from stuffed specimens in museums. The largest species, as *Ramphastos Toco*, are about two feet in length. The *R. Tucanus* is the yellow-breasted T.; the *R. Ariel* is the commonest species.

TOUCH is the sense through which we take cognizance of the palpable properties of bodies. It is used in two senses. In its extended acceptation it implies, says Dr. Carpenter, 'our consciousness of *all* those sensory impressions which are neither olfactive, visual, auditory, nor gustative; and it is therefore designated as the *general sense*, in contradistinction to those which are considered as *special senses*. In its limited application, on the other hand, it is used to designate that modification of the general sensibility which is restricted to the tegumentary surface, or to some special portion of it, and which serves to excite definite ideas in our minds respecting the form, size, number, configuration, weight, temperature, hardness, softness, &c. of objects brought within its cognizance.'—Article 'Touch,' in *Cyclopædia of Anatomy and Physiology*, vol. iv. p. 1163. In the article SENSIBILITY, we have briefly noticed touch in its general sense; and we shall here confine ourselves to the investigation of the sense of touch in its limited application, as exercised by the organs specially adapted for the reception of tactile impressions.

The special organs of touch are the papillæ, which are figured and very briefly noticed in the article SKIN. These papillæ are more elevated and numerous on the palmar surface of the ends of the fingers than on any other part of the skin (although they are still larger on the tongue). They have an average length in man of $\frac{1}{100}$th of an inch. Their surface, after the removal of the epidermis, appears, from the investigations of Todd and Bowman, to be composed of the basement membrane of the cutis itself; and their interior is composed of fibrous tissue, vessels, and nerves, as is seen in the figures of the lingual papillæ given in the article TASTE, SENSE OF. In each papilla is a small arterial twig, which, entering at the base, subdivides into capillary vessels, which form loops, whose convexity lies in the papillary summit. The vascularity of the papillæ is so great, that their presence and relative size may be determined simply by the depth of the color imparted to the skin by a good injection of its vessels. Hence, as a general rule, the vascularity of the integument is proportioned to its perfection as an organ of touch. With regard to the mode in which the nerves terminate, there is still considerable doubt. According to Todd and Bowman, it is often impossible to detect any nerves at all within the papillæ, when such were plainly visible at their base; and they incline to the belief, that the nervous tubules either entirely, or in a great measure, lose the white substance when within the papillæ.

In the lower animals, as in man, the papillæ are especially developed in those parts of the outer surface which are especially endowed with tactile sensibility. For the following illustrations of this statement, drawn from comparative anatomy, we are indebted to Dr. Carpenter: 'In the quadrumana generally, both the hands and feet are thickly set with papillæ; and in those which have a prehensile tail, the surface of this organ possesses them in abundance. In the carnivorous and herbivorous mammalia, whose extremities are furnished with claws, or encased in hoofs, we find the lips and the parts surrounding the nostrils to be the chief seat of tactile sensibility, and to be copiously furnished with papillæ; this is especially the case with those which have the lips or nostrils prolonged into a snout or proboscis—as in the pig, the rhinoceros, the tapir, and the elephant.

'In the mole, too, the papillary structure is remarkably developed at the extremity of the snout. The only part of the skin of birds on which tactile papillæ have been discovered is on the under surface of the toes, and on the web of the palmipedes, where they obviously receive impressions which guide the prehensile and other movements of the feet. In many lizards, a papillary structure is found on the under surface of the toes; and in the chameleon, it exists also on the integument of its prehensile tail..... In serpents and chelonians (tortoises), no papillary apparatus has as yet been detected; and in fishes and invertebrata, its presence has not been ascertained, although it would appear that certain parts, especially the tentacles around the mouth, are endowed with a high degree of tactile sensibilty.'—*Op. cit.*, p. 1166. It is probable that in all animals which have a soft fleshy tongue furnished with papillæ, this organ is an instrument of tactile sensibility as well as the organ of taste. Besides the papillary apparatus, certain animals have special organs of touch, constructed on a totally different plan, and 'consisting of a rod or filament, which is in itself insensible, but which is connected at its base with nervous fibres in such a manner that any motion or vibration communicated to it must be transmitted to them.' The so-called 'whiskers' of the cats and certain rodents, as the hare and rabbit, belong to this class; and it has been proved, experimentally, that if they be cut off, the animal loses, to a great extent, its power of guiding its movements in the dark.

Amongst the conditions necessary for the exercise of the sense of touch are (1) a normal condition of the papillary apparatus and of the nerves supplying it; (2) a due supply of blood to the tactile organs; and (3), as has been noticed in the article TASTE, a temperature not too far removed from the natural heat of the body. It has been shown by Professor Weber, that if the fingers or the lips be immersed for half a minute or a minute in water heated to 125°, or cooled to 32°, the power of distinguishing between a hot or cold fluid or solid body is for the time completely lost, a feeling of pain alone being experienced. The result was the same on applying cold to the trunk of a nerve, the ulnar nerve at the elbow, where it lies just beneath the skin, being selected for the experiment. The fingers supplied by this nerve soon lost the power of distinguishing between heat and cold, and could only imperfectly perceive the contact and pressure of bodies.

The above named physiologist has made a large number of experiments on the general subject of Touch. His investigations regarding the tactile discrimination in different parts of the skin have been noticed in the article SENSIBILITY. Professor Valentin, whose results, on the whole, correspond very closely with those of Weber, found, however, a considerable extent of individual variation, some persons being able to distinguish the separate compass-points at half, or even one-third of the distances required by others.

There is no sense which is so capable of improvement as that of touch. Of this power of improving the delicacy of touch, says Dr. Carpenter, 'we have examples in the case of certain artisans, whose employments require them to cultivate their tactile discrimination; thus, the female silk-throwsters of Bengal are said to be able to distinguish by the touch alone *twenty* different degrees of fineness in the unwound cocoons, which are sorted accordingly; and the Indian muslin-weaver contrives by the delicacy of his touch to make the finest cambric in a loom of such simple construction that European fingers could at best propose to make a piece of canvas at it.' The highest degree of tactile sensibility is met with in blind persons—a circumstance which is to be attributed for the most part to the concentration of the attention and of the powers of recollection and comparison which are brought to bear upon the mind; and probably to some extent to an increased development of the tactile organs themselves, resulting, as the above-named physiologist suggests, 'from that augmented nutrition which would be the natural consequence of the frequent use of them, and of the increased flow of blood that seems to take place towards any part on which the attention is constantly fixed.' —For much interesting information on this subject the reader is referred to Dr. Kitto's *Lost Senses*, in which cases, apparently quite authentic, are given of blind persons being able to distinguish colors by the touch.

TOUCH-HOLE, or VENT. See GUN.

TOUCH-PAPER. See NITRE.

TOUCH-STONE, a hard black stone, occasionally used in assaying. The best kind is a peculiar bituminous quartz obtained from Lydia, in Asia Minor; but black basalt may be employed. The process is as follows: A series of 'needles' or small bars are formed, the first consisting of pure gold; the second, of 23 of gold and 1 of copper; the third, of 22 of gold and 2 of copper, and so on. The assayer selects one of these alloys, or 'needles,' which, from its color, he judges to approach nearest in composition to the alloy which he is about to assay. This he rubs on the stone, and the streak which it leaves is red in proportion to the copper that is present. The streak formed by the alloy to be assayed is then compared with that formed by the various 'needles,' and corresponding streaks indicate corresponding amounts of copper.

Hence, an approximate estimate of the amount of copper in an alloy can be made.—See Miller's *Inorganic Chemistry*, 2d ed., p. 739, *note*.

TOUCH-WOOD is the wood of willows and some other trees softened by decay. It is used as tinder for obtaining fire, from the readiness with which a spark ignites it.

TOUL, a fortified town of France, dep. of Meurthe-et-Moselle. On Sept. 23, 1870, this fortress surrendered to the Germans after a bombardment of three days' duration. It has an old cathedral, which took more than five centuries to finish (965—1496), and which is reckoned one of the most splendid in France. Cotton, woollen, lace, and fayence manufactures are carried on. Pop. (1876) 9566.

TOU'LA, or TULA, one of the governments of Great Russia, bounded on the N. by the government of Moscow. Area, 11,909 sq. m.; pop. (1880) 1,279,715. The surface is for the most part level; the climate is temperate; the soil, fertile. The Oka is the only river which is navigable throughout the government, and the other streams are tributaries either of the Oka or the Don. The surface is in general dry, there being no lakes or marsh-lands, and forests are rare. The inhabitants are occupied chiefly in agriculture, cattle-breeding, the manufacture of pottery, fishing, and the working of iron mines.

TOULA, or TULA, an important manufacturing town of Great Russia, capital of the government of the same name, on the Upa, an affluent of the Oka, 110 miles south of Moscow. Its 28 churches, its arsenal, theater, industrial museum, cathedral, and the ancient Kreml are the principal buildings. T. is an ancient town, and has suffered severely from Tartar invasion, and during the wars of the commencement of the 17th century. Iron-works founded here under Czar Alexis Michailovitch have acquired a well-merited reputation. The Russian army is largely supplied with muskets and small-arms from the works of this town. Cutlery, locks, tea-urns, and bells are made in great perfection; and bristles are prepared in large quantities both for home consumption and export. Pop. (1880) 57,400.

TOULON, a great seaport and naval arsenal of France, in the dep. of Var, stands on the shore of the Mediterranean, 37 miles south-east of Marseille, with which it is connected by railway. It stands at the head of a deeply penetrating inlet or gulf, rises in the form of an amphitheater towards the north, where its ramparts extend to the foot of a chain of lofty elevations, in part clothed with beautiful forests. The port is divided into two parts, the old and the new; the former, on the east, appropriated to merchant-vessels, and bordered by a quay; the latter, on the west, surrounded by the dockyard, slips, arsenal, store-houses, cannon-foundry, &c. Numerous forts defend the town on the land-side; and the mouth of the harbor, and the hills commanding it, are studded with forts and redoubts; while moles, hollow and bomb-proof, and formed externally into batteries, level with the water's edge, separate the roadstead from the old and new ports. Belonging to the arsenal, which is perhaps the finest in France, the chief objects of attraction are the sail-yard, the armory, the museum, the magazine, and the basin for the repair of ships. The fortifications of the town have been greatly extended since the conquest of Algeria, T. having become the chief port of communication with Africa. The population has also greatly increased, and two new suburbs have been constructed. The town is surrounded by a double rampart, and by a wide and deep fosse. The streets are straight and wide; and, on the whole, the town is both agreeable and healthy. This town is the Plymouth of France; and its industry consists, for the most part, of those manufactures to which its position as a great naval arsenal gives rise. Pop. (1881) 69,474.

T. was destroyed by the Saracens in 889, and again by the Saracens about the close of the 12th century. It is only at the end of the 16th c. that T. comes to be important as a naval and military stronghold. It was taken by the English and Spaniards in 1793; but the allies were obliged to evacuate the town in December of the same year, after being fiercely attacked by the Republicans, whose guns were commanded by Napoleon—then a simple officer of artillery—who here evinced for the first time his genius and self-reliance.

TOULOUSE (anc. *Tolosa*), an important city in the south of France, capital of the dep. of the Haute-Garonne, is situated in a broad and pleasant plain, on the right bank of the river Garonne, 160 miles by railway south-east of Bordeaux. Pop. (1881) 136,627. The *Canal du Midi* sweeps round its eastern and northern sides. The Garonne is here crossed by a beautiful bridge upwards of 810 feet in length, and 72 broad, which connects T. with the suburb of St. Cyprien. The city, with the exception of the southern faubourg, is not particularly handsome (though the broad quays have rather an imposing appearance), and there are few fine public buildings. One may note, however, the cathedral, containing the tombs of the counts of Toulouse; the *Capitole*, or town-hall; the church of St. Sernin (1090 A.D.); the Musée, with its interesting collection of antiquities, forming an almost uninterrupted chain in the history of art, from the Gallo-Roman to the Renaissance period. T. is the seat of an archbishop, has a university academy, an academy of 'floral games' (*Société des Jeux Floraux*), pretending to derive its origin from the contests of the ancient troubadours, academies of arts, sciences, antiquities, &c., schools of law, and medicine, and artillery, a national college, an observatory, a museum, botanic garden, and a public library of 50,000 volumes. T. manufactures woollens, silks, leather, cannon, steam-engines, tobacco, brandy, &c., and carries on a great trade with Spain. Its duck-liver and truffle pies are celebrated throughout the south of France.

History.—Tolosa was, in Cæsar's time, a city within the limits of the Roman *Provincia*, and had been originally the capital of the Volcæ Tectosages, a Gallic tribe noted for its wealth and consequence. Under the empire its importance continued. Ausonius describes it as surrounded by a brick wall of great circuit, and so populous that it had founded four colonies. In 412 A.D., the Visigoths made it the capital of their kingdom; and after the time of Charlemagne, it was under the sway of counts, who made themselves independent about 920, but in 1271 the 'county of T.' was reunited to the crown of France by Philippe *le Hardi*. Its literary celebrity reaches as far back as the Roman Empire. Ausonius speaks of the *toga docta* of 'Palladian' Tolosa, and the favorite deities of the city were Jupiter, Minerva, and Apollo. At a little village close by, which still bears the name of *Viel Toulouse*, a multitude of cinerary urns, statuettes, Phœnician, Celtiberian, Gallic, Greek, and Roman medals, fragments of buildings, and an entire paved street have been discovered. Early in the middle ages, under the Counts of T. it became a seat of Provençal poetry, and was the center of the papal crusade against the Albigenses, conducted by Simon de Montfort. The parliament of T. had also a great reputation, but unhappily it is likely to be best remembered by one of its most iniquitous decisions, that delivered in the case of the Calais (q. v.) family.

TOURAINE, one of the former provinces of France, of which the capital was Tours (q. v.), and which was bounded on the N. by the province of Orleannais, on the E. by Berri, on the S. by Poitou, and on the W. by Anjou. It was about 60 miles in length, and nearly the same number of miles in breadth, and it appears on the map now as the department of Indre-et-Loire.

TOURCOING, a frontier town of France, dep. of Nord, 7½ miles north-east of Lille, is built on an eminence in the midst of a fertile territory. It has a great reputation for its manufacture of linen-cloths, and also carries on sugar-refining, distilling, and manufactures of soap, colors, &c. Pop. (1876) 33,013 (1881) 50,268.

TOU'RMALINE, a mineral ranked amongst Gems (q. v.), and occurring in primitive rocks in many parts of the world. Its chemical composition is very complex and somewhat various, but the chief constituents are always silica and alumina in about equal proportions, and forming about three-fourths of the whole; the remainder consisting of boracic acid, fluorine, phosphoric acid, peroxide of iron, peroxide of manganese, protoxide of iron, magnesia, lime, soda, potash, and lithia, which are not, however, all present in any specimen. T. is harder than quartz, but not so hard as topaz or emerald. Its specific gravity is a little more than 3. It occurs in crystals, or massive and disseminated, although always crystalline. Its lustre is vitreous. Some varieties are transparent, some translucent, some opaque. Some are colorless, some green, brown, red, blue, and black. Red T. is known as *Rubellite;* Blue T., as *Indicollite;* and Black T., as *Schorl*. This last is the most common kind. T. crystallizes in prisms, with 3, 4, or 9 sides, variously acuminated. The sides of the prisms are striated. The finest tourmalines are much valued by jewelers, but are comparatively rare. They mostly come from Ceylon, Siberia, and Brazil. Tourmalines are found in several parts of Britain. Very large crystals abound in the granite of Aberdeenshire.

TOU'RNAMENT (Fr. *tournoi*, from *tournoyer*, to turn round), a military sport of the middle ages, in which combatants engaged one another with the object of exhibiting their courage, prowess, and skill in the use of arms. The invention of the tournament has been ascribed to Geoffroy de Prenilly, ancestor of the Counts of Anjou, who lived in the 10th c.: France was its earliest *locale*, whence it spread first to Germany and England, and afterwards to the south of Europe. A tournament was usually held on the invitation of some prince, who sent a king-of-arms or herald through his own dominions and to foreign courts signifying his intention of holding a tournament and a clashing of swords in presence of ladies and damsels. The intending combatants hung up their armorial shields on the trees, tents, and pavilions round the arena for inspection, to show that they were worthy candidates for the honor of contending in the lists in respect of noble birth, military prowess, and unspotted character. The combat took place on horseback, or at least was always begun on horseback, though the

combatants who had been dismounted frequently continued it on foot. The usual arms were blunted lances or swords; but the ordinary arms of warfare, called arms *à l'outrance*, were sometimes used by cavaliers who were ambitious of special distinction. Tournaments were the subject of minute regulations, which in some degree diminished their danger. The prize was bestowed by the lady of the tournament on the knight to whom it had been adjudged, he reverently approaching her, and saluting her and her two attendants. The period when tournaments were most in vogue comprised the 12th, 13th, and 14th centuries; and the place where the most celebrated English tournaments were held was the tilt-yard near St. James's, Smithfield, London. The church at first discountenanced tournaments, some of its decrees prohibiting persons from engaging in them under pain of excommunication, and denying Christian burial to a combatant who lost his life in one. The church seems, however, to have looked with more favor on these combats after the middle of the 13th century.

During the 15th and 16th centuries, tournaments continued to be held, but the alteration in the social life and warfare of Europe had changed their character, and they are rather to be regarded as state pageants than as real combats. The death of Henry II. of France, in 1559, consequent on the loss of his eye at a tournament, led to their general abandonment, both in France and elsewhere, and there have been few attempts to revive them even as mere spectacles. A magnificent entertainment, consisting of a representation of the old tournament, was given at Eglinton Castle in 1839, by the late Earl of Eglinton: Lady Seymour was the Queen of Beauty, and many of the visitors enacted the part of ancient knights; among them Prince Louis Bonaparte, afterwards Napoleon III.—According to Ducange, the difference between a tournament and a JOUST, is that the latter is a single combat, while in the former a troop of combatants encounter each other on either side. But this distinction has not been always observed.

TOURNAY (Flemish, *Doornik*), a fortified town of Belgium, province of Hainault, on both sides of the Scheldt, near the French frontier. It has a splendid cathedral with five towers (and pictures by Jordaens, Rubens, Gallait, &c.), several fine churches, particularly St. Quentin and St. Jacques, a gallery of art, an episcopal seminary, five hospitals, and a lunatic asylum. Although one of the oldest towns in Belgium, it has quite a modern appearance, with fine suburbs and beautiful broad streets. The chief manufactures are hosiery, linen, carpets, and porcelain; but there are few large workshops, most of the fabrics being executed by the people in their own houses. Pop. (1880) 32,566. A little to the south-east lies the famous village of Fontenoy (q. v.).

T., the ancient *Tornacum* or *Turris Nerviorum* ('Fort of the Nervii'), was in the 5th and beginning of the 6th centuries the seat of the Merovingian kings, subsequently belonged to France, but at the Peace of Madrid was included in the Spanish Netherlands. Subsequently, it was oftener than once taken by France, but again restored by treaty. During the month of May 1794, it was the scene of several hotly-contested fights between the French and Austro-English armies, the most important of which was that of the 19th May, in which Pichegru beat the Duke of York.

TOURNEFORT, JOSEPH PITTON DE, one of the greatest botanists of the 17th c., born at Aix, in Provence, in 1656. He exhibited an ardent love of botany from his youth, and devoted his whole life to this science. After having explored the flora of his native district, he was sent, at the king's expense, to Spain, Portugal, England, and Holland, and afterwards to the East. He visited the Grecian Archipelago and Thrace, the shores of the Black Sea, and Asia Minor, and added a great number of species to the list of known plants. He lost his life in 1708, in consequence of a carriage running against him in Paris. He published several botanical works, and a *Voyage to the Levant*. His botanical system, which maintained its ground till the time of Linnæus, was of great use in promoting the progress of botany; but he rendered still greater service to his favorite science by grouping plants in genera. He was the first to do so. Previous botanists had merely described them individually, as species.

TOU'RNIQUET, an instrument for compressing the main artery of the thigh or arm, either for the purpose of preventing too great a loss of blood in amputation, or to check dangerous hæmorrhage from accidental wounds, or to stop the circulation through an aneurism.

The common tourniquet consists of three parts—viz., (1) a pad to compress the artery; (2) a strong band which is buckled round the limb; and (3) a bridge-like contrivance over which the band passes, with a screw whose action raises the bridge and consequently tightens the band. The best kind of pad is a small firm roller about an inch thick; it must be placed lengthways over the main artery so as to compress it against the bone, and must be secured in its place by a turn of bandage, over which the band of the tourniquet must be applied. This band must first be tightly buckled, and the pressure must be then increased to the necessary extent (namely, till the beating of the artery beyond the instrument ceases to be perceptible) by the action of the screw, which should always be opposite the buckle of the band. As the instrument arrests the venous blood, it should never be applied tightly in cases of amputation, until the surgeon is ready to make his incision, as otherwise there would an excessive loss of venous blood.

Common Tourniquet.

The credit of the invention of this most useful instrument is usually ascribed to the French surgeon Morel, who, in 1674, used a stick passed beneath a fillet, and turned round so as to twist it up to the requisite degree of tightness, as a means of preventing the undue loss of arterial blood in amputations of the limbs—a rough, but by no means ineffectual form of tourniquet, which may often be usefully extemporized in cases of emergency at the present time. Mr. Young of Plymouth, in 1679, described a similar apparatus. A much improved screw tourniquet was invented by Petit early in the following century.

TOUROUKCHA'NSK, a small town of East Siberia, in the government of Yeneseisk, stands on the Yenesei, 4122 miles east of St. Petersburg, and only 50 miles south of the Arctic circle. Pop. (1880) 300, who trade in furs.

TOURS, a city of France, capital of the dep. of Indre-et-Loire, and formerly capital of Touraine, stands in the midst of a fertile but flat valley, 146 miles by railway south-west of Paris. Along its north side runs the Loire, and along its south side the Cher—these two rivers uniting about 25 miles south-west of the city, between which and their point of confluence only a very narrow strip of land separates them. The bridge over the Loire, which continues the great highway from Paris south to Bordeaux, is upwards of 1400 feet long. The cathedral is a stately Gothic edifice. Surrounding the choir—begun in 1170—there is beautiful old painted glass. The Tour de St. Martin or d'Horloge, and the Tour de Charlemagne, are noteworthy as being the only remains of the cathedral founded by St. Martin in the 4th century. The church was pillaged by the Huguenots, and utterly destroyed, with the exception of the two towers mentioned, at the Revolution. T. has a town-hall and a museum. A little to the west of T. are the remains of Plessis les Tours, in which Louis XI. died in 1483. Manufactures of silk stuffs, carpets, painted glass, and pottery are carried on. Pop. (1881) 52,510.

T., the ancient *Cæsarodunum*, dates from the time of the Gauls, and was visited by Cæsar and by Adrian. Here Clovis, having come to thank St. Martin for the victory of Vouillé, received the crown of gold and the purple robe presented to him by the Emperor Anastasius. Henry IV. planted the first mulberry-trees known in France here, and here the first silk-factories were established. Under Richelieu, 40,000 hands were employed at T. in this branch of manufacture; but the industry of the town was ruined by the revocation of the Edict of Nantes. In the Franco-German war of 1870—71, T. was for a time the seat of the French Provisional Government, and was occupied by the German troops.

TOURVILLE, ANNE HILARION DE COTENTIN, COUNT DE, third son of César de Cotentin, seigneur de Tourville, was born at Tourville in 1642. Entering the French navy when about eighteen, it seems that his somewhat delicate and effeminate appearance caused him to be regarded as anything but a hopeful seaman. He became, however, almost immediately conspicuous for bravery and enterprise; and the first six years of his naval service, directed against the Turks and Algerians, established his reputation both in France and in the south of Europe. In 1667, he was received at Versailles with great distinction by Louis XIV. In

1669, he distinguished himself in the expedition sent by France to the relief of Candia, then besieged by the Turks; and again in 1671—1672, in the naval war waged by the combined fleets of France and England against the Dutch. In 1682, he was made lieutenant-general of the navy, and for the following two or three years he was engaged in suppressing the pirates of Algiers and Tripoli. In the war which broke out after the English revolution of 1688, between France on the one part, and England and Holland on the other, T. was put at the head of the French navy. In June 1690, he entered the English Channel at the head of a powerful fleet, and inflicted a disastrous and ignominious defeat on the united English and Dutch armament near Beachy Head. 'There has scarcely ever been so sad a day in London,' says Macaulay, 'as that on which the news of the battle of Beachy Head arrived.' T. ranged the Channel unopposed; and on 22d July his fleet cast anchor in Torbay (see Macaulay, *History of England*, vol. iii. p. 652—654, ed. 1855). In 1692, Louis XIV. having resolved to invade England on behalf of James II., an immense fleet was assembled at Brest under T., in order to protect the descent. On the 16th May of this year the French fleet was described from the cliffs of Portland, and on the following morning the English and Dutch force stood out to give battle. From the morning of the 19th to the afternoon of the 24th, raged one of the greatest naval battles of modern times, that of Cape La Hogue. It ended in the complete defeat of the French, 16 of their men-of-war being utterly destroyed.

In spite of this disaster T. was graciously received at Versailles: 'We have been beaten,' said Louis to him, 'but your honor and that of the nation are unsullied' (see *Memoirs of St. Simon*). On 27th March 1693, T. was made a Marshal of France. Sailing from Brest harbor in the spring of this year, he attacked an English merchant fleet under inadequate convoy, and succeeded in inflicting a damage on English traders estimated at some millions sterling. Sir George Rooke, who commanded the convoy, had some difficulty in saving his own squadron from destruction. This was the last exploit of the great French admiral; his career ending with the peace of Ryswick in 1697. He died at Paris, 28th May 1701. It has been said of T. that he was competent to fill any place on board ship, from that of carpenter to that of admiral. It has also been said of him, that to the dauntless courage of a sailor he united the suavity and urbanity of an accomplished gentleman. But though a brave man, he was, during the earlier part of his career, a timid commander. Reckless of his life, he was often pusillanimously cautious where his professional reputation was at stake. Latterly, stung by the censures drawn on him by his natural disposition, he became bold even to rashness.

TOUS-LES-MOIS, a starch made in the West Indies, from the roots of a species of canna (see INDIAN SHOT); it is used as a substitute for arrow-root.

TOUSSAINT, ANNA LOUISA GERTRUDE, one of the most popular living Dutch novelists, was born at Alkmaar, September 16, 1812, where her father, a highly esteemed lecturer on chemistry, died in 1859. After the revocation of the Edict of Nantes, her paternal ancestors fled from France, and took refuge, first at Hanau, and later in Friesland, where they ranked among the nobility, but were reduced in circumstances during the French usurpation. By the mother's side, she is also of a refugee family of the name of Rocquette, belonging to the higher class of merchants and manufacturers. Her first work, *Almagro*, published in 1837, was well received, and translated into German.

Speedily followed *De Graaf van Devonshire*, an episode in the early life of Elizabeth Tudor; then *De Engelschen te Rome*, a historical novel of the times of Pope Sixtus V.; in 1840, the *Huis Lauernessé*, a story of the Reformation, which has gone through several editions, and been translated into German and English. Her popularity was increased by a series of novels in 10 volumes, 1845—55, under the titles of *De Graaf van Leycester in Nederland*, (The Earl of Leicester in the Netherlands), *De Vrouwen van het Leycestersche tijdperk* (The Women of the Times of Leicester), and *Gideon Florentz*. Her other works are numerous, including *Cardinal Ximenes*, *The Duke of Alba in Spain*, *The Princes Orsini*, *De Maulëon*, *Don Abbondio II.*, *Mother-joy and Mother-grief*, *The Orphan of Alkmaar*, *The Leyden Student in* 1593, *The Biography of the Landscape Painter Maria van Oosterwijk*, and *Major Frank*. The writings of T. are everywhere characterized by historical accuracy, and show a Christian spirit and tendency. In 1845, the magistrates of Alkmaar gave her a handsome present. In 1851, she married Johannes Bosboom, a distinguished painter, and has since resided at the Hague. Besides other honors, her husband obtained the gold medal at Brussels in 1842, and for paintings of churches, the large gold medal at the Paris Exhibition in 1855.

TOUSSAINT, FRANÇOIS DOMINIQUE, surnamed L'OUVERTURE, was born at Buda, in St. Domingo, in 1743. His father and mother were both African slaves. When the French Revolution broke out, it found him in the position of coachman to a M. de Libertat, who appears also to have employed him as a sort of sub-manager of an estate for which he was himself the factor. In 1791, the French Convention passed the memorable decree, by which the rights of French citizens were given to people of color. In the revolutionary strife which followed in St. Domingo, T. was, for the next three years, conspicuous for his adherence to the cause of royalty and Catholicism; but the decree of February 4, 1794, which declared all slaves free, won him over to the side of the French republic. He joined their commander, Laveaux, by whom he was made a general of division. In 1793, in the midst of the troubles, the British had landed a force and taken partial possession of the island. Against them T. now proved himself an able and indefatigable enemy, bringing the whole of the northern division of the island under the dominion of the French republic. In 1795, in consequence of a conspiracy of three mulatto generals, Laveaux was arrested at Cape Town; but T., assembling his negroes, and uniting himself to the French force, quickly effected the release of the governor. The gratitude of Laveaux was very great; and, in 1796, the Commissioners of the Directory appointed T. chief of the army of St. Domingo. Shortly after this event, General Maitland, the British commander, surrendered to him all the strong places which he had hitherto held in the island. This was followed in 1801 by the submission of the Spanish forts. The whole of St. Domingo was then under the rule of Toussaint. His sway was vigorous and upright; and the agriculture and trade of the island both flourished under him. He was now at the summit of his prosperity. He assumed great state, though still retaining habits of personal simplicity. But a more powerful despot now found himself at leisure to interfere in the affairs of the island.

During the peace of Amiens, Napoleon Bonaparte issued a proclamation re-establishing slavery in St. Domingo. This was met by a counter-proclamation by T., issued on December 18, 1801, in which, while professing obedience, he showed plainly that he meant resistance. A squadron of 54 sail of the line, under General Le Clerc, very soon made its appearance to enforce the edict of the first consul. T. was obliged to retire, was proclaimed an outlaw, and, agreeing to surrender, was received with military honors. He was afterwards treacherously arrested, and sent to Paris, where, after ten months of rigorous imprisonment, he died on April 27, 1803.—See *Vie de Toussaint l'Ouverture*, by St. Remy (Par. 1850); and *The Life of T.*, by Dr. Beard (Lond. 1853).

TOWER HAMLETS, a parliamentary borough in Middlesex, lying in the east of London, and having the City and Finsbury to the west of it. It contains the parish of St. George-in-the-East, the hamlet of Mile-End Old Town, the unions of Poplar, Stepney, and Whitechapel, and the Tower of London. In T. H. are the Mint, Trinity House, St. Katharine's Docks, the East and West India, South, and London Docks, the London Hospital, and various charitable institutions. The T. H. send two representatives to parliament. Pop. of borough (1881) 438,910.

TOWER OF LONDON, in feudal days, a powerful fortress; then, and long after, a state prison of gloomy memories; now, a government storehouse and armory, and still, in some sense, a stronghold, is an irregular quadrilateral collection of buildings on rising ground adjoining the Thames, and immediately to the east of the city of London. The space occupied is between 12 and 13 acres, and the whole is surrounded by a moat of fair width, but no great depth. Usually, the moat is dry, but the garrison have the power of flooding it.

Seen from without, the moat is bordered within by a lofty castellated wall, broken by massive flanking-towers at frequent intervals. Within this wall rises a second of similar construction, but greater height; and within this, again, are the several barracks, armories, &c.; and in the center of all, the lofty keep or donjon known as the White Tower. This last, which nearly resembles Rochester Castle, and like it, was built by Gundulph, Bishop of Rochester, in the time of William the Conqueror, is the center of interest and antiquity in the whole structure. Its walls are in parts 16 feet thick, and of solid masonry. This tower was the court of the Plantagenet kings. The various other towers are principally noteworthy on account of the illustrious prisoners who have pined in them, or left them for the scaffold. In the northwest corner of the quadrangle is St. Peter's Chapel, now the garrison church. In another part is the Jewel-house, containing the crown jewels, or *Regalia*, comprising several crowns, sceptres, globes, and jewels of enormous value. Near this building is the Horse-armory, a collection of ancient and mediæval arms and armor, the latter being exhibited in complete suits on wooden figures of men and horses. To the crown jewels and the armory, visitors are admitted on payment of a small fee.

Early writers have alleged that Julius Cæsar first built the Tower of London as a Roman fortress; but there is no written evidence to prove the existence of any fortress on this site before the construction of the White Tower by Bishop Gundulph in 1078. Some earlier structure of the Saxon times appears to have been

there, from the massive foundations which have been discovered in the course of subsequent erections; but of the nature of those buildings we know nothing. During the reigns of the first two Norman kings, the Tower seems to have been used as a fortress merely. In Henry I.'s time, it was already a state prison. That monarch and his successors gradually increased the size and strength of the ramparts and towers, until the whole became a stronghold of the first class for feudal times. The kings frequently resided there, holding their courts, and not unfrequently sustaining sieges and blockades from their rebellious subjects. Of the long list of executions for political offences, real or imputed, that of Lords Kilmarnock, Balmerino, and Lovat, after the Rebellion of 1745, was the last. Wilkes, Horne Tooke, and others have since been confined there; but happily, blood has ceased to flow since the existence of a living opposition has been found consistent with the safety of the government.

Not the least interesting memorials are the quaint and touching inscriptions cut by hapless prisoners on the walls of their dungeons.

In 1841, a very serious fire broke out in the Bowyer Tower, and extended to the armories, causing the destruction of numerous modern buildings and many thousand stand-of-arms. At present, the Tower of London is a great military storehouse in charge of the War Department, containing arms and accoutrements for the complete equipment of a large army. The Mint and Public Records were formerly kept in it, but have now been removed to other buildings more suitable. Flamsteed, when first appointed Astronomer-royal, made his observations from the summit of the White Tower; afterwards, he removed to Greenwich. It is needless to say that, viewed as a fortress, the Tower would be useless against modern arms.

The government is vested in a Constable, who has great privileges, and is usually a military officer of long service and distinguished mark; the Deputy-constable, also a general officer of repute, is the actual governor. He has a small staff under him, and the corps of Yeomen of the Guard, more commonly known as Beefeaters. In addition, a wing, and occasionally a battalion, of infantry is quartered in the barracks.—Bayley's *History of the Tower of London*, 2 vols. 4to.; *Memoirs of the Tower*, by Britton and Brayley (1831); *Memorials of the Tower of London*, by Lord De Ros (1866); *Her Majesty's Tower*, by Hepworth Dixon, 4 vols. (1871).

TOWN-ADJUTANT, TOWN-MAJOR, officers on the staff of a garrison. They are often veteran officers, too much worn for field-service. The pay depends on the magnitude of the trust. The town-major ranks as a captain: the adjutant as a lieutenant. The duties of these officers consist in maintaining discipline, and looking after the finding of the batteries, &c.

TOWN-CLERK is the clerk to a municipal corporation, elected by the town-council. In England, he holds his office during pleasure, and his salary is paid out of the borough funds. His duties are: to take charge of the voting-papers in the election of councilors, to keep the records of the borough and lists of burgesses, and to perform a variety of miscellaneous duties imposed by sundry acts of parliament.—In Scotland, he holds his office *ad vitam aut culpam*, is the advisor of the magistrates and council in the discharge of their judicial and administrative functions, attends their meetings, records their proceedings, is the proper custodier of the records of the burgh, and keeper of the registers of sasines and deeds within it. Various important statutory duties are also assigned to him in relation to the registration of voters, the conduct of municipal elections, the valuation of lands and heritages, the registration of births, marriages, and deaths, the licensing of public-houses, &c. In the performance of a large proportion of these duties, he is independent of the town-council, who cannot make his appointment during pleasure, or attach to it any condition which might enable the council either to control him in the conduct of the business of his office, or withdraw from him any portion of his emoluments, so far as derived from fees. Being thus protected in the independent and impartial discharge of his functions as a public officer, he is bound to give extracts from the records in his custody without reference to the town-council, and is liable *personally* for the consequences of failure in any department of his duty. He is not, however, a magistrate in any sense, and cannot be held responsible for the obligations of the burgh, or for the omissions or neglect of the magistrates and council.

TOWN-COUNCIL is the governing body in a municipal corporation, elected by the ratepayers. The town-council administers the affairs of the borough in relation to its common property and to a variety of other matters, appointing the several officers required for this purpose. It is also charged with important functions in regard to police and sanitary matters; and the tendency of recent legislation is to concentrate in the council all matters of local administration. For the more effectual government of the community under its jurisdiction, the council is empowered to make by-laws, like local statutes, so far as not inconsistent with common law or public statute, or the constitution of the borough. One-third of the council go out of office every year, but are eligible for re-election at the annual elections in November. In all the corporate or borough towns of England (except London, and a few other places specially excluded from the Municipal Corporation Act, 5 and 6 Will. IV. c. 76), the town-council consists of the mayor, aldermen, and councilors. The councilors vary in number from 12 to 64 according to the population of the town; and one-third of the number are aldermen. Every burgess who is enrolled in the burgess-roll—i. e. every inhabitant householder (who has been for one year, in respect of property, rated to the poor) in the borough, or within seven miles of the borough—is entitled to vote in the election. See BURGESS. The council elects the mayor, who continues in office for one year. The aldermen are elected from the councilors, or from persons qualified to be councilors. In the larger boroughs, a person is not qualified to be a councilor unless he is worth £1000, or is rated for the support of the poor to the extent of £30 and upwards; but in the smaller boroughs, he is qualified if worth £500, or rated for the poor at £15.—In Scotland, the town-council consists of the provost (in burghs which have a provost), bailies, treasurer, and common councilors, with the addition, in Aberbeen, Dundee, and Perth of the dean of guild, and in Edinburgh and Glasgow, of the dean of guild and convener of the trades.

The election of councilors is regulated by 3 and 4 Will. IV. c. 76, and other acts mentioned below, under which every person who possesses the qualification requisite for voting in the election of the member of parliament, and who has resided for six months previous to the 30th June in or within seven miles of the royalty, is entitled to vote in the election of councilors. The persons entitled to be registered as parliamentary electors in burghs, are those who are of full age, and not subject to any legal incapacity, and have been for not less that twelve calendar months next preceding the last day of July, inhabitant occupiers, as owners or tenants, of any dwelling-house within the borough, and have paid, before 20th June, all poor-rates up to 15th May; also lodgers occupying lodgings worth ten pounds. But no person can vote who is in receipt of poor relief, or is merely a joint occupier of a dwelling-house. Every elector residing or carrying on business within the royalty is eligible as a councilor; and in burghs where burgesses exist, the person elected is made a burgess before induction. The number of councilors varies in different burghs. The larger burghs are divided into wards or districts, each of which elects its proportion of councilors, as the smaller burghs do the whole council. The provost (in burghs which have a provost), bailies, treasurer, and other office-bearers fixed by the set or usage of each burgh, are elected by the councilors, the provost and treasurer holding office for three years, and the other office-bearers for the unexpired period of their councilorship. Vacancies in the magistracy or council are filled up *ad interim* by the remaining members of council—the person so elected retiring at the succeeding annual election. In burghs returning members to parliament, and all royal burghs, the election of members of council is regulated by 3 and 4 Will. IV. c. 76, 31, and 32 Vict. c. 108, 33 and 34 Vict. c. 92, and the Ballot Act (1872), 35 and 36 Vict. c. 33. In those more ancient royal burghs which, on account of the smallness of the population, were exempted from the provisions of the 3 and 4 Will. IV. c. 76, the election of magistrates and councilors is conducted according to ancient practice.

Previous to the municipal reform acts in the reign of William IV., town-councils were generally close corporations; the members elected their successors; business was conducted in private; and corrupt practices, with a variety of other abuses, prevailed. The Ballot Act, 1872, which applies to England, Scotland, and Ireland, leaving, however, some slight variations in each kingdom, extended to contested municipal elections nearly all the enactments relating to the poll at parliamentary elections. In England, the mayor is the returning officer, who is to provide everything required for the purpose of a poll. The Ballot (q. v.) is the means provided for taking the poll, and minute directions are contained in the act for the carrying out of this practice. In Scotland, all municipal elections were directed by the Ballot Act (1872) to be conducted in the same manner in all respects as under the practice applicable to the royal burghs mentioned in Schedule C of the Act 3 and 4 Will. IV. c. 76—namely, Edinburgh, Glasgow, Aberdeen, Dundee, Perth, Dumfermline, Dumfries, and Inverness. Subject to this enactment, the poll at a contested municipal election is to be taken as in England. In Ireland, the same act directs that the provisions of the English Municipal Elections Act (1859) shall apply in relation to the nominations at Irish municipal elections; but in other respects the practice in taking the poll at a contested municipal election is to be the same as in England. Corrupt practices at municipal elections in England and Ireland are now inquired into by means of an election court presided over by a barrister, 35 and 36 Vict. c. 60. In England, town-councils may, at the expense of the borough and local funds, promote and oppose

bills in parliament for the public benefit, when sanctioned by special meetings, 35 and 36 Vict. c. 91.

TOWNSHEND, Charles, Viscount Townshend, English statesman, born 1676, was descended from a very ancient English family, which has been settled at Raynham, in Norfolk, since the reign of Henry I. His father, Horatio, had been a prominent member of the Presbyterian party before the Restoration, and having been one of the most forward in restoring the monarchy, was, by Charles II., made Baron in 1661, and Viscount in 1682. He died in 1687, when his son was only eleven years old. When he was of age to take his seat in the Upper House, he adopted his father's politics; but soon afterwards became a disciple of Lord Somers, and cordially co-operated with the Whigs. He was named by the Godolphin administration one of the commissioners for arranging the Union with Scotland, and was rewarded for his exertions by the captaincy of the yeomen of Queen Anne's Guard. He was then employed as a diplomatist; was joint-plenipotentiary with Marlborough at Gertruydenberg; and negotiated with the States-general the Barrier Treaty, which pledged the States-general to the Hanoverian succession, and England to procure the Spanish Low Countries for the United Provinces, as a barrier against France. In 1712, upon the formation of the Harley ministry, T. was dismissed from his places, and the Barrier Treaty was censured by the House of Commons, which voted that T. and all who had been concerned in the treaty were enemies to the queen and kingdom. This persecution raised him from the rank of a follower to the station of a leader. He maintained a close correspondence with the court of Hanover, and obtained the entire confidence of George I., who, on his accession to the throne of England, made him his chief minister.

While George I. was still at the Hague, on his way to his new kingdom, he made T. Secretary of State, with power to name his colleagues. He selected General, afterwards Earl, Stanhope, and formed a ministry entirely Whig in its party character. He strengthened it by the addition of Walpole, who, from being at first Paymaster of the Forces, was soon made Chancellor of the Exchequer and First Lord of the Treasury. The principal act of the government was the passing of the Septennial Bill, a bold and unconstitutional act. After the breaking up of the South Sea Bubble, and the deaths of Sunderland and Stanhope (q. v.), T. (1721) again became Secretary of State. But he was no longer the acknowledged leader of the Whigs. The superior talent of Walpole, his financial abilities, and his influence in the House of Commons, caused a change in the relative position of the two ministers, and converted those who had been so long friends and colleagues, and who were also connected by ties of marriage (for T. had married Walpole's sister), into rivals and enemies. An open and unseemly quarrel broke out between them. They seized each other by the collar, and then laid their hands upon their swords. The interposition of friends prevented a duel; and T., resigning the contest, retired to Raynham, to cultivate his paternal acres. Walpole, on being asked the cause of his difference with his brother-in-law, replied: 'As long as the firm was Townshend and Walpole, all did very well; but when it became Walpole and Townshend, things went wrong, and a separation ensued.' T. introduced the turnip into Norfolk from Germany, and thus effected a most beneficial revolution in agriculture. He steadily refused to re-appear in public life, and died in a good old age, in June 1738, leaving behind him a high reputation for integrity and steady consistency in sound and constitutional principles of government.

TOWNSHEND, Charles, The Right Hon., English orator and statesman, was second son of the third Viscount Townshend, and grandson of the foregoing. He was born in 1725, and entered the House of Commons in 1747, as a supporter of the Pelham (Whig) Administration. His first great speech was against the Marriage Bill in 1753, which gained him a great reputation for eloquence. Upon the dissolution of the Whig government, the Earl of Bute gained him by the offer of the post of Secretary at War. On Bute's resignation in 1763, he was appointed First Lord of Trade and the Plantations. By this time, the versatility of his political career had obtained him the appellation of 'the Weathercock.' In the Chatham ministry of 1766, he accepted the post of Chancellor of the Exchequer and leader of the House of Commons. When Lord Chatham, in a distempered state of mind, abdicated the post of First Minister, T. broke loose from all restraint, and manifested the greatest vanity, ambition, and arrogance. George Grenville, smarting under the defeat of his favorite scheme of taxing America, on one occasion, in the middle of his harangue, turned to the ministers: 'You are cowards,' he said; 'you are afraid of the Americans; you dare not tax America.' T.'s fiery temper was kindled, and he exclaimed: 'Dare not tax America! I dare tax America.' Grenville retorted: 'I wish to God I could see it!' and T. replied: 'I will, I will.' He was not allowed to forget his pledge; and finding the notion of an American revenue agreeable to the court, and not unpalatable to the House of Commons, he proposed and carried those measures that led to the separation of the American colonies.

T.'s wife was created a peeress, and he was about to be intrusted with the formation of a ministry, when he was carried away by a putrid fever (September 1767) in his 42d year. The difference between his contemporary reputation and his fame is very striking. He was ranked as an orator with Pitt. He was far more popular than the great commoner with the House of Commons; yet his name will not go down to posterity, save in the annals of his time. Burke called him 'the delight and ornament of the House of Commons.' Macaulay speaks of him as 'the most brilliant and versatile of mankind,' who had 'belonged to every party, and cared for none.' Earl Russell describes him as 'a man utterly without principle, whose brilliant talents only made more prominent his want of truth, honor, and consistency.' He married Caroline, daughter and heiress of John, second Duke of Argyll and Greenwich, and widow of the Earl of Dalkeith, and had the discrimination to select Adam Smith as the tutor and traveling-companion of his step-son, the youthful Duke of Buccleuch.

TOWNSHIP, in English Law, means a division of a parish in which there is a separate constable, and for which there may be separate overseers of the poor.

TOYS. The making of toys forms a very important industrial occupation. Large numbers are made in London, Birmingham, and other places in Great Britain; but by far the largest number are made in Germany and Switzerland. Nürnberg is especially important in this respect, a large portion of the inhabitants of that town being engaged in the manufacture and trade in toys. The value of the toys imported annually into Britain is about £500,000.

TOXICO'LOGY is the term commonly employed in Medical Jurisprudence to designate the science of poisons. It embraces the physical and chemical history of all known poisonous substances, the methods of testing for them, their action on the living body, the *post-mortem* results which they occasion, and (according to some writers) the medical treatment that should be adopted. The word has a somewhat far-fetched origin. The Greek word *toxicon* signifies 'anything relating to *toxon*, a bow;' hence, with the word *pharmacon*, a drug, it was used to designate 'poison for smearing arrows,' and finally, *poison* generally.

TRA'CERY, the beautiful forms in stone with which the arches of Gothic windows are filled or traced for the support of the glass. These forms vary with every variety of Gothic architecture. Gothic windows were at first narrow, and were covered

Fig. 1.

with a simple arch. Then two windows were grouped together, and an arch thrown over both. The space thus enclosed became part of the window, and was at first pierced with a circle, quatrefoil, or other opening (fig. 1). When three or more windows

Fig. 2.

were grouped under one arch, the *shield* or space in the arch became larger, and was pierced with apertures of various forms. In the early Pointed styles, these were usually circles filled with cinquefoils, trefoils, &c. (fig. 2). During the Decorated period

the tracery became more varied in form, being composed of squares, triangles, and other forms, filled with foils, and having the appearance of being packed together (fig. 3). This kind of

Fig. 3.

tracery is called 'Geometric.' The windows of the transition from Decorated to Perpendicular had tracery of a more flowing character, while that of the Perpendicular Period (q. v.) became almost entirely composed of vertical lines. The Flamboyant (q. v.) or contemporary style in France had tracery of a very different description—being as free and graceful as the other was straight and stiff.

Panels are often filled with tracery, the exteriors of the Perpendicular period being covered with such. The woodwork of all periods is filled with ornamental tracery.

TRACHE'A, THE, is sufficiently described in the article RESPIRATION. We have here only to notice those affections of this tube which require surgical or medical aid.

Foreign bodies occasionally pass through the larynx into the trachea. In cases of this kind, the patient who has had some foreign substance in his mouth which is supposed to have been swallowed, is seized with a convulsive cough, threatening suffocation, but subsiding after a time. The symptoms that then ensue vary with the weight and figure of the substance, and according as it is fixed or movable. A large and very irregular body may be impacted in the trachea, and may thus more or less obstruct the respiration on both sides of the chest; and this obstruction will probably soon be increased by the inflammatory products that are excited. A small heavy body will usually pass through the trachea into one of the bronchi (usually the right), or into one of its branches, obstructing respiration to a less extent.

'If the foreign body be allowed to remain, the progress of the symptoms presents much variety in different cases. Death may occur from spasm of the glottis, or, the foreign body being propelled upwards into the rima, death may take place by its mechanically preventing the passage of air, or rupture of one of the cerebral blood-vessels may be produced during one of the fits of coughing. At a later period the lungs may become congested and emphysematous, or bronchitis, pneumonia, or pleurisy may supervene.'—Gray's article on 'Injuries of the Neck,' in Holmes's *System of Surgery*, vol. ii. p. 306. Although inversion of the body, together with succussion and lateral movement of the larynx, has in some few cases been successful, it is now deemed advisable by the highest authorities to precede the attempt at removal by making an artificial opening into the windpipe. A free aperture is thus secured for respiration, spasm of the glottis is prevented, and the foreign body is commonly expelled through the artificial opening, or falls through the glottis into the mouth.

Rupture of the Trachea from external injury occasionally happens, and generally proves fatal in consequence of the rapid and extensive emphysema which usually ensues. It is too rare an accident to require a more special notice.

Wounds of the Trachea are sufficiently described in the article THROAT. With the exception of Croup (q. v.), there is no special disease of the trachea; and indeed in croup the trachea is seldom exclusively affected. Hence the term *Tracheitis*, used by some nosologists as synonymous with croup, is hardly warrantable. Similarly, in more advanced life, the trachea is doubtless often the seat of inflammation, but never the special and exclusive seat, and both the symptoms and treatment merge into those of bronchitis or laryngitis.

TRACHEO'TOMY AND LARYNGO'TOMY. The air-passages may be opened in three different situations—namely, through the crico-thyroid membrane (see LARNYX), when the operation is termed Laryngotomy; through the cricoid cartilage and the upper rings of the trachea, the operation being known as Laryngotracheotomy; and through the trachea, below the isthmus of the thyroid gland, constituting Tracheotomy proper. Laryngotomy and tracheotomy are more commonly performed than laryngotracheotomy, to which no further allusion is required. Laryngotomy is more quickly and easily performed, especially in adult males, and is less dangerous; tracheotomy is a more difficult, tedious, and dangerous operation, but in some cases (as, for example, where there is any necessity for introducing the forceps) must be selected. It is unnecessary to enter into details regarding the modes of performing these operations. When the operation is completed, a large curved tube to breathe through is inserted in the aperture, and secured round the neck with a tape.

A double tube or canula possesses many advantages, as, by withdrawing the inner one, which should slightly project at its lower extremity, it may be cleared of any mucus or blood that may have accumulated in it, without disturbing the wound. The calibre of the inner tube should always be sufficiently large to admit as much air as usually passes through the chink of the healthy glottis. The after-treatment is much the same as that required for wounds in the Throat (q. v.). 'Opening of the air-passages may be required,' says Mr. Gray, 'in any case of disease or injury which produces mechanical impediment to the passage of air from the mouth into the trachea; in cases of foreign substances in the air-passages; and in some cases of suspended animation where artificial inflation of the lungs cannot be performed by the ordinary means.'—Holmes's *System of Surgery*, vol. ii. p. 317. In the case of a foreign body, its situation will determine the seat of the incision. Amongst the cases in which tracheotomy is, or may be, required, are cut throat, acute laryngitis, croup, diphtheria, chronic inflammation and ulceration of the larynx, necrosis of the laryngeal cartilages; tumors, excrescences, or epithelial growth within the larynx; tumors (bronchocele, abscesses, &c.) external to the larynx or upper part of the trachea, and impeding respiration by pressure, &c. It has also been recommended, but with little advantage, in hydrophobia, tetanus, and severe forms of epilepsy, with the view of relieving the suffocating spasms that occur in these diseases. Laryngotomy may advantageously be resorted to in cases of spasm of the glottis, in inflammation with œdema of the cellular tissue of the larynx, in inflammation of the tongue, in tonsilitis and pharyngitis, if the swelling is so great as to produce symptoms of suffocation, &c.

TRACHO'MA (derived from the Greek *trachus*, rough) is the term employed in ophthalmic surgery to designate a granular condition of the mucous covering of the eyelids, often accompanied with haziness and vascularity of the cornea. It is one of the most serious *sequelæ* of purulent Ophthalmia (q. v.).

TRA'CHYTE, a volcanic rock, principally composed of Felspar (q. v.), confusedly agglomerated in crystals, which are usually very small. Crystals of mica and hornblende are often also present, and more rarely crystals of augite, all imbedded in a felspathic paste. The name is from the Greek *trachys*, rough; the rock being rough to the touch. *Trachytic Porphyry* is a porphyry essentially composed of trachyte. By some geologists, T. has been made the name of a class of volcanic rocks, in which Clinkstone, Obsidian, and Pumice are included.

TRACING-PAPER. See PAPER.

TRACTA'RIANISM, a remarkable and important movement in the English Church during the second quarter of the present century, which consisted in an endeavor to revive and bring into prominence the principles of antiquity, catholicity, and authority recognized in some portions of the Anglican formularies, in contrast to the Protestant sentiments long and widely prevailing. The name is derived from a series of papers entitled *Tracts for the Times*, published at Oxford during the years 1833—1841, hence called the 'Oxford Tracts.' The causes of this remarkable reaction it would be difficult to ascertain. The agitation of the question of Roman Catholic emancipation led, in some cases, to the study of Catholic theology, with a view to determine the real grounds of difference between the Roman and Anglican churches; and the religious and æsthetic tone of Wordsworth's poetry, still more developed in Keble's *Christian Year* (published in 1828), may have disposed some minds to sentiments to which it was akin.

The lectures of Bishop Lloyd, when Regius Professor of Divinity at Oxford about 1823, on the Prayer-book and the Council of Trent, are considered to have led the way to the teaching of the *Tracts*. But the immediate origin of the movement appears to have been the alarm aroused for the interests of the English Church on the occasion of the suppression by the reform government of some of the Irish sees, and threatened alienation of Irish church property. It is said that about that time a meeting of clergymen took place at Hadley, in Suffolk, at which measures were concerted for opposing the alleged latitudinarian tendencies of the day, and restoring the High Church theology of the Anglican divines of the 17th century. The chief promoters of the movement were the Rev. John Keble (q. v.), author of the *Christian Year*, and formerly Professor of Poetry at Oxford; Rev. J. H. Newman (q. v.), and R. H. Froude, Fellows of Oriel; the Rev. E. B. Pusey (q. v.), Regius Professor of Hebrew, and Canon of Christ Church; Rev. Isaac Williams, Fellow of Trinity, author of the *Cathedral and other Poems;* Rev. Hugh Rose of Cambridge; and others. The *Tracts* were issued anonymously, and, together with articles in the *British Critic* by the same writers, produced a great effect, especially among the clergy. Protestant principles were openly discountenanced, and tenets

closely resembling those of the Church of Rome were boldly put forward. The doctrines of Apostolical Succession, Priestly Absolution, Baptismal Regeneration, the Real Presence, the Authority of the Church, and the value of Tradition, which had long lain hid in the language of the Prayer-book, were widely revived and taught, and caused much alarm in some quarters; though it must be admitted that those principles had always been held by a portion of the English clergy, and claimed to be only a fair exponent of the teaching of the church. The study of the Fathers and old divines, of church history and ancient liturgies, was greatly revived in the universities and among the clergy, and a host of publications inculcating with more or less extravagance the same views issued from the press.

The movement proceeded, notwithstanding the general opposition of the authorities, till it culminated in the publication, by the Rev. J. H. Newman, of the Tract No. 90, which was designed to show that much Roman doctrine might be held consistently with subscription to the Thirty-nine Articles. This being held to favor a 'non-natural' interpretation, was received with general condemnation, and led to the termination of the series, to the resignation by Mr. Newman of the vicarage of St. Mary's, Oxford, and subsequently to his secession, in 1845, to the church of Rome. In this step he was followed by many of his friends and associates, though the other leaders of the movement have continued in the English Church. With Mr. Newman's secession, the Tractarian movement terminated; but its effect remains in several visible results. 1. The first of these may be said to be the revival and strengthening of the High Church party, which still maintains to a great extent the principles advocated in the *Tracts;* and though checked by some judicial decisions, such as the Gorham (q. v.) judgment, in the endeavor to acquire exclusive power, has gained great and perhaps increasing influence in the church. 2. Side by side with the revival of Catholic doctrines, there has been a great development of ritual. The Tractarian movement was early marked by the introduction of various alterations in the mode of performing divine service, such as the use of the surplice instead of the gown, intoning the prayers and singing the responses, the elevation of the communion table into an altar, the substitution of low open benches for high pews—all of which, though claiming to be a restoration of ancient usage, having the authority of the law, were regarded with alarm as approximating to the Church of Rome (see RITUALISM). 3. Another effect of the Tractarian movement was the remarkable impulse given to the building and restoration of churches, and the revival of Gothic architecture, which has been manifested in all parts of England, and given a character to the ecclesiastical buildings of the present century which will mark them for ages to come. 4. The Tractarian movement has undoubtedly been the cause of the secession of many English clergy and laity, some of them men of considerable ability and distinction, to the Church of Rome, which has greatly increased the strength and influence of that communion in the country, and caused great scandal to Protestants. Lastly, the movement may, however, be admitted to have produced a great increase of learning, piety, and devotedness among the clergy, and the establishment of colleges, sisterhoods, and other religious and charitable institutions.

TRACTION ENGINES. See STEAM-CARRIAGE.

TRADE, BOARD OF, a department of government more correctly designed 'The Lords of the Committee of Her Majesty's Privy Council appointed for the Consideration of all Matters relating to Trade and Foreign Plantations.' In 1660, Charles II. created two separate councils for Trade and for Foreign Plantations, which, in 1672, were consolidated into one. The Board of Trade and Plantations, after being abolished in 1675, reappointed in 1695, and after modifications, was again abolished in 1782. In 1786, the presently existing department was established by Order in Council, being a permanent committee of Privy-council for the consideration of all matters relating to Trade and the Colonies. The Board consists of a president, together with the Lord Chancellor, the Archbishop of Canterbury, the First Lord of the Treasury, the principal Secretaries of State, the Chancellor of the Exchequer, the Speaker of the House of Commons, and others. But of the latter *ex officio* members, none take part in the work of the board, which is managed by the president and his staff; the staff includes the permanent and parliamentary secretaries, four assistant secretaries, and a chief of the statistical department; the board is now divided into five departments: (1) the statistical and commercial department, (2) the railway department (3) the marine department, (4) the harbor department, and (5) a financial department. Since 1864, the presidentship has always been held by a Cabinet Minister. Before 1867 there was a vice-president, who was a member of the administration, though without a seat in the cabinet.

The functions of the Board of Trade are partly of a ministerial, partly of a judicial kind, and have of late years been greatly enlarged by a variety of statutes. The Board is charged with the general superintendence of all matters relating to the mercantile marine. It requires and considers reports made to its inspectors and other officers, and orders returns of various kinds regarding trade and navigation. In the exercise of a certain amount of control over marine boards, it is empowered to make regulations regarding the examination and qualifications of applicants for the position of master or mate of passenger-ships. Under 17 and 18 Vict. c. 104, it grants licenses to persons to engage or supply seamen or apprentices for merchant-ships, decides on claims for wages, and investigates charges of misconduct and incompetency. In virtue of 14 and 15 Vict. c. 79, it appoints officers to inquire into and report on the condition of steam-vessels.

The supervision of railways and railway companies, both as to their original formation and their working, constitutes an important part of the duties of the Board of Trade. Railways were first subjected to government control by 3 and 4 Vict. c. 97, which conferred power on the Board of Trade to appoint inspectors of railways, to approve or disallow by-laws, to require returns of traffic, and to decide disputes between connecting lines. Further powers were added by 5 and 6 Vict. c. 55. In 1846, the increase of these duties, arising from the rapid extension of railways, led to the transfer of this department of the Board of Trade to a separate Board, created exclusively for the management of railway business; but in 1851 this latter Board was abolished, and its powers again transferred, by 14 and 15 Vict. c. 64, to the Board of Trade. Notices of applications for railway acts, with plans, are required to be deposited with the Board before any bill can be introduced into parliament; and before any railway can be opened for traffic, the permission of the Board must be obtained, on the report of an inspector. On the occurrence of an accident, notice must be given to the Board, which sends an inspector to inquire into the circumstances, and, on his report, the Board is empowered to take what steps are judged necessary for the security of the public.

Many matters relating to the interests of trade, which come before other departments, are referred to the Board of Trade for information or advice. Thus there are frequent communications with the Foreign Office regarding the negotiation and working of commercial treaties, and with the Treasury regarding alterations in the customs.

A statistical department of the Board was established in 1832, whose province is to collect and publish tables containing classified information regarding the revenues, population, commerce, wealth, and moral and economical condition of the United Kingdom and its dependencies, to prepare a selection from the statistics of foreign countries, and a monthly account of trade and navigation. All applications made to the Queen in Council by companies or private persons for charters of incorporation, are referred to the Board of Trade; and among the functions committed to it by statute are the registration of joint-stock companies, and of copyright in designs. The Board is empowered by several local and personal acts to control the proceedings of the commissioners for regulating the employment of coal-whippers, and the discharge of coal-laden vessels in the port of London. In 1853, the Department of Science and Art, which owed its origin to suggestions made in the Second Report of the Commissioners for the Exhibition of 1851, and was at first a department of the Committee of the Privy Council on Education, was placed under the control of the Board of Trade; but in February 1856, it was retransferred, by an Order in Council, to the Committee of the Privy Council on Education.

TRADE CORPORATIONS. See CORPORATION, and JOINT-STOCK COMPANY.

TRADE, LIBERTY TO, is one of the rights incident to all persons by the law of England. So absolute is this right, that it is considered by courts of law to be an illegal and void covenant when a person, however deliberately, engages never to trade, for it is against public policy to support it. In the sale of the good-will of a business, such covenants are sometimes resorted to, in order to prevent the party selling a business from setting up immediately afterwards the same business, and so defeating the object of the transaction. Accordingly, in all such cases, the courts have arrived at the following result: If a person engage absolutely not to carry on a particular business anywhere, his engagement is void, and not binding; but it is competent for him to engage not to carry on a particular trade within a certain specified reasonable distance—as 20 or 30 miles—from a certain point, the reasonableness being estimated according to the nature of the trade and locality. If this engagement were not legal, it would be impossible to negotiate the sale of the good-will of a business. Subject to the above restriction, any person may carry on trade in any locality he pleases. But in the case of an alien enemy, a license of the crown is necessary to enable a subject to carry on trade with him. It was also anciently a maxim, now obsolete, that none of the king's subjects could lawfully trade with a nation of infidels without the king's leave, because of the danger of relinquishing Chris-

tianity. Though, at common law, every man is free to carry on what trade he pleases, still there are a great variety of lawful trades which are subjected to certain restrictions, either ostensibly for purposes of revenue, or for the purpose of protecting the public from certain evils attending such trades.

Thus, attorneys, publicans, manufacturers of cotton, &c., chimney-sweepers, and many miscellaneous employments, are subject to various restrictions. Formerly, also, the liberty to trade was considerably impeded by the ancient corporations and guilds; and it was a practice for these guilds to impose certain conditions on all persons who sought to trade in large towns, otherwise they were excluded from certain commercial as well as political privileges. As the by-laws which were the instruments of creating these restrictions were often authorized by charter of the crown, or grew up by ancient use and custom, then in harmony with the spirit of the age, the courts had a difficulty in treating them as illegal. But by the Municipal Corporations Act which passed for England in 1835 (5 and 6 Will. IV. c. 76), these restrictions were abolished. That act recited that, in divers cities, towns, and boroughs, a certain custom had prevailed, and by-laws had been made that no person, not being free of a city, town, or borough, or of certain guilds, mysteries, or trading companies, should keep any shop, or place for putting to show or sale any wares or merchandise for hire, gain, or sale; and it enacted that henceforth, notwithstanding such customs or by-laws, every person in any borough might keep any shop for the sale of all lawful wares and merchandise by wholesale or retail, and use every lawful trade, occupation, mystery, and handicraft, for hire, gain, sale, or otherwise within any borough. The city of London, however, was excepted from that act, and some of these old restrictions still flourish there. The law in Scotland and Ireland was also altered at the same time. The repeal of the Navigation Laws (q. v.) has also removed many restrictions on those who traded with ships.

TRADE-MARKS. The attaching of peculiar marks, by which manufacturers seek to distinguish their own productions from those made by other persons, is an important privilege, both as concerns the producer and the consumer; because no honest manufacturer will invent and apply a trade-mark to his wares, unless he is convinced that they possess some special excellence, which he wishes thus to make known; and it is desirable the public should have the benefit of such direction in the choice of their purchases as is thereby afforded. Nevertheless, until 1862, the law in Great Britain was in a very unsatisfactory state upon this subject, and the marks of celebrated manufacturers were pirated with the most reckless audacity both by British and foreign firms, in most cases, to enable them to pass off upon the public articles of very inferior character. For such infringement, the only remedy was to proceed by injunction from the Court of Chancery, a process which was far too troublesome and costly for the class of inventors most likely to be injured. The 'Merchandise Marks Act' of 1862 has remedied this evil, and simplified the whole matter, by making it a misdemeanor to forge or counterfeit any trade-mark, or falsely to apply any such trade-mark, with intent to defraud, whether applied to a cask, bottle, stopper, vessel, case, cover, wrapper, band, reel, ticket, label, or any other thing, in or with which any commodity is sold, or intended to be sold. It is henceforth an offence to sell or expose, either for sale or for any purpose of trade or manufacture, articles with forged or false trade-marks, under a penalty of a sum equal to the value of such articles, and a sum besides not exceeding £5, or less than 10*s*. Every addition to, or alteration and imitation of, any trade-mark made with intent to defraud—the intent being the essence of the offence in all cases—is to be deemed a forgery, and punished as such. It is further made obligatory on every person who shall sell an article having a false trade-mark to give information as to where he procured it, on a demand for such information being made to him in writing. In 1875, an Act was passed to establish a register of T.-M., and amended in 1876; to the effect that, after 1st July 1877, no steps can be taken to prevent infringement unless the trade-mark has been entered in the register established under the superintendence of the Commissioners of Patents.

To mark any false indication of quantity is also punishable with penalties. A conviction under the act is not to affect the civil remedy at law, nor need any indictment specify who is intended to be defrauded by the fraudulent use of spurious marks. The punishment for the misdemeanor may, at the discretion of the court, either be by fine or by imprisonment, with or without hard labor; and in the event of fines not being paid, the offender may be imprisoned until they are. The vendor of an article with a trade-mark is to be deemed to warrant or contract with the purchaser that the mark is genuine, unless otherwise vouched for in writing. A similar obligation rests upon those who sell articles marked with specific quantities. In suits against persons using forged trade-marks, the court may not only order the destruction of the articles fraudulently marked, but may by injunction prevent a repetition of the offence. The time during which proceedings may be taken is limited to three years. See *Trade-marks*, by Hardington (1881).

TRADE PROTECTION SOCIETIES are associations composed of merchants, tradesmen, and others, which have been formed for the promotion of trade, and for protecting the individual members from losses in their business transactions with each other, and with the community at large. They began to spring up about the middle of the last century—one of the first started in this country being the 'London Association of Guardians for the Protection of Trade,' which was established in 1776. In 1871, the Board of Trade granted a license for incorporation to one under the Companies Acts, 1862—1867. The operations of these societies used to be confined chiefly to the compilation of registers of bankruptcies, insolvencies, and private settlements with creditors. The registers were formed thus: Each member informed the secretary of his society of the name, occupation, and address of the customers who became insolvent, with the amount of dividend their estate yielded; and latterly, the circumstances connected with such insolvency, whether recklessness or extravagance on the part of the bankrupt, or innocent misfortune. These circumstances were carefully recorded, and the information thus collected having been found useful, means were taken to render the registers more complete. With this view, new sections were added to the registers, and special attention was directed to the exposure of swindlers, and persons who had been guilty of fraud or embezzlement.

The information accumulated in the registers, though always accessible to such members as made inquiry at the offices of the society, was kept strictly private from all others. But the extraordinary development of commercial enterprise which took place in the early part of this century, added a new stimulus to the trade protection movement. The registers which the societies now printed and circulated among their members contained transcriptions from the following public records; viz., the records of the bankruptcy courts, registers of assignments and trust-deeds, bonds or warrants of attorney, bills of sale, judges' orders, protested bills, and decrees in absence. In addition to the diffusion of information of this description, the societies undertook to recover past-due bills and accounts for their members, to investigate the circumstances connected with bankruptcies and insolvencies, collect dividends, and perform the general agency business of their members—the whole being done under the direction of a committee appointed for this purpose. Committees were also appointed to scrutinize all measures affecting trade and commerce which might be introduced into parliament, and to promote legislation favorable to the commercial interest. The sphere of action of trade protection societies thus rapidly widened, and their utility kept pace with their growth. The older societies established offices and branches throughout the country; and new societies sprang up in the large provincial cities, which in their turn opened agencies and branches in other towns and villages; and the various societies being in communication, the machinery of the whole is available for the purposes of each.

TRADES' UNIONS, in their character of benefit and sick societies, do not fall within the range of this article. We have principally to consider them as associations of workmen against employers, for the purpose of gaining, either in time or money, a larger share of the profits of their trade. A brief historical sketch of the growth of the principle of combination may fitly introduce the subject.

In one form or other, combination has always existed, ever since the employed and employing classes became distinguishable from each other. For a long time after the Conquest, the inhabitants of England were of two classes, freemen and slaves. These relations not permitting work for wages, there could be then no combination in the modern sense. About the middle of the 13th c., we find that wages had begun to be paid, so that for 600 years there have been laborers receiving a money price for their services, competing for employment, and arranging terms with employers. The power of legislation was, however, with men who believed their interests antagonistic to those of the workmen, and its complexion was always favorable to masters. When, after the great pestilence of 1349, the reduced number of laborers demanded better pay, it was enacted that carters, ploughmen, and agricultural servants generally should be content with their previous rate of liveries and wages; they were to continue to be paid in kind where payment in kind had been customary; they were forbidden to hire themselves for the day, but must take service for a year or other fixed period; a rate of wages was fixed for weeders, haymakers, mowers, and reapers; and their hiring for the future was to be in public. A little later, in1363, the diet and clothing of artificers and servants were fixed by act of parliament, and clothiers were required to make, and tradesmen to sell, cloth of a regulated quality at a regulated price. The rate at which labor should be purchased was fixed after this fashion for almost two centuries, and the practice declined solely because of the impossibility of preserving it. But even within the last 150 years, a relic

of the old superstition revived, so characteristic as to be worth notice.

A tariff of wages, drawn up in 1725 by the Manchester justices, declares that any workman conspiring to obtain more than the rate thereby fixed, should for the third offence stand in the pillory, and lose an ear. Economical error, it will be seen, is by no means the monopoly of the poor.

One of the earliest forms assumed by combination is shown by the statutes, passed about 1400 A.D., which excluded from city labor all who had been trained to the plough up to the age of 12 years. The evasion of these acts was the subject of bitter complaints from the city inhabitants, whose practical union against agriculturists was defeated by the sending of country children into towns as apprentices before they reached that age. For generations, this jealousy of corporation against corporation, continued with more or less intensity.

In the more ancient forms of associated labor, such as guilds and chartered companies, combinations such as those which now prevail could not exist. There were no masters and workmen as separate and opposed classes. Producers were united as against the community, and they had no reason, so long as the guild was prosperous, for internal dissension. When, by the abuse of their power in prosperity, they incurred hostile legislation, they became disintegrated; workmen were employed who had never been apprentices; and ultimately the owners of capital and the owners of labor became distinct and often opposing camps. Instead of a guild or trade being any longer a compact monopolist body, acting for itself against the community, the tendency was thenceforward for combination of one section against the other.

Trades' unions, organized for purposes such as those which contemporary unions contend for, have existed for more than three centuries. So early as 1548, a statute of Edward VI. is directed, amongst other culprits, against certain 'artificers, handicraftsmen, and laborers,' who had 'sworn mutual oaths' to do only certain kinds of work, to regulate how much work should be done in a day, and what hours and times they should work. The usual penalties of fines, pillory, and loss of ears were to follow a breach of its enactments. Add the regulation of wages to the objects enumerated in this statute, and we have in effect the trades' unions of the present day. Many fruitless acts were afterwards passed to prevent combinations for raising wages. So long as a tacit bond existed, and unquestionably one did and does exist, amongst employers, reprisals on the part of workmen were certain, and the only question was, whether the right of combination should be recognized by the law, or whether the parties who had recourse to it should be driven into secrecy and illegality. But it was not till 1824 that the legislature had sufficient wisdom to repeal the numerous and vexatious acts of parliament by which it had been sought to prevent the union either of masters or workmen. By the celebrated act of that year, the combination of either workmen or capitalists was legalized, so long as the unions refrained from violent interference with persons who might refuse to join them. This act was supplemented by another, passed in 1825, which in effect declared legal all combinations to settle rates of wages or hours of work, and illegal all such as aimed at other methods of controlling employers in the use of capital, or in processes of manufacture. The latest legislation (see COMBINATION) goes further still, declaring combinations legal even when acting (peaceably) in restraint of trade.

A modern trades' union is a rather complex organization. Perhaps the best definition of them is the one given by the Social Science 'Committee on Trade Societies,' appointed at Bradford in 1859, and which published its Report in 1860. The committee included Dr. Farr, Professor Fawcett, Mr. W. E. Forster, and many other well-known names, and its investigations were very searching and valuable. Indeed, its Report is even yet by far the best repertory of facts on the subject. A trade society is therein defined as 'a combination of workmen to enable each to secure the conditions most favorable for labor.' The capitalists accumulations afford him an advantage which the laborer, without association, does not possess. The funds of the union are intended to supply this deficiency. As accessories, the unions collect funds for other purposes, such as benefit societies, insurance of tools, libraries, and reading-rooms; but their trade objects are those with which we are especially concerned. The following means of assisting and defending the trades associated are enumerated by the committee as now in general use—1. Publishing periodically the state of the trade in different parts of the country; 2. Keeping registers of men unemployed and of masters wanting men; 3. Assisting men from town to town in search of employment, and occasionally to emigrate; 4. Regulating the number of apprentices in the trade; 5. Maintaining men in resistance to employers; 6. Regulating number of working-hours, and preparing trade rules; 7. Organizing strikes.

The advocates of the unions insist that they are the only means by which workmen can defend themselves against the aggression of employers. It is argued that the individual laborer has no chance of resisting the capitalist on equal terms; that starvation treads too closely on his heels to permit his successfully opposing a reduction of his wages, however arbitrary or unjust. It is urged that associations of employers are practically universal, and that their object is mainly to secure for themselves the largest possible share of the profits which are the product of capital and labor united. It is further said, that in the event of any depression of trade, the masters invariably attempt to reduce wages; and that when trade improves, they defer as long as possible the restoration of the former rate. Thus, workmen are the first to feel commercial disaster, and the last to benefit by better times. Any attempt to remedy this state of things by individual action would, it is conceived, be abortive.

The capitalist might easily do without the services of any single laborer, while to the latter the loss of employment might be ruin. Association on the part of the employed class becomes, therefore, a necessity, and their organization puts them at once much more nearly on an equality with employers when negotiating either as to rates of wages or terms of labor. That in both these matters there is a constant gravitation against the workman seems to be admitted by most who have considered the subject, and there is difficulty in suggesting any effective resistance to the downward tendency, except that of combination. Unionists point to many regulations in the interests of workmen which combination has enabled them to introduce, and while they freely admit that in numerous instances the contest between labor and capital has resulted in the apparent defeat of the former, yet they assert that, in the long run, most of the points contended for have been gained. They maintain that, in very many trades, they have succeeded in preventing abuses, and that the unions have contributed, more than any other agency, to make 'the workman's life regular, even, and safe.' Further, it is contended that the necessity for strikes will become continually less as organization becomes more perfect and uniform; the just limits of their action will be more fully comprehended; the sufferings and losses of past strikes will act as a warning against too precipitate action in the future, either on the part of masters or men; and that, in the end, the main results of combination will be secured, without the necessity of having recourse to the arbitrament of force, either in the shape of strikes or lock-outs—the latter of which, indeed, is only a strike of the employers against the employed.

Yet it cannot be concealed that against this catalogue of uses may be set many and serious evils. Some unions dislike the exertion of special or superior ability by any of their members, deeming it an injustice to the rest that one should gain higher pay or win a loftier position. In many cases, as a matter of deliberate policy, they set themselves against and discountenance any elevation of the standard of labor, and so act as an effectual bar to the industrial progress of their class. In other instances, strikes are determined upon by unions at times when the position of the market renders success impossible, resulting in severe and prolonged suffering; while in some 'highly skilled and limited trades,' a far higher rate of wages has been enforced for a time than the value of the labor performed would justify, in the end materially checking production, or transferring the industry itself to other countries. The same effect has been produced by the arbitrary enforcement, in some branches of manufacture, of obnoxious restrictions upon the hours and mode of working. Thus, Birmingham lost much of that portion of its hardware manufacture which is now carried on by machinery, in consequence of the resistance offered by the Birmingham artisans to the introduction of machine-labor; and the steel manufacture threatened at one time to migrate from Sheffield, on account of trades' union dictation. There is, moreover, another and serious class of objections. There can be no doubt that unions foster an unfortunate spirit of antagonism. Being constantly and consciously on the defensive, they come at last to suspect evil in every movement, and to put a sinister interpretation on every action of employers.

The special interests of the trade affected are too often the only objects cared for; and narrow, selfish, and unjust regulations are enacted for its supposed benefit. One trade is isolated from another; one class of laborers fences itself off against incursions upon its peculiar territory, and tries, by the limitation of the number of apprentices, the enforcement of objectionable terms of service, and other coercive methods, to remain a close monopolist corporation. It is needless to point out how injuriously such a policy affects the working-classes generally, and what a complete subordination it implies of the general well-being to the desired prosperity of a small and selfish number. In some trades, the practice of coercion has grown into systematic terrorism and crime. The Sheffield grinders and the Lancashire brickmakers began with merely refusing to work with non-unionists; but their methods of procedure have ended in frequent brutal and murderous outrage. The revelations of the special commissions of 1867 are among the saddest contributions to English history.

One of these special commissions—that of Mr. Overend and his colleagues at Sheffield—is of sufficient importance and interest

to warrant rather special reference. Out of about sixty trades' unions in that town, thirteen are proved to have promoted or encouraged outrages of various degrees of criminality, from theft and intimidation up to personal violence and murder. The most ordinary method of coercion in use bears the name of 'rattening,' and it is employed to enforce payment of contributions to the unions, and to compel obedience to their rules. If any workman fall into arrear with his payments, or infringe the rules of the trade to which he belongs, his wheelbands, tools, or other materials of work are secretly removed and held in pledge, until he submits to the requirements of the union. This is done most frequently under the direct orders of the union officers; but sometimes a private member 'rattens' another, who is known to be in some way at issue with his society, and takes the risk of his action being adopted by the remainder.

In the majority of cases, on due submission and a moderate payment, the property rattened is restored to its owner. The practice is defended on the ground that it is the readiest and most effectual means of compelling the regular payment of contributions to the union funds, and of enforcing obedience to union orders. So thoroughly is it understood that rattening is the work of a trade society, that a man whose tools are taken never thinks of applying to the police for restitution; he communicates with the secretary of the union which governs his trade. In cases of contumacy on the part of a member, it is sometimes attempted to saddle his employer with the cost of the rattening, even when he is no party to the dispute, on the ground, that he ought to compel his workmen to comply with the rules of the union. Rattening is generally successful in securing its ends; but if it fail, an anonymous letter is sent to the refractory person, threatening vengeance in the event of further resistance; and in only too many instances, the threats have been carried out to the last extremity. Thus, in 1854, a man named Elisha Parker had his house blown up by gunpowder, his horse was hamstrung, and he himself disabled by a pistol-shot, because he worked with non-union men, after being warned to leave his employment. In 1857, James Linley was shot at and wounded for changing his business of grinding scissors for that of grinding saws, and keeping a greater number of apprentices than the rules of the trade prescribed. As he still persisted, he was shot to death with an air-gun in 1859. At other times, powder has been mixed with filings or other materials near the working apparatus of obnoxious persons, who have often suffered serious injuries from its explosion. The list of outrages, fatal and other, might be largely extended; but those we have given are not unfair representatives of the whole. It is only fair to add that of late years the evil pre-eminence of Sheffield has not been so obvious, but the old spirit occasionally asserts itself still, though happily in somewhat milder forms.

The bellows-cutting by the chainmakers of the midland districts, during their strike of 1859, is somewhat analagous to the rattening at Sheffield; and disclosures of similar practices were made at the inquiry before Mr. Pickering and others in Manchester, also, in 1867. We have not space to go into detail; but the examples of Sheffield, Dudley, and Wolverhampton were faithfully repeated. Powder explosions, personal injuries, the wholesale destruction of bricks by trampling upon them while soft, a shed destroyed by naphtha, the insertion of needles into the clay, so as to disable the workmen; such were among the characteristic confessions made by the witnesses. Among other reasons given for a strike was one that an employer had himself 'set a brick,' a task expressly reserved for brick-setters; and among the restrictions on trade was one forbidding the use in Manchester of bricks not made within the Manchester district, a circle about eight miles across.

Although in very many instances strikes have been begun and concluded without the intervention of trades' unions, yet, as a matter of fact, all the more notable strikes have either been organized by them, or had their direct support; and of late, the tendency has been to associate the unions of different trades into one body, so far as this particular policy is concerned. This article would therefore be incomplete without a brief reference to some of the more remarkable contests between masters and workmen.

Among the leading strikes, few, if any, have occupied the attention of the public more than the struggle between the Amalgamated Society of Engineers and their employers, which took place in 1851—1852. It originated in the determination of the workmen to abolish piecework and overtime. The dispute was further complicated through a demand made by the mechanics at Messrs. Hibbert & Platt's works, in Oldham, insisting that certain self-acting machines in use there should be attended to by skilled laborers only. Thirty-four Lancashire firms entered into a written agreement to meet any action on the part of the men by the immediate closing of their establishments, which furnished employment to 10,000 people. A similar resolution was adopted by the master engineers of the London district. The men left work on the 1st of January 1852, and the works were formally closed on the 10th. The strike virtually ended on the 30th March, when the men conceded the points in dispute, with the exception of an obnoxious declaration insisted upon by the masters, that none of the men employed should, for the future, either directly or indirectly support trades' unions. The cost of the strike is understood, besides the enormous loss of wages, to have exceeded £40,000, including moneys contributed to non-society men. Great numbers of the men emigrated, and fearful suffering was endured by thousands of families. The Amalgamated Society still exists, and is one of the most extensive and powerful organizations in the interest of labor in the world. In 1852, after its failure in the great struggle, it started with 7000 members. In 1860, its members exceeded 17,000, and in 1881 they numbered 46,101. The total income of the society for 1881 was £124,109, and its accumulated funds were £145,957. It has branches in every part of the world where English engineers are employed.

The strike of 1853 in the cotton trade at Preston was also met by a lock-out. About 18,000 people were thrown out of work. The struggle lasted seven months, and during its progress public feeling was keenly roused. The 10 per cent. advance in wages contended for was successfully resisted by the masters, the last chances of the work-people being destroyed by the depression of trade consequent upon the outbreak of the Russian war. The cost of the strike to the workmen and their friends, in actual money paid, was £105,000.

In 1859, there occurred a strike and lock-out in the building trades of London. The object of the strike was to reduce the working day from ten to nine hours, the existing rate of wages being retained. It was met by the simultaneous closing of 225 building establishments, at which 24,000 men were employed. The contest lasted for nearly seven months, and ended in the surrender of the men, after an enormous loss in wages and trade funds. No less than £23,000 was contributed by other trade societies, in aid of the men concerned in this dispute.

The mining trades—coal and iron—have within the last few years shown marked triumphs of labor over capital. The great Forest of Dean and South Wales strikes in the coal-trade terminated at the beginning of 1873, substantially in favor of the employed. Yet there are some later facts which tell the other way. A determined strike of the Edinburgh book-printers (1872—1873), for the 51 hours limit, which lasted 13 weeks, terminated in favor of the employers. Notwithstanding the absolute necessity which exists for coal in a climate and a manufacturing country like ours, and the close unions maintained by the working colliers, the coal-masters have succeeded in maintaining the upper hand, and wages are sinking back towards the old level, though now they will probably always remain at a somewhat higher point than they had reached up to 1872. The failure of the farm-laborers in 1873—1874 to carry their struggle to a successful issue, even under the singularly able leadership of Mr. Joseph Arch, and notwithstanding the fact that large numbers were assisted to emigrate, so reducing the competition for employment upon which the farmers relied for victory, is another proof that triumph is not always with the men. It is only right to add that the men could scarcely be expected to succeed in their first organized attempt against a system centuries old.

Only a small proportion of existing trades' unions have registered themselves in accordance with the Act 34 and 35 Vict., cap. 31; yet the report of the Registrar of Trades' Unions showed in 1881, 179 registered trades' unions, with 200,370 members, an income of £228,211, and a fund of £258,663.

The nine-hours movement created great excitement for a time, but was practically settled in favor of the labor-classes. The first strike for it was by the Edinburgh masons in 1861. After an exhaustive struggle, the masters yielded the men's demand for a limit of 51 hours a week. Agitation was kept up by different trades in succession; and ultimately the hours of labor were generally so fixed. But in 1878 a disposition to insist on 54 hours was manifested by employers in various quarters.

The lowering of the franchise to household suffrage has lent a new significancy to trades' unions. They have now become a great power in politics. There is the Trades' Congress, which holds an annual conference in the different leading towns, and discusses questions affecting the interests of labor. They have not yet begun to publish transactions; but, no doubt, they soon will, for this congress is undoubtedly to be one of the controlling social powers of Great Britain. It appoints a committee every year, which sits in London, to look after the acts of parliament and other public movements affecting trade. Another object they contemplate is to get working-men returned as members of parliament; and this they have at last accomplished by the election to the parliament of 1874 of Mr. Alexander Macdonald for Stafford, and Mr. Thomas Burt for Morpeth.—Mill's *Political Economy; Report of the Social Science Committee on Trades' Societies*, 1860. For recent legislation on the subject of trades' unions, see the article COMBINATION.

TRADE-WINDS. See WINDS.

TRADI'TION. See RULE OF FAITH; INFALLIBILITY.

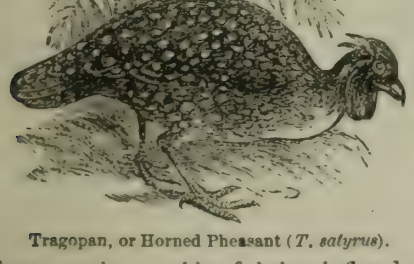
TRADU'CIANISM (Lat. *traducianismus;* from *tradux*, a 'vine-layer' for propagation), one of the theories adopted for the purpose of explaining the production of the soul in the procreation of the human species. The theory known as traducianism is ascribed to Tertullian as its first author; and is elaborately explained and defended by him in his book *On the Soul*, written after he had lapsed into the Montanist heresy. In opposition to others who had held the theory of the pre-existence of souls, of which pre-existing souls one is divinely infused, or, by some natural affinity, is attracted into each fœtus as soon as it has been formed by generation in the procreation of man, Tertullian taught that souls are propagated by souls as bodies by bodies, and by the same or a simultaneous process. In another place he describes this origin of soul from soul as generation, and even of a class analogous to corporeal generation; and this more gross and material exposition of the theory of traducianism is sometimes called *Generationism;* which, however, is commonly looked upon as a totally distinct theory. A third hypothesis as to the origin of the soul suggested that, in the propagation of the human species, whenever a human body is formed by generation, the soul which is to animate that body is created, and by divine power infused into it. This theory is called *Creationism*. The discussion of these theories in the 4th and 5th centuries was much promoted by the controversies on Manichæism. See MANICHÆANS.

TRAFA'LGAR, CAPE, a low promontory on the south coast of Spain, about 29 miles west-north-west of Tarifa (q. v.), on the Straits of Gibraltar. It is memorable for the great naval victory obtained (Oct. 21, 1805) by the British fleet under Nelson, over the combined fleets of France and Spain, under the French commander Villeneuve and two Spanish admirals. The British force consisted of 27 sail of the line, 4 frigates, 1 schooner, and 1 cutter; the force of the French and Spaniards united amounted to 33 sail of the line, 5 frigates, and 2 brigs. It may be remarked that the largest of the enemies' ships carried 30 guns more than the largest of the British ships. The engagement resulted in a splendid victory for the British, who captured nineteen of the enemies' ships. The victory, however, was gained at the cost of the life of the greatest of English admirals. See NELSON.

TRA'GACANTH. See GUM.

TRA'GEDY. See DRAMA.

TRA'GOPAN, a genus of birds of the family *Phasianidæ*, having the head crested, but naked on the cheeks and around the eyes; a horn-like caruncle projecting backwards from behind each



Tragopan, or Horned Pheasant (*T. satyrus*).

eye; and a loose wattle, capable of being inflated, hanging beneath the bill. The tarsi are armed with a blunt spur in the male, unarmed in the female. The species are few, and are natives of Asia. They are birds of beautiful plumage, somewhat resembling pheasants, but of more bulky form, and with rounded tails of moderate length. The first-known species (*T. satyrus*) has been called the *Horned Pheasant*. It inhabits the higher parts of the Himalaya, Tibet, and some of the mountainous provinces of China. The tragopans seem particularly deserving of attention, as capable of acclimatization in Britain, and probably of domestication.

TRAIN-BANDS (or, more properly, TRAINED BANDS), a force of militia, and not differing essentially from that force, substituted by James I. for the old English Fyrd, or national militia. The train-bands of London were chiefly composed of apprentices; and their unruly doings formed the subject for many facetious plays and tales. In the civil wars, the train-bands sided with the Parliament; and Charles II. restored the militia on its old local footing.

TRAINING, applied in a Sporting sense, implies the acquisition of the most vigorous and perfect health, and is used alike in reference to men, horses, and dogs. An individual is said to be trained 'in condition,' when he has by certain processes rendered his frame as fit as it is possible for it to be, for performing some feat of strength or endurance—such as undergoing a pugilistic encounter, a wrestling match, or a trial of speed, or any other prolonged exertion. To accomplish this end, a long course of training is often gone through, in many instances of a very severe nature. It being necessary to divest the muscles of every particle of fatty tissue which can possibly be got off without direct injury to the health, it often happens that many pounds of flesh are required to be dispersed, and the most severe and continued exertion, the body being wrapped in thick suits of flannels, denominated 'sweaters,' is necessary. Constant hard and sharp exercise in this fashion, combined with rigid abstinence, and a strict regard to other established laws of the art, are a *sine quâ non* in getting the body into the height of condition. For example, however thirsty the person training may be, after perhaps ten miles' rapid walking in a triple suit of sweaters, he must drink but very sparingly, for although he may have taken off pounds of flesh by profuse perspiration, one glass of ale would undo the whole effect. Great attention to diet is necessary. Indeed, much of the system may, as a modern writer has aptly expressed it, be laid down in the resolute performance of the three cardinal virtues—temperance, soberness, and chastity. Almost the same course is pursued towards animals; and whether for hunting or racing, horses and dogs have to submit to a course of training to bring them into condition.

Lately, the Turkish bath, as a means of procuring the necessary reduction of flesh without such excessive labor, has been found a most efficient ally in training. Out of condition, the muscles are flabby, confused, and coated with fat; the skin dead and lifeless; the eye dull and heavy; the lungs laboring, and the movements slow. In condition, the muscles stand out hard, clear, and defined; the tendons show like cords; the skin is clear and ruddy; the eye bright; the lungs play with unrestrained freedom; and the whole frame is endued with vigor and perfect activity. See Maclaren's *Training in Theory and Practice*.

TRAINING COLLEGES. See NORMAL SCHOOLS.

TRA'JAN'S COLUMN, a celebrated column at Rome, which was reared, 114 A.D., by the Roman senate and people, in honor of the Emperor Trajan. It is considered not only the greatest work of its architect, Apollodorus, but one of the noblest structures of its kind ever erected. The pedestal is covered with bas-reliefs of warlike instruments, shields, and helmets; and a very remarkable series of bas-reliefs, forming a spiral round the shaft, exhibits a continuous history of the military achievements of Trajan. These are in excellent preservation, and, independently of their beauty as works of art, they are invaluable as records of ancient costume. A spiral staircase in the interior of the column leads to its summit. The height of the entire column is 132 feet. It still stands erect in all its ancient beauty amid the ruins of Trajan's forum. The summit was originally crowned by a colossal statue of the emperor, which has been incongruously replaced by one of St. Peter.

TRAJAN'S WALL, a line of fortifications stretching across the Dobrudscha from Czernavoda, where the Danube bends northwards to a point of the Black Sea coast near Kustendji. It consists of a double, and in some places a triple line of ramparts of earth, from 8¼ to 11 feet in height on the average (though occasionally it attains an altitude of 19½ feet), bounded along its north side by a valley, which, being generally marshy, and abounding in small lakes and pools, serves admirably the purpose of a fosse. This valley was long erroneously supposed to have been at one time the channel by which the Danube emptied itself; and a scheme for utilizing it by the construction of a canal to provide a more commodious water-communication with the Black Sea, in lieu of the long and troublesome navigation by the Sulina mouth, has been frequently mooted, and is undoubtedly quite practicable; but the cost of the undertaking has hitherto been a bar to its execution. During the war of 1854, Trajan's Wall became an important line of defence on the invasion of the Dobrudscha by the Russians, and the invaders were twice defeated in their attempts to pass it—at Kostelli (10th April) and Czernavoda (20—22d April).

TRAJA'NUS, MARCUS ULPIUS, Roman emperor, was born at Italica (Alcala), near Seville, 18th September 52 A.D. He was descended from a family which was probably of Roman origin, and was early trained to arms, becoming a prominently successful leader in the Parthian and German campaigns, during the reigns of Titus and Domitian. He was rewarded for his valuable services by promotion to the offices of prætor and consul (91 A.D.), and was ultimately adopted (97 A.D.) by Nerva (q. v.) as his colleague and successor. T. became sole ruler in January of the following year, and celebrated the event of his accession by the usual largess to the soldiers, which gift his liberality prompted him to extend also to the Roman citizens and their children; and he made large provision out of the imperial treasury for the upbringing of the children of poor freemen in Rome and other Italian towns, with the view of encouraging the increase of the population.

In 101 A.D., Rome, for the first time, beheld its emperor leading forth his legions in person on a career of conquest, when T. set

out on his first campaign against the Dacians who had exacted tribute from Rome since Domitian's time. The struggle was long and destructive; the emperor's opponents were valiant warriors, and headed by an able leader, their monarch, Decebalus; but the Romans at last gained a decisive superiority; and in a subsequent campaign (104—105) completely subdued their opponents, whose country thenceforth became the Roman province of Dacia, and was secured by partial colonization. This conquest, the first since the death of Augustus, was celebrated, on T.'s return to Rome, by a triumph, and by games on a most extensive scale, which continued for four months. Thirst for dominion again impelled T. to the east in 106 A.D. Landing in Syria, he marched northwards, received on his way the submission of numerous princes, possessed himself of Armenia, which he made a province of his empire, and hugely gratified the Roman senate with long lists of monarchs, never before heard of, who had bowed to their sway. The record of the events of the next seven years of T.'s reign is extremely defective, the few notices in Dion Cassius and others being insufficient for the construction of a consecutive narrative. In 115 A.D., he again set out from Syria, directing his march this time against the degenerate Parthian Empire; took Ctesiphon almost without a struggle; and descending the Tigris, and subduing the tribes on both banks, became the first and only Roman general who navigated the Persian Gulf. On his return, he found that, like the bent reed which recovers its position when relieved from pressure, the peoples of Mesopotamia, North Syria, and Arabia required to be again and more thoroughly subdued. This being done, and Parthia again conquered, T., sinking under a combination of dropsy and paralysis, which had long afflicted him, attempted to reach Italy, but was overtaken by death at Selinus, in Cilicia, August 117. Though most of T.'s reign was spent in the gratification of his warlike ambition, the internal administration was far from being neglected; the administration of justice was vigorous and impartial; that of finance was equally acceptable; informers (*delatores*) were severely punished, and peculating governors of provinces rigorously prosecuted.

The improvement and beautifying of Rome—a favorite occupation of the emperors—was carried on: the empire was traversed in all directions by new military routes, canals and bridges were constructed, new towns built, the Via Appia was restored, the Pontine Marshes partially drained, the magnificent 'Forum Trajani' erected, and the harbor of Centum Cellæ (Civita Vecchia) constructed. Even if there were not abundant evidence of the sincere desire of T. to increase the comfort and happiness of his subjects, the customary wish formally uttered on the occasion of an emperor's accession, that he might be 'happier than Augustus, better than Trajan' (*Augusto felicior, Trajano melior*), would of itself suffice for proof. During T.'s reign, a persecution of the Christians, of a mild character, took place; and taking into account that T. almost necessarily shared the general belief that Christianity was a perilous species of fanaticism, his conduct towards them deserves, perhaps, to be entitled moderation.

TRAJE'CTORY, in Mathematics, is any plane curve which cuts at a given angle a series of plane curves of the same species and having a common origin. In Mechanics and Astronomy, it denotes the path described by any body projected into space, and continuously acted upon by constant or varying forces; thus, the trajectory of a body projected obliquely for a little distance above the earth, is approximately a parabola (it would be accurately so, were space void, and the center of gravity of the earth infinitely distant), and the trajectories of the planets are approximately ellipses; the term, however, was long, in astronomy, exclusively applied to the paths of comets.

TRALEE', a seaport and parliamentary borough of Ireland, chief town of the county of Kerry, stands on the river Lee, about a mile from the point at which it enters the sea, 162 miles west-south west from Dublin, with which it is connected by the Great Southern and Western and Killarney Railways. The pop. in 1871 was 9506, of whom 8563 were Roman Catholics, and 746 Episcopalians; in 1881, 9664. The first origin of T. was due to the building of a castle, and the foundation of a Dominican convent by the Geraldine family, in 1213; and somewhat later a considerable House of the order of Templars was established. The borough is under the management of commissioners, who dispose of a revenue amounting to above £2000. It returns one member to the imperial parliament. The town is well built, and possesses many public buildings. A large traffic in grain and agricultural produce is carried on, the annual exports amounting to £200,000, and imports to about £150,000. There is a ship-canal, by which vessels discharge their cargoes close to the town.

TRAM. See SILK.

TRA'MMEL-NET, a kind of net resembling the drift-net used in the Herring-fishery (q. v.), but anchored and buoyed at each end, the back-rope supported by small cork-floats, and the foot-rope kept close to the ground by weights. The length varies from twenty to three hundred yards. A variety of trammel-net, chiefly used in the west of England and in Guernsey, consists of three long nets fastened together at top, bottom, and ends. The two outer nets are each five meshes deep, the meshes ten inches square; the middle net is twice as long and deep as the outer ones, but the excess at the edges is gathered in and united all round with the other nets. The outer nets stand with their meshes square and opposite one another, and a fish, in passing through the first net, meets the second or middle net—which, being slack, yields to the pressure—and is carried through the opposite large mesh of the third net into a loose bag or pocket, from which it cannot escape. This net is much used for taking red mullet, and in some parts of Cornwall is called a *tumbling-net*.

TRAMWAY. See RAILWAYS.

TRANCE, or MORBID SLEEP, differs from natural repose in duration; in profound insensibility to external impressions; in following excitement and the exaltation of certain instincts, chiefly the religious and amative, rather than fatigue and exhaustion; and in being the concomitant or symptom of diseases of the nervous system. The attitude, aspect, lowered respiration, and circulation of the entranced, resemble those of the sleeper. But there are many exceptions to this observation. A girl who remained dormant for 13 years, although she grew from a child to a woman in that time, was corpse-like in appearance, had locked-jaw, and there was all but a total suspension of the signs of life. But while an individual cannot be roused from this condition by the most powerful stimulants, an electric shock, or even, it is affirmed, by a surgical operation, thought or dream goes on uninterruptedly, and is more continuous and coherent in character than what takes place in ordinary sleep. So connected and real do these visions appear to the ecstatic, that they are generally accepted as true events, revelations, or impressions, received during a brief visit to another world. Trance has occurred epidemically during periods of great religious fervor and superstition; and whole classes of persons are described as having preached while asleep, in the insurrection of the Cevennes. A similar phenomenon was observed in 1865 in those affected by hysteromania at Morzine, in Savoy. The affection has been divided, according to the intensity of the symptoms, into (1) *Death-trance*, where neither the heart nor lungs act; where the temperature of the body falls; where no sustenance is taken, and the inner dream-life is the only vestige of vitality. Engelbrecht, who was subject to trance, wrote a book descriptive of this inner life, during which he believed himself to be transported to supernatural, if not to heavenly regions. (2) *Trance-coma*, where the breathing and action of the heart are feeble, but perceptible; the joints flexible; but where the external senses are not awake, and where the patient cannot be roused. (3) *Trancesleep*, where, except in the insensibility to external stimuli, and in the length of the suspension of volition, little abnormal is noticed. As these states often succeed hysteria, nervous and other diseases, the bodies of the supposed dead are for a time, in certain countries, so placed as to be watched, and in circumstances favorable to resuscitation.—Mayo, *On the Truths contained in Popular Superstitions;* Figuier, *Histoire du Merveilleux.* See also the articles CATALEPSY, HYSTERIA, ANIMAL MAGNETISM, in this work.

TRA'NI, a maritime city of Southern Italy, in the province of Terra di Bari, 25 miles north-west of the town of Bari. Pop. (1881) 21,173. It is surrounded by a wall with towers and moats, and entered by three gates. T. is an archbishop's see, and has a handsome cathedral, convents, a court of appeal, a theater, and a strong castle. The streets are wide, well built, and paved with flagstones. There is a handsome square. A considerable trade in oil, wine, corn, and cotton, which last is also manufactured here, is carried on.

T. comes first into notice when it submitted to the Normans in 1053. It was then the chief town of a vast county, and was an important harbor in the time of the Crusades. Under the kingdom of Italy, it has again begun to prosper, and promises once more to become an emporium of the commerce of the Levant, as it was in the middle ages.

TRANQUEBA'R, a corruption of *Tallangambadi*, a seaport town on the east coast of British India, 155 miles south of the city of Madras. It stands on a small bay, and is backed by a well-wooded and cultivated country; is a healthy station, much cooler than Madras, and has therefore been made a convalescent dépôt. The town is surrounded by walls, with bastions, and is further protected by the fort of Dansborg. The territory of T. embraces 15 sq. m., and produces rice, the cocoa-nut and other palms, the mango, and a variety of fruits. The town itself contains about 25,000 inhabitants. The territory passed finally into the hands of the English—the Danes having been its former possessors—in 1845.

TRANSCAUCA'SIA, the tract of territory belonging to Russia, and extending between the Caucasus (q. v.) on the north, and Turkey in Asia and Persia on the south. The provinces on both

sides of the Caucasus, with the New Armenian districts, constitute Caucasus or Caucasia in the widest sense, and are under one central authority, with 14 minor governments or provinces. But the government is sometimes divided into North Caucasus, Transcaucasia, and Armenia. Transcaucasia comprises eight governments.

TRANSCENDE'NTAL, TRANSCENDENT (*transcendentalis, transcendens*), words employed by various Schoolmen, in particular Duns Scotus, to describe the conceptions that, by their universality, rise above or transcend the ten Aristotelian Categories (see CATEGORIES). Thus, according to Scotus, *Ens*, or Being, because it is predicable of Substance and Accident alike, of God as well as of the World, is raised above these by including or comprehending them; it has the same relation to the sum of the Categories, as the *summum genus* to the various genera within a single category—Relation (*summum genus*) to the classes of Related things (included genera). Further, the predicates assumed by Scotus to belong to *Ens*, or simple existence; viz., the One, the True, the Good—*Unum. Verum. Bonum*—are styled transcendent, because applicable to *Ens* before the *descent* is made to the ten classes of real existence. In later times, since Kant, the word Transcendental has been largely used as equivalent to the philosophical meaning of *à priori*. See COMMON SENSE, INSTINCT.

Between the hitherto convertible terms, Transcendental and Transcendent, Kant himself drew a distinction, of considerable importance in understanding his own system. By the word 'Transcendental,' he designates the various forms, categories, or ideas assumed to be native elements of human thought; implying that, although they are not products of Experience, they are manifested only in experience; such are Space and Time, Causality, &c. The word 'Transcendent,' Kant reserves for those among the transcendental or *à priori* elements that altogether transcend experience. They may seem to be given in experience, but they are not really given. Such are the 'Ideas of the Pure Reason,' God, an Immaterial Soul, &c. Transcendental elements, when legitimately applied to experience, as Causality and Relation, are called Immanent.

TRA'NSEPT, the projecting wings on the north and south sides of a church, forming the smaller arms of the cross, in the ground plan of cruciform churches.

TRA'NSFERENCE, in the Law of Scotland, means the step by which a pending suit is transferred from a person deceased to his representative.

TRANSFU'SION OF BLOOD has been regarded as a recognized and legitimate operation in obstetric surgery since the year 1824, when Dr. Blundell published his well-known work, entitled *Physiological and Pathological Researches*. The operation had, however, been vaguely known to the medical profession for the last four centuries; and there are obscure allusions in the Roman poets, which would seem to indicate that it was practised as early as the Augustan age:

> Ut replesm vacuas juvenili sanguine venas.
>
> *Ovid.*

The earliest authentic case on record is, so far as we know, that of Pope Innocent VIII., who was unsuccessfully operated on in April 1492. 'The vital powers of Innocent VIII. rapidly gave way; he had for some time fallen into a kind of somnolency, which was sometimes so profound that the whole court believed him to be dead. All means to awaken the exhausted vitality had been resorted to in vain, when a Jew doctor proposed to do so by the transfusion, by a new instrument, of the blood of a young person—an experiment which had hitherto only been made on animals. Accordingly, the blood of the decrepit old pontiff was passed into the veins of a youth, whose blood was transferred into those of the old man. The experiment was tried three times, and at the cost of the lives of three boys, probably from air getting into their veins, but without any effect to save that of the pope.'—Villari's *Life of Savonarola*.

Although Libavius, in 1615, accurately describes the operation, there is no evidence that he ever practised it. Passing over various experiments by Wren and Lower (both of Oxford) in the transfusion of blood from one animal to another, we find Denys of Montpellier, in June 1667, injecting the blood of calves into the veins of a young man who had been much weakened, and had become torpid and slightly dropsical, in consequence of repeated bleedings. The first operation restored him to perfect health. Subsequent cases of his gave rise to a most virulent controversy, which ended with the decision, 'that for the future, no transfusion should be made upon the human body but by the approbation of the physicians of the Parisian faculty.' In November of the same year, Lower publicly made a similar experiment, which seems to have been successful; and in the following year, Riva and Manfridi repeated the experiment in Italy. But the operation, although thus fairly started, soon fell into obscurity, doubtless from a want of success, due partly to the blood of calves and sheep, instead of human blood, being used, and partly to hopeless cases of old age and decrepitude being selected for its application.

At the present day, transfusion is an operation which is almost always restricted* to cases of profuse hæmorrhage in connection with labor; and as Dr. Playfair, in his excellent *Handbook of Obstetric Operations* (Lond. 1865), observes: 'The benefits derived from it are probably twofold: 1. The actual restitution of blood which has been lost; and 2. The supply of a sufficient quantity of blood to the heart, to stimulate it to contraction, and thus to enable the circulation to be carried on until fresh blood is formed. Its stimulant action is probably of far the most importance; and if the operation is performed before the vital energies are entirely exhausted, the effect is most marked, and indeed may be said to be almost unfailing.'—Pp. 212, 213. Blundell was in error in believing that the blood of animals of the same species was essential; Dr. Brown-Sequard having since shown that the blood of various animals can be used indiscriminately provided only certain precautions are taken; and the important† discovery has recently been made by Panum, that defibrinated blood is in every respect as well suited for the operation as pure blood.

'The cases suitable for the operation,' says Dr. Playfair, 'are those in which the patient is reduced to an extreme state of exhaustion from hæmorrhage during or after labor or miscarriage. The operation will not come into contemplation until other and simpler means have been tried and failed, and when the symptoms indicate that life is on the verge of extinction.' The value of the operation in suitable cases is proved by statistical evidence. Mr. Soden of Bath has recorded 36 cases, in 29 of which the patients were rescued from an apparently hopeless state; and out of 57 cases recorded by Professor Martins of Berlin, 43 were entirely successful, and 7 temporarily so. Of the various syringes that have been invented for this operation, Dr. Playfair gives the preference to that of Dr. Graily Hewitt. The blood to be injected should be taken from the arm of a strong and healthy man who can spare a sufficient quantity, since a change of persons leads to delay, and should therefore be avoided. Generally speaking, from four to six ounces of blood are sufficient, but more may be required. It would be out of place to enter, in these pages, into details regarding the mode of performing the operation. They are fully described in Dr. Playfair's work.

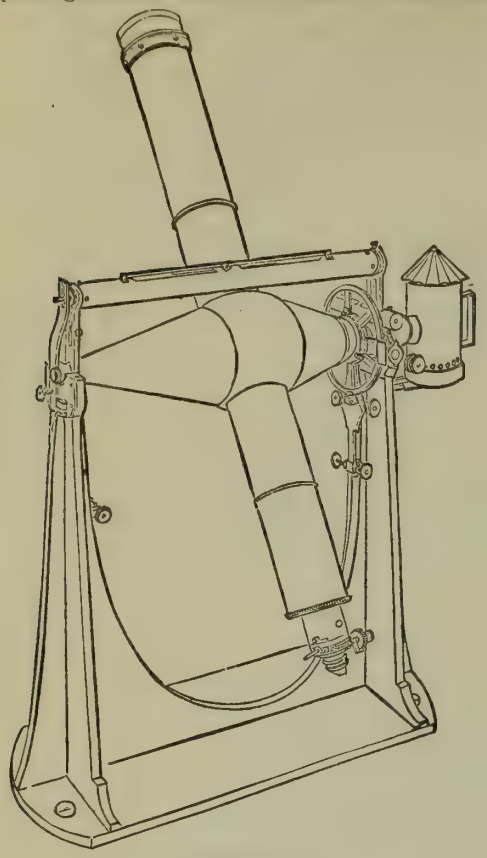
TRA'NSIT-INSTRUMENT, one of the most important of astronomical instruments, consists of a telescope fixed to a horizontal axis, so as to revolve in the plane of the meridian, and is employed, as its name denotes, in the observation of the meridian transits of the heavenly bodies. The axis, which is the most important part of the instrument, and thus demands the utmost care in its construction, consists of a hollow sphere or cube, to opposite sides of which are tightly fastened the bases of two cones in whose apices the pivots are screwed; the sphere or cube is pierced for the admission of the telescope, which is firmly soldered at right angles to the axis. One of the pivots is hollowed so that a stream of light can be directed from a lantern half way along the interior of the axis, and through an aperture in the side, into the telescope tube, where, being received by an annular mirror, set at 45° to the axis and telescope tube, it is directed to the eye-piece, and brilliantly illumines the field of view, while the annular form of the mirror prevents any interference with the passage of rays from the object under observation to the eye. The pivots must be very carefully turned to a perfectly cylindrical form, and fitted into the instrument, so that their axes are accurately in line.

One extremity of the axis carries one and sometimes two small graduated circles, each supplied with index, clamping screws, and vernier; these circles are capable of indicating angular measures to within 1′ or 2′. The pivots rest on massive blocks of stone or other stable material which is little affected by change of temperature, stability being the great mechanical essential of the instrument. This condition satisfied, there are three adjustments necessary before a transit can be observed: the axis must be horizontal; the line of collimation must be at right angles to the axis of motion; and the latter must be placed so as to point accurately east and west. On the perfection of the first two of these adjustments depends whether the telescope sweeps over a great circle of the sphere, and the third is necessary to insure that this great circle shall be the meridian of the place of observation. These adjustments can never be made quite perfect, and the usual mode is to investigate the amount of error in each, and allow for it in the apparent result. To note accurately the instant of time by the astronomical clock at which the object (e. g., a star) is seen to pass the center of the field of view, is the essential part of a tran-

* A case has lately been recorded in which it proved successful in a case of coma from the fumes of carbonic oxide and carbonic acid; and it is not improbable that it may again come into more general medical use.

† Dr Markham has, we believe, suggested the trial of transfusion of blood in cases of the cattle disease. As it would be impossible, without danger, to bring a healthy animal in contact with a diseased one, the value of Panum's discovery, provided the proposed remedy be successful is obvious. The blood of healthy oxen, killed for the market, could be defibrinated by whipping and straining, and would remain fit for injection, when raised to the normal temperature, for many hours.

sit observation. The most effective method is to register the beats of the clock by an apparatus, which, at the end of each oscillation of the pendulum, marks a dot upon a uniformly moving slip of paper. This is effected by the agency of electricity, and is one of its most valuable contributions to astronomical science. At a certain point in each oscillation of the pendulum, it becomes part of a complete galvanic circuit, the contact being immediately



Transit Instrument.

broken by its progression in its oscillation; and it is at these points that the galvanic agency causes the dot to be made.

The instant of a transit's occurrence is similarly noted by the observer, who, by a tap on a break-circuit key fastened to the side of the transit-instrument, causes the graver to make an extra dot; and the distance of this dot from the previous seconds one, compared with the distance between two seconds dots, gives the time accurately almost to $\frac{1}{100}$th of a second. Various ingenious modes of registering have been proposed, all founded on the above principles. It is from the times of transit of the several heavenly bodies thus accurately observed, that their right ascensions are determined.

The transit-instrument was invented by Römer about 1690, and first described in 1700, in the *Miscellania Berolinensia*, vol. iii. One was erected in Greenwich Observatory by Halley in 1721; but it was little used till 1742. The present instrument in that observatory is by Troughton, and was erected in 1816.

TRANSI'TION, a term employed at first by Werner to designate rocks having a mineral character intermediate between the highly crystalline or metamorphic rocks and ordinary sedimentary deposits. As these rocks, in the region where the Wernerian classification originated, had a definite relation to the inferior and superior strata, and contained a uniform series of fossil remains, the term gradually came to have a chronological meaning. It was employed to designate similar deposits wherever they occurred. But a more enlarged view of the sedimentary deposits in the different countries of Europe, exploded the idea of a transition either in mineral structure or organic contents being characteristic of any set of beds, and caused the Transition series to be more accurately classified as Cambrian, Silurian, and Devonian strata.

TRANSKEI TERRITORY is a dependency of the Cape Colony, lying between the Great Kei River (which is the boundary of British Kaffraria) and the borders of Natal. It includes Fingoland, the Galeka country, and No Man's Land. The coast districts from the Umlata to the Natal frontier are still independent, though surrounded, except to seaward, by British territory.

TRANSMIGRA'TION, or the passing from one place, state, or condition into another, means, in the theological acceptation of the term, the supposed transition of the soul after death into another substance or body than that which it occupied before. The belief in such a transition is one of the most important phases in the religions of mankind. It was common to the most uncivilized and the most civilized nations of the earth; it was the object of fantastical superstition, as well as that of philosophical speculation, and it is the property of both ancient and modern times. Its basis being the assumption that the human soul does not perish together with the body, it could belong to those nations only which had already conceived an idea of the immortality of the soul; but in proportion as such an idea is crude or developed, as it is founded merely on a vague fear of death, and a craving for material life, or on ethical grounds, and a supposed causal connection between this and a future life, the belief in transmigration assumes various forms, and influences more or less the actions of men.

The lowest forms of this belief are probably those met with among several tribes of Africa and America, which hold that the soul, immediately after death, must look out for a new owner, and, if need be, enter even the body of an animal. Several negro tribes entertain this belief; they assume that the soul will choose with predilection the body of a person of similar rank to that of its former owner, or a near relation of his; and they frequently therefore bury their dead near the houses of their relatives, in order to enable the souls of the former to occupy the newly-born children of the latter, and the princely souls to re-enter the princely family; and until the soul is thus accommodated, milk, brandy, and food are placed on the grave of the deceased, to keep it, as it were, from starving; and sometimes holes are dug in the grave, to facilitate the soul's egress from it. In North America, some tribes slaughter their captives, to feed with their blood such souls in suspense. The negro widows of Matamba are especially afraid of the souls of their husbands, for at the death of these they immediately throw themselves into the water, to drown their husbands' souls, which otherwise, as they suppose, would cling to them. The natives of Madagascar seem to have invented a kind of artificial transmigration, for in the hut where a man is about to die, they make a hole in the roof, in order to catch the outgoing soul, and to breathe it into the body of another man on the point of death. From these and instances of a similar kind, it will be seen that nations which entertain such a belief in transmigration, assume that the souls of the deceased must continue to dwell upon earth, and that one human being may be possessed of several souls. With them, the final destination of the soul is a matter of comparative indifference; its transition from one body into another a mere matter of chance, devoid—apparently, at least—of any ethical principle, and therefore without any moral effect on the living, except, perhaps, that of a stolid indifference to death, as often manifested in the plantations of the West Indies, where negroes hang themselves, in the belief that their souls will migrate into other countries, and there enjoy a happier life.

Another, more poetical, and in some respects also, more ideal form of this belief in transmigration, is that which occurs in Germanic mythology, and is still entertained in some parts of Germany and England. According to it, the soul, before entering its divine abode, assumes certain forms, or animates certain objects, in which it lives for a short period. Thus, it is supposed to enter some flower or tree, a rose, a vine, a plantain, a pine-tree; or to animate a butterfly, a pigeon, and sometimes also—if a person dies while enchanted or sleeping—a serpent, a weasel, or a mouse. The most popular form of these supposed transmigrations, however, is that of a pigeon, a representation of which bird, therefore, often occurs on the oldest tombstones. When the robber Madej, for instance, under an apple-tree confessed his crimes, one apple after another, transformed into a white pigeon, flew into the air. They were the souls of the persons murdered by him; only one apple remained, because he had not yet confessed the murder of his father; but when he did so, the last apple also—the soul of his father—assuming the shape of a gray pigeon, flew after the rest.

Different from this kind of belief in transmigration is that which is based on ethical grounds. It proceeds from the theory that the human souls, being of divine essence, are originally pure, but during their earthly career, lose of their purity; being destined, however, to regain their original quality, are reborn again and again, until they have become free from fault, and thus worthy of re-entering the place of their origin.

A belief of this nature was entertained by the old Mexicans, and probably also the Druids. It is met with in a more developed form with the old Egyptians; but its real importance it obtained as a tenet of the religion and philosophy of the Brahmanical Hindus and the Buddhists, whence it passed into the doctrine of several philosophers of ancient Greece, and into that of some Jewish and Christian sects.

The ethical and philosophical value which such a belief may have, is necessarily relative. It will depend on what a religion or philosophy may call right or wrong, virtue or sin; it will likewise

depend on the notions which religion or philosophy may entertain on the origin of the human soul, on the cause of its first birth, and on its ultimate destination, whether this destination is the merging of the soul into the essence of its Creator, or a personal immortality; and again, the mode in which such a personal immortality is conceived, will also necessarily influence the mode in which transmigration is supposed to take place.

Where the ideas on these questions have remained crude, the idea of transmigration, too, is but of little ethical or philosophical worth. The old Mexicans imagine that the gods *Ometeuctli* and *Omecihuatl* create in heaven the soul of a child destined to be born, and that by its acts on earth it will either ascend to the abode of the highest felicity, or remain in an intermediate heaven, or fall to hell. The highest goal, situated in the house of the sun with the god *Huitzilopotchli*, is full of pleasure and joy, and is attained merely by the souls of fallen warriors, or those who died in captivity, and women dying in childbirth. The second or intermediate heaven, cool and pleasant, but of moderate enjoyments, falls to the lot of men who are not wicked. The wicked, however, go to the abode of darkness; and in darkness consists their punishment. But those entitled to the second heaven may, if they like, also return to earth, in order to qualify themselves for the highest heaven, if such is their aspiration.

Of the Druids, it is told by classical writers that they believed in the immortality of the soul, and in its migration after a certain period subsequent to death. Little is known of the manner in which they imagined such migrations to take place; but to judge from their religious system, there can be no doubt that they looked upon transmigrations as a means of purifying the soul, and preparing it for eternal life.

According to the doctrine of the old Egyptians, the human race originated after the pure gods and spirits had left the earth; and this they did because the demons, who inhabited the earth, had revolted against them, and therefore tainted it with guilt. But, in order to enable the demons to purge themselves of their guilt, the gods created earthly bodies, which the demons were sentenced to animate, so that by expiations they might regain their state of original purity. And these earthly bodies, united to the demons, are the human race; their souls were therefore created at the same time as that of the gods; and human life—the connection of body and soul—is merely intended as a means of purifying the soul, which had rebelled against its divine nature. All the precepts regulating the course of life are laid down by the Egyptians for this end; and the judgment passed after death, in the palace of Osiris, decides whether it has been attained or not. If it has not, the soul must return to the earth again, to renew its expiations; and according to the nature and measure of the guilt which it had contracted during its previous career, it must form a new union with a human body, or with the body of an animal, or even a plant. But if the soul is declared pure by the judge of the dead, it gradually ascends through the various regions of heaven, to the highest abodes of the gods and pure spirits, presided over by Phtah and Neith.

At the time when in *India* the dogma of transmigration became an integral part of the Brahmanic religion, the Hindus believed that the human souls emanated from a supreme Being, which, as it were, in a state of bewilderment or forgetfulness, allowed them to become separate existences, and to be born on earth. The soul, thus severed from the real source of its life, is bound to return to it, or to become merged again into that divine substance with which it was originally one; but as its nature becomes contaminated with sin through its earthly career, it must, so long as it remains in this world, endeavor to free itself from all guilt, and thus to become fit for its ultimate destiny. Religion teaches that this is done by the observance of religious rites, and a life in conformity with the precepts of the sacred books; philosophy, that the soul will be re-united with Brahman, if it *understands* the true nature of the divine essence whence it comes. So long, therefore, as the soul has not attained this condition of purity, it must be born again, after the dissolution of the body to which it was allied; and the degree of its impurity at one of these various deaths, determines the existence which it will assume in a subsequent life. See INDIA, sec. *Religion and Philosophy;* and UPANISHAD.

Since there can be no proof of the soul's migrations, the detail in which these are described in the religious works of the Hindus, is merely fantastical, and interesting only so far as it affords a kind of standard by which, at various epochs, and by different writers, the moral merit or demerit of human actions was measured in India. Thus, Manu (in the 12th book of his Code of Laws) teaches: 'The slayer of a Brâhman'a—according to the degree of his guilt—is reborn as a dog, a boar, an ass, a camel, a bull, a goat, a sheep, a stag, a bird, a Chân'dâla, or a Pukkas'a. A Brâhman'a, who drinks spirituous liquor, will migrate into the bodies of a worm, an insect, a grasshopper, a fly feeding on ordure, or some mischievous animal. A twice-born who steals the gold of a Brâhman'a, will pass a thousand times into the bodies of spiders, snakes, and chameleons, of aquatic monsters, or of murderous bloodthirsty demons. He who violates the bed of his guru, will a hundred times migrate into the forms of grasses of shrubs, and of creeping plants, of carnivorous animals and beasts with long teeth, or of cruel brutes. Those who inflict injury (on sentient beings), become flesh-eaters; and those who eat forbidden things, worms.

'Thieves become devourers of each other; and those who embrace women of the lowest castes, become ghosts. . . . . If a man, through covetousness, has stolen gems, pearl, or coral, or whatever belongs to the precious substances, he is reborn in the tribe of goldsmiths; if he has stolen grain, he becomes a rat; if kânsya (a composition of zinc and copper), a *hansa* bird; if water, a diver; if honey, a gadfly; if milk, a crow; if juice (of the sugar-cane or the like), a dog; if clarified butter, an ichneumon; if flesh, a vulture; if fat, a shag; if oil, a cockroach; if salt, a cricket; if curds, the crane, called Valâkâ;' &c. A more general doctrine of the migration of souls is based by Hindu philosophers on the assumption of the three cosmic qualities of *sattwa*, i. e., purity or goodness; *rajas*, i. e., troubledness or passion; and *tamas*, i. e., darkness or sin, with which the human soul may become endued. And on this doctrine, again, Manu and other writers build an elaborate theory of the various births to which the soul may become subject. Manu, for instance, teaches that 'souls endued with the quality of *sattwa*, attain the condition of deities; those having the quality of *rajas*, the condition of men; and those having the quality of *tamas*, the condition of beasts.' Each of these conditions, he continues, is, according to the acts or knowledge of the soul, threefold: the lowest, the middle, and the highest. 'The lowest embodiment of the quality *tamas* is inanimate objects, worms, insects, fish, serpents, tortoises, tame and wild beasts; the middle state, to which the same quality leads, is (the state of) an elephant, a horse, a S'ûdra, a Mlechchha or barbarian, a lion, a tiger, and a boar; the highest, that of a public performer, a bird, a cheat, a demon called Rakshas, and a vampire-demon. The lowest condition to which the soul imbued with the quality *rajas* arrives is that of a cudgel-player, a boxer, a public dancer, a man who lives on the use of weapons, and one addicted to gambling and drinking; the middle condition, that of a king, a man of the Kshattriya or military caste, a house-priest of a king, and a man fond of learned controversy; the highest, that of a Gandharva or musician in Indra's heaven, a Guhyaka or Yaksha (two kinds of attendants on the god of riches), or another attendant on another god, or an Apsaras or heavenly nymph in Indra's heaven. The lowest state procured by the quality of *sattwa* is that of a Vânaprastha—or a hermit of the third order of life—a religious mendicant, a Brâhman'a, or one of the demigods traveling about in palace-like cars, one of (the genii presiding over) the lunar mansions, or an offspring of Diti. The middle state, procured by the same quality, is that of a sacrificer, a Rishi (q. v.), a god of the lower heaven (a deity personating one of the) Vedas, (a deity presiding over one of) the luminaries or years, one of the manes or progenitors of mankind, and of the demigods called Sâdhya. The highest condition to which the quality of *sattwa* leads is that of the god Brahmâ, that of a creator of the world (as *Marîchi*, or another patriarch of the same rank), that of the genius of Dharma (virtue or right), of *Mahat*, or the intellectual principle of creation, and of *Prakr'iti*, or matter.' See SANKHYA.

It is not necessary here to show that this detail regarding the migrations of the souls is more or less differently given by other authors at other periods of Hindu religion, according to the views which they entertained of right and wrong, of the value and rank of imaginary or created beings, and of the social conditions of men. For, since all orthodox Hindu writers agree in principle with Manu, the quotations alleged from his work suffice to illustrate the imaginary positiveness with which the doctrine of transmigration was propounded, and to establish the conclusion that this doctrine rested in India on ethical grounds.

It has been already pointed out that the belief in the soul's life after the death of the body must precede the doctrine of transmigration. As such a belief, however, may be traced in some hymns of the *R'igveda* (see VEDA), it has been supposed that this doctrine, too, is as old as this Veda. But apart from the uncertainty which still exists regarding not only the age, but even the relative age at which the different hymns of the *R'igveda* were composed, and setting aside the fallacy which therefore attaches to speaking of this Veda as a contemporaneous whole, it is necessary to observe that the only passage which has been adduced in proof of this important discovery does not bear it out. It is the 32d verse of the hymn I. 164, and according to the translation of Professor Wilson (vol. ii. pp. 137, 138), runs as follows: 'He who has made (this state of things) does not comprehend it; he who has beheld it, has it also verily hidden (from him); he, whilst yet enveloped in his mother's womb, *is subject to many births*, and has entered upon evil.' But the word of the text, *bahuprajâh'*, rendered by Wilson, according to the commentator, 'is subject to many births,' may, according to the same commentator, also mean, 'has many offsprings,' or 'has many

children;' and as the latter sense is the more literal and usual sense of the word, whereas the former is artificial, no conclusion whatever regarding the doctrine of transmigration can safely be founded on it.

The Buddhistic belief in transmigration is derived from that of the Brahmanic Hindus; it agrees with the latter in principle, though it differs from it in the imaginary detail in which it was worked out.

Like the Brahmanic Hindus, the Buddhists believe that all souls have existed from the beginning; like them, they believe in the unreality and sinfulness of the world, in the necessity of the soul's freeing itself from the bondage of this world, and in the causal connection between the actions of man in this, and his condition in a subsequent, life. Like the Brahmanic Hindus, they hold, therefore, that sin is the cause of transmigration, and that by a total expiation of sin, the soul ceases to be reborn, and attains its final resting-place. But since this resting-place is to the Buddhists Nirvâna (q. v.), or Non-entity, whereas to Brahmanism it is Brahman, or the principle of Entity; since they reject the institution of caste, which is the social foundation of Brahmanic life; since they do not acknowledge the authority of the Vedas, and the codes based on it, and therefore consider as morally wrong much that the Brahmanic 'Sâstras enjoin as morally right, the standard according to which the life of a Buddhist is regulated must differ in many respects from that which governs the conduct of a Brahmanic Hindu; and his ideas of reward and punishment, therefore, as reflected by his ideas of the mode of transmigration, likewise differ from those of the Brahmanic believer. To enlarge here on this difference is not necessary, for, after the illustrations already afforded from Manu, it is easy to conceive that the *detail* of the Buddhistic doctrine of transmigration is as fanciful as that of the Brahmanic doctrine; that it is therefore partly devoid of interest, and partly intelligible only if taken in connection with the detail of Buddhistic religion and literature (see BUDDHISM; also LAMAISM). Yet it is not superfluous to point out one great difference which separates the notions of one class of Buddhists from those of the rest, as well as from those of the Brahmanic Hindus. According to the latter, and the great mass of Buddhists, it is always the same soul which ever from its first birth reappears in its subsequent births, until it is finally liberated from transmigration. But among the southern Buddhists, another idea has also taken root. In their belief, the succession of existences of a being is also a succession of souls; and each such soul, though the result of its predecessor, is not identical with it. According to this view, the body dies, and with it the soul, too, is 'extinguished,' leaving behind only the good and bad acts which it has performed during its life.

The result of these acts now becomes the seed of a new life, and the soul of this new life is therefore the necessary product of the soul of the former life. Thus all the succeeding souls have to labor at the solution of the same problem, which began when their first ancestor entered this world, but no succeeding birth is animated by the same soul. This dogma is illustrated in their works by various similes. One lamp, they say, for instance, is kindled at another; the light of the former is not identical with that of the latter, but nevertheless, without this, the other light could not have originated. Or, a tree produces fruit; from the fruit, another tree arises, and so on; the last tree is therefore not the same as the first, though the fruit is the necessary cause of the last.

In Greece, the doctrine of transmigration—or, as it is there called, *metempsychosis*—did not become the belief of the people, but was confined to the teaching of the mysteries and the tenets of philosophers, who probably derived it, either directly or indirectly, from Egypt or India. According to some, Thales (q. v.) was the first Greek philosopher who propounded it; according to others, Pherecydes (q. v.), the teacher of Pythagoras (q. v.); but its importance in Greek philosophy it first obtained through the system of Pythagoras, who, it seems, became acquainted with it through Egyptian sources. After him it was Plato (q. v.) who assigned to it a prominent place in his philosophy; and he probably was indebted to Hindu writers for his views on metempsychosis, as explained in his dialogues, especially in *Phædros*. Plato's doctrine was refuted by Aristotle, but revived, though in a modified shape, by the Neo-Platonists.

Since a belief that the consequences of the acts of man must follow their inevitable course, and can neither be averted nor stopped by the intercession of a divine power, is incompatible with a belief in divine grace, the doctrine of transmigration or metempsychosis could never gain a firm ground in the religion of the Jews and Christians. It deserves notice, however, that in both these religions it found adherents as well in ancient as modern times. Amongst the Jews, the doctrine of transmigration—the *Gilgul Neshamoth*—was taught in the mystical system of the *Kabbala*, which pretends to divulge the secrets of creation and those of the nature of the divine and human soul. 'All the souls,' the *Sohar*, or the book of 'light,' the spiritual code of this system, says, 'are subject to the trials of transmigration; and men do not know which are the ways of the Most High in their regard. They do not know how they are judged in all times, as well before they come to this world as after they leave it. They do not know how many transformations and mysterious trials they must undergo: how many souls and spirits come to this world without returning to the palace of the divine king.' The principle, in short, of the Kabbala is the same as that of Brahmanism. The souls, like all other existences of this world, it teaches, must re-enter the absolute substance whence they have emerged. But to accomplish this end, they must develop all the perfections the germ of which is planted in them; and if they have not fulfilled this condition during one life, they must commence another, a third, and so forth, until they have acquired the condition which fits them for their re-union with God. On the ground of this doctrine, which was shared in by Rabbis of the highest renown, it was held, for instance, that the soul of Adam migrated into David, and will come into the Messiah; that the soul of Japhet is the same as that of Simeon, and the soul of Terah migrated into Job.

Generally, it was supposed by writers of this school, the souls of men are reborn in men, and those of women in women; but also the reverse takes place, as in the case of Thamar, who had the soul of a man, and in that of Judah, whose soul was in part that of a woman. And because Ruth had the soul of Thamar, she could not bear children until God imparted to her sparks of a female soul. If the soul of a man, however, is reborn in a woman, such a migration is held by some to be a punishment for the committal of great sins, as when a man refuses to give alms, or to communicate to others his wisdom. And it is by way of punishment, too, that the soul of a Jew is reborn in a heathen, or in an animal—a clean or unclean beast, a bird, a fish—or even in an inanimate object. Of all these transmigrations, biblical instances are adduced—according to their mode of interpretation—in the writings of Rabbi Manasse ben Israel, Rabbi Naphtali, Rabbi Meyer ben Gabbai, Rabbi Ruben, in the Jalkut Khadash, and other works of a similar character. Modern Kabbalists—for instance, Isaac Loria—have imagined that divine grace sometimes assists a soul in its career of expiation by allowing it to occupy the same body together with another soul, when both are to supplement each other, like the blind and the lame. Sometimes only one of these two souls requires a supplement of virtue, which it obtains from the other soul, better provided than its partner. The latter soul then becomes, as it were, the mother of the other soul, and bears it under her heart like a pregnant woman. Hence the name of gestation or impregnation is given to this strange association of two souls. That all these wild fancies have for their main object the explanation of obscure or mystical passages of the Bible, and the reconciliation of such as are or may seem contradictory, requires no remark; the philosopher, however, must look to their basis, which is purely ethical.

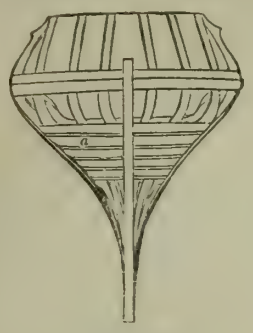
Among the early Christians, St. Jerome relates the doctrine of transmigration was taught as a traditional and esoteric one, which was only communicated to a selected few; and Origenes, like the Kabbalists, considers it as the only means of explaining some biblical traditions, as that of the struggle of Jacob and Esau before their birth, or the selection of Jeremiah when he was not yet born, and many more events which would throw discredit on divine justice, unless they were justified by good or bad acts done in a former life. Of Christian sects, the Manichæans (q. v.) especially adhered to this belief, but the church always rejected it as a heresy.

In concluding, at least one great philosopher of modern times may here be named, as one whose views of the progress of mankind are based on the same doctrine; it is the celebrated German critic, G. E. Lessing, who endeavored to establish it on metaphysical grounds. His arguments are briefly these: The soul is a simple being, capable of infinite conceptions. But being a finite being, it is not capable of such infinite conceptions at the same time; it must obtain them gradually in an infinite succession of time. If, however, it obtain them gradually, there must be an order in which, and a degree to which, these conceptions are acquired. This order and this measure are the senses. At present, the soul has of such senses five; but neither is there any ground to assume that it has commenced with having five senses, nor that it will stop there. For, since nature never takes a leap, the soul must have gone through all the lower stages before it arrived at that which it occupies now . . . . . and since nature contains many substances and powers which are not accessible to those senses with which it is now endued, it must be assumed that there will be future stages, at which the soul will have as many senses as correspond with the powers of nature. And 'this my system,' he concludes his little but important essay, *Dass mehr als fünf Sinne für den Menschen sein können*—in a fragmentary note discovered after his death—'this my system is certainly the oldest of all philosophical systems; for it is in reality no other than the system of the pre-existence of the soul and metempsychosis, which did not only occupy the speculation of Pythagoras and Plato, but

also before them of Egyptians, Chaldeans, and Persians—in short, of all the sages of the East; and this circumstance alone ought to work a good prejudice in its favor; for the first and oldest opinion is, in matters of speculation, always the most probable, because common sense immediately hit upon it.

TRA'NSOM, a horizontal mullion or bar in a window, door, &c., chiefly used in late Gothic and Elizabethan architecture.

TRANSOMS, in Artillery, the bars or bolts by which the two sides—technically called 'cheeks'—of a gun-carriage are held to-



a, Transom.

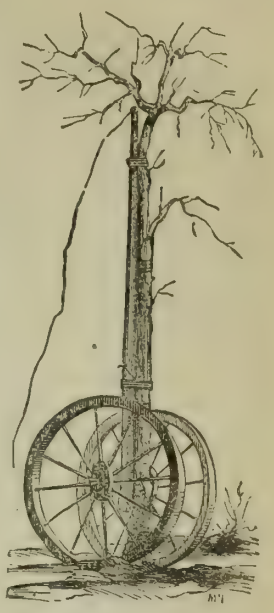
gether.—In a Ship, beams across the sternpost, at right angles to that timber, fastened in the same way as the floors upon the keel.

TRA'NSPADANE REPUBLIC. See CISALPINE REPUBLIC.

TRANSPLA'NTING—the removal of a growing plant from one situation to another—is much practiced with many kinds of cultivated plants, which are reared in a nursery, and *planted out*. Many flowers and culinary plants are generally treated in this way, as well as ornamental shrubs, and fruit and forest trees. It is desirable to have a ball of earth attached to the roots in every case, although this is often neglected. It is also desirable to shade the plant and water it for a few days after transplanting, when possible. Young plants are easily transplanted, as their roots, not having spread far, are raised from the ground without much injury, and this is the thing of first importance in the operation. At a more advanced age, transplanting becomes difficult, great part of the difficulty, however, being mechanical. No plant can be transplanted with safety when in flower or fruit; the plant may live, but the flowers or fruit will almost certainly perish. In like manner, leaves often wither; and transplanting ought, if possible, to be performed in winter, when vegetation is least active.

The transplanting of large trees, in order to immediate effect in the neighborhood of a mansion, has been practised for many years with success. Notwithstanding all the care that can be taken, the trees are *thrown back* for two or three years; but this, in general, is all the injury which they sustain, unless removed from a situation very different from that in which they are placed. It is of great importance, in transplanting trees, that they should be placed in their new situation in the same direction to the prevailing wind as in their former situation. This is often disregarded, and many failures are the consequence. It ought also to be borne in mind, that trees taken from a thick wood, and planted in a lawn, or along the sides of an avenue, cannot be expected to succeed there. They have neither roots nor branches adapted to their new situation, and suffer from unaccustomed exposure to wind and weather. Trees of quick growth, such as limes and poplars, succeed most readily when transplanted; oaks are particularly difficult. In every case, however, there is much hazard, because the roots of trees generally spread far from the stem, and when the operation is unskilfully performed, the principal roots are often cut off, and the smaller ones torn by the violence used, whilst all are injured by being laid bare. Trees thus treated seldom ever again assume a healthy appearance. The method is therefore now generally adopted of preparing the tree for transplanting by digging a trench around it, at least two years beforehand, at such distance as is thought expedient, cutting the roots all round, except two or three which are left to hold the tree fast, and then filling up the trench with fresh soil of the best quality that can be procured, into which a vast number of young roots are speedily thrown out. When the tree is to be removed, a new trench is made immediately on the outside of the former trench, and young roots sufficient for the nourishment of the tree are thus preserved. The ball of earth being generally too heavy for removal, is reduced in size by a very careful picking away of earth, so that the rootlets shall be as little as possible injured or even laid bare.

The tree is generally transported to its new situation by attaching it firmly to a pole fixed upon an axle with a pair of wheels, the ball resting upon the axle. Good soil is put into the pit dug for it, and the roots are spread out. The tree is stayed by sticks and ropes till it is well established, and heavy stones are also laid on the top of the ball, or large beams of wood are laid across it, and firmly fastened to the ground at both ends. An improvement on this method has been effected by the use of a compost of vegetable mould, decayed leaves, &c. in preparing the tree for transplanting, not only in the trench dug around it, but on the top of the ball itself, so that the tree is encouraged to send out many new rootlets. A still greater improvement consists in the use of a machine by which a large ball of earth can be removed along with the tree, so that it is no longer necessary to pick away any part of the soil or to lay bare the young roots; whilst the tree being carried in a vertical instead of a horizontal position, all possibility of damage in this process is avoided. One of the machines used for this purpose consists of two pair of wheels, about 15 feet apart, each pair on a strong axle; the first pair smallest, and in a very large machine about 5½ feet in diameter; the second pair 7 feet. A strong frame rests on each axle to raise the horizontal bearers to a sufficient height. The front frame turns on a horizontal wheel, as in a carriage, for easy turning of the whole machine. Resting on the two frames are two strong horizontal beams of wood, above which are two short cross beams, with jack screws and strong chains for raising the tree. Beneath the roots and ball of earth, when the tree is raised from the ground, strong planks are placed, supported by chains from the beams. In order to raise the tree from its place, a sloped cutting is made, and the tree is drawn gradually up the inclined plane.



Transplanting Apparatus.

TRA'NSPORT, MILITARY AND NAVAL. Without a powerful system of transport, an army is helpless. To cross a sea, a large fleet of vessels properly fitted for men and horses, is requisite. When the English army, of about 30,000 men, crossed, in 1854, from Varna to the Crimea, it took 600 vessels to carry them, without any reserves of stores or food.

Not less important to the army moving by land is its transport. On entering battle, infantry and cavalry usually carry three days' rations with them, and 60 rounds of ammunition. The moment these are exhausted, they become dependent on the transport department for their replenishment. The first reserves are immediately in rear. To bring up supplies from these, and to keep these reserves themselves supplied, is the duty of the Military Train (q. v.) as regards food, and of the field-train in respect of ammunition. Between the grand dépôt and the base, the operation is generally intrusted to the wagons and beasts of the country, driven by natives, of course under proper military control. The amount of transport required by an army seems almost fabulous. The lowest computation must put one animal to four fighting-men. In addition to the transport of food and ammunition, the wounded and sick have to be carried, both from the field to the hospitals and during a march.

In the British army, the direction of the transport rests with the quartermaster-general: in the French army, it is under the *Intendant*, who is over all the administrative departments.

TRANSPORTA'TION, from the Latin for carrying across, means the removing of persons from one territory to another; and is thus distinguished from banishment, which is the mere driving of persons out of the country in which they live. Transportation, in this country, means a removal beyond seas, and has been in use to express the punishment of crime in that manner. The practice was known to the Romans; and transportation to Sicily will be found referred to in Cicero's charges against Verres. When the English monarchs had possessions on the continent, there was much jealousy about their carrying off troublesome persons to these dominions, and thus bringing them under irresponsible power. The legal transportation of criminals from the British dominions began early in the 17th c., when they were removed to the Plantations in America, and treated as slaves. This practice continued, under modifications, until it was stopped by the American revolution. Its unfitness as a punishment is obvious. The

amount of infliction would depend, not on the extent of the criminal's guilt, but on his master's humanity. There were even worse evils; for young lads were kidnapped in Britain, and sold to the planters, and these victims were often unable to prove, even when they had an opportunity, that they were not legally transported for offences. When this method of getting rid of convicts ceased, there was great alarm that Britain would be overrun with crime, and it was hailed as a deliverence when the government resolved to establish a penal colony in Australia. The first convicts were conveyed thither in 1787. Such was the beginning of the famous colony of Sydney, or Botany Bay. Between the years 1820 and 1830, the system was at its full perfection; but though thousands were annually removed, crime did not appear to decrease. It was forgotten, that the predatory and fraudulent offences, which are by far the greater number in this country, are trade as well as crime; and that where there is a large portion of the population, as there unfortunately is, prepared to have recourse to crime whenever it pays, the place of those removed is immediately supplied.

When the criminals were sent to the antipodes, the mistake was made of supposing that they took the crime of the country with them, and that there was so much less need for precautionary measures at home. During thirty years, however, the greater proportion of the class of criminals who used to be transported, have been retained in this country, and liberated in it at the end of their punishment. This practice has been accompanied with two classes of precautionary measures—an improved police, and the reformation of juvenile delinquents. To these influences have been added free trade, and the consequence of all is, that crime is diminished to the extent of between a third and a half of what it was 20 years ago. In 1838, a committee of the House of Commons issued a celebrated Report on the effect of transportation. It was shown to be still an extremely unequal punishment—in some instances giving rogues an opportunity of making their fortune, in other cases subjecting men less depraved, but more infirm in temper, to punishments of the most frightful kind. It was found to be accompanied by the prevalence of crimes which cannot be mentioned, and with a vast amount of general demoralization in the convict settlements. Yet it was found not to have much terror for the criminal classes, who heard more about the success than the hardships of transportees. In 1840, transportation to New South Wales came to an end; and by a succession of statutes, sentences to penal servitude were substituted for sentences to transportation. In 1868 transportation to Western Australia also wholly ceased, to the great benefit of the whole continent. The practice of transportation cannot, it will be easily understood, be carried out by governments which have no colonies, though Russia manages it by possession of the desolate region of Siberia. It is a curious circumstance that the practice began in France just as this country was abandoning it.—See CONVICT, PRISON DISCIPLINE, and TICKET OF LEAVE.

TRANSPO'SE, in Music, is to change a piece of music in performance from the key in which it is written to another key. To play at sight an accompaniment for such an instrument as the pianoforte or organ, transposed from one key to another, requires considerable artistic skill. To the singer, transposal presents no difficulties.

TRANSUBSTANTIA'TION (Lat. *transubstantiatio*, change of substance, from *trans*, over, and *substantia*, a substance), a word used by the scholastic writers of the Roman Catholic Church to designate the change which is believed by Roman Catholics to take place in the Eucharistic elements of bread and wine, in virtue of the consecration. Under the head REAL PRESENCE (q. v.), which is often loosely comprehended under the larger name of transubstantiation, the doctrine of Catholics as to the presence of the body and blood of Christ in the Eucharist, after consecration has been fully explained. There remains, however, beyond this doctrine as to the presence of Christ, a further inquiry concerning the elements of bread and wine which had existed in their natural condition before the consecration. For Sacramentarians (q. v.), this question is easily resolved. But those Protestants who hold in common with Catholics the reality of Christ's presence, differ from them as to the co-presence of the substance of bread and wine after consecration. Some Anglican divines, who hold the real presence of the body and blood, would appear to content themselves with remaining silent as to the mode of the presence. Dr. Pusey goes so far as to say, that the dispute between Anglicans and Romanists is 'probably a dispute about words' (*Eirenicon*, p. 229). The Lutheran views as to the mode of the presence have been explained under the heads IMPANATION, REAL PRESENCE (q. v.).

According to the Catholic doctrine, which has been explicitly defined as an article of faith (Council of Trent, Sess. xiii. Can. 2), 'the whole substance of the bread is changed into the body of Christ, and the whole substance of the wine into His blood, the species alone remaining.' What is the precise philosophical meaning of the word 'species,' called also 'accidents,' in this definition, is not declared; but in popular language it may be described as simply meaning the appearances, that is to say, those qualities or conditions of bread and wine which produce upon the senses the impression of the presence of bread and wine. It is not taught, however, that in the change called transubstantiation, the body and blood of Christ are formed out of the substance of the bread and wine, but that, in virtue of the Eucharistic consecration, the substance of bread and wine cease to exist, and that the body and blood of Christ take their place; nor that the body and blood of Christ become what the schoolmen call the 'subject' of the 'accidents' of the bread and wine, but merely that, by a miraculous suspension of the ordinary law, the senses still continue to receive from the Eucharistic elements all the same impressions which they had previously received from the bread and wine; viz., of color, taste, smell, solidity, extension, figure, &c.

The history of the controversy regarding transubstantiation is sketched in the article LORD'S SUPPER. The objections to the doctrine have been chiefly drawn from the philosophical difficulties which are involved in it; and the defenders of it have, for the most part, contented themselves with resting on the proofs which they profess to draw from Scripture and tradition, and a general demonstration that the doctrine, although mysterious, does not involve any philosophical repugnance or impossibility, and that the philosophical arguments against it are at the least not conclusive. Some Catholic philosophers have even undertaken to demonstrate the possibility of transubstantiation by philosophical arguments; and it is especially remarkable that the celebrated Leibnitz (q. v.) has not only entered at great length, and in several portions of his works, into this philosophical discussion, but professes to prove, by strict philosophical principles—by the consideration of the properties of matter, of substance, of space, extension, and the like—that the essential principle of the body 'may exist in many places at the same time, nay, under far-distant and distinct species.'

TRANSVAAL (i. e., 'across the Vaal'), in South-east Africa, till 1877 a republic, from 1877 till 1881 a British territory, and now under the suzerainty of the British sovereign. It includes the country north of the Vaal River, and on both slopes of the Magaliesberg or Cashan Mountains, into which the immigrant Boers retired after the annexation of the Orange River Free State, in 1848, to the British crown. Its limits lie between lat. 22°—27° S. and long. 25°—32° E. The N. boundary of the republic may be described as formed by the Oori or Limpopo River, here running nearly from west to east; its E. boundary by the continuation of the Drachenberg Mountains, separating it from the coast-region, inhabited by the Zulu Kaffirs; on the S., it has the Vaal River from its source, dividing it from the Free State Republic; while on the W., an undefined line separates it from the Betjuana tribes, still independent, living along the edge of the desert region of the Kalihari. Thus, an area of not less than 114,000 sq. m. was more or less under the control of the emigrant Boers, who were not very scrupulous in their dealings with the poor native tribes who lived, or live still, in the country they now occupy. This region may be described in general terms as a vast plateau, sloping to the north, supported by the coast-line of mountains, which, presenting a bold mural buttress, or escarpment, to the low country at their feet, stretch away on their western flank into vast undulating plains. At right angles to the coast-range, another belt of very high lands, called the Magaliesberg, runs east and west, forming a watershed between the river-system of the Vaal or Orange and Limpopo rivers. The southern face of this range also presents long and undulating plains, generally well watered and wooded, and abounding with large game. The chief exports of the T. are ostrich feathers, wool, ivory, cattle, cereals, tobacco, &c.

The average height of the plateau inhabited by the emigrant farmers of European descent is from 4000 to 5000 feet. Many of the peaks of the mountain-range traversing the plateau attain an elevation of 9000 or 10,000 feet, and are covered with snow some months in the year. The altitude of the coast-line of mountains is considered at from 6000 to 7000 feet above the low region at their feet.

The principal towns are—Mooiriverdorp, or Potschefstroom, on the Mooi River; Pretoria, about 100 miles north-east of Potschefstroom, the seat of the local government; Leydenburg, 170 miles north-east of Pretoria; Rustenberg, a few miles north of the Magaliesberg; and Zoutpansberg, the most remote village inhabited by men of European descent in S. Africa, about 40 miles south of the Limpopo River.

The population consists of emigrant farmers, and a mixture of deserters and foreign refugees from the Cape Colony and Natal. Their number is about 50,000 souls. Scattered through the country are numerous kraals of Betjuans and other tribes, in number about 775,000, whom the Boers compelled to supply labor. The republic was established in 1840, and recognized by Britain in 1852. The budget for 1878 gave the revenue at £105,130, and the

expenditure at £152,000. According to a treaty entered into between Portugal and the T. Republic, the latter enjoyed free transit of all goods through the Portuguese harbors on the east coast; and in order to save the import dues levied by the colony of Natal, industrious efforts were made to secure direct access, by road and rail, to Delagoa Bay. As this line passed through the dominions of an independent chief, the Boers were soon embroiled in desultory war with the latter. Their policy further provoked so intense excitement amongst the natives upon the Kaffrarian frontier of the Cape Colony, and so seriously menaced the wellbeing of the British settlements, that Britain interfered, and ultimately, on the 12th April 1877, annexed the territory of the republic.

A rising of the Boers took place in the end of 1880. The British garrisons in the T. were besieged, and a force of Boers crossed into Natal to meet the available British forces advancing against them. The Boers took up a strong position at Laing's Nek, within the Natal frontier, from which the English forces failed to dislodge them; and in several engagements the Boers more than held their own. Peace was negotiated while large English reinforcements were on their way to South Africa. It was agreed that the T. should acknowledge the suzerainty of the British sovereign; and, while complete self-government is granted to the Boers, the control of foreign relations (i. e., specially with the native tribes) is reserved.

With regard to the social aspect of the country, very marked progress has been made within the last few years. The large influx of Europeans and colonists of a more educated class than the original settlers, has produced very marked effects. The state church has been the Dutch Reformed, but all other creeds are tolerated.

The climate is generally healthy, although north of the Magaliesberg its tropical nature begins to manifest itself. Hot winds and violent thunder-storms prevail in the summer months. The fly *Tsetse*, whose bite is death to the bovine and equine species, abounds in many parts, and renders traveling with oxen and horses difficult.

When Captain Harris visited this region 50 years ago, the number of the larger mammalia found by him was enormous; and even Gordon Cumming, who hunted over part of it many years subsequently, found them still numerous. Crocodiles are numerous in the rivers, and a large species of boa is found.

The first diamond discovered in South Africa was found in October 1866, north of the Vaal River, and since then diamond mining has been carried on with great success in that district. Diamonds have also been found in the districts of Marico, Waterberg and Pretoria. Gold has been discovered in quartz reefs and alluvial deposits near Marabastad, 180 miles N. of Pretoria; also near Leydenburg, where mining is actively prosecuted; and the gold-bearing strata are supposed to extend for hundreds of miles in various directions. The country is also rich in other minerals, such as copper, lead, iron, tin, and coal.

The T. is rich in corn-land, and might become the granary of the interior. See Aylward's *The T. of To-day* (1879); *The T.*, its Natural Features, Industries, Populations (pub. by Silver, 1881).

TRANSYLVA'NIA (called by the Hungarians *Erdély-Orszag* —Walach. *Arjal*—' the woody and mountainous country;' by the Germans *Siebenbürgen*, 'seven castles,' from the seven forts built by the Saxons which became nuclei of cities; and by the Romans *Transylvania*, from its position *beyond* the forest range which stretches southwards from the Carpathians, and forms its western boundary) is the most easterly territory of Austria, and since 1868 has been completely incorporated with Hungary, of which it now forms the eastern portion. The area is 21,150 square miles; pop. (1880) 2,116,132. Of the pop. of 2,115,024 in 1869, 1,200,400 were Walachs and Roumanians, 573,000 Magyars and Szeklers, 235,000 Germans, the rest being Slavs, gipsies, Armenians, Jews, Italians, &c. Classed according to their religious professions, 652,945 were Non-united Greeks, 600,800 Greek-Catholics and Armenians, 505,540 Protestants, 263,769 Roman Catholics, and 24,848 Jews. T. is an elevated plateau (its lowest parts being 530 feet above sea-level) of an irregular form, somewhat resembling a triangle of which the upper part has been irregularly removed, and is bounded partially on the north, and wholly on the east and south, by a high range of mountains—a continuation of the Carpathians—which sends out innumerable lateral ridges towards the center of the country, and along the western frontier, so that T. is an almost perfect natural fortress. There are no plains except where a river-basin widens out; but the valleys are numerous and exceedingly picturesque. Almost the whole country is drained westwards into the Danube, by the Theiss and its feeders in the north, and by the Maros, a tributary of the Theiss, and its feeders, in the center and south; the south-eastern corner is drained by the Aluta, or Alt, which, after a winding course, breaks through the southern bounding range near Hermannstadt; while a number of streamlets worm their way through the eastern range, and join the Sereth. The climate is more healthy and temperate than that of Hungary, the mountain chain along the southern frontier keeping off the hot winds.

The soil is extremely fertile; but much arable land is still uncultivated. The valleys and hill-sides supply abundant pasturage for numerous herds of cattle and droves of horses; the cultivated districts yield good crops of maize, rye, barley, oats, all sorts of leguminous plants, tobacco, saffron, madder, hemp, and lint. The culture of fruits is extensively practised, and immense quantities of apricots, peaches, plums, apples, pears, and walnuts, are annually produced. The extensive forests, which cover nearly 5,300,000 acres of ground, contribute largely to the wealth of the country. The vine is extensively cultivated, and, in spite of the defective mode of preparation, the produce is excellent in quality. The mineral wealth of T. is great; gold is found more abundantly than silver, and silver than copper; yet there are few gold mines regularly worked, and a thorough investigation of the extent to which this valuable metal exists in the country, seems never to have been made. Iron is found in abundance at Torockzo, copper at Balan, lead at Rodna; the other minerals are mercury, manganese, antimony, sulphur, arsenic, vitriol, alum, marble, &c. Coal is not absent; but firewood is so abundant and cheap, that no other combustible has been sought for; and even the extensive tracts of peat have been allowed to lie undisturbed. Rock-salt is abundant. T. has almost no manufactures, and the commerce, owing to the isolation of the country, the want of enterprise of its inhabitants, and the absence of good roads, is far from bearing a fair proportion to the amount of the country's produce.

Of the various races which now inhabit T., the Walachs, the earliest possessors, though by far most numerous, were till recently subordinated to the other races of T., but since the revolution of 1848—1849, have acquired a position in the country which, by all means, honest or dishonest, they are striving to improve; the Magyars entered as conquerors in the 10th c., and still constitute the nobility and gentry of the land; the Saxons were introduced in 1143 and 1247 from the Rhenish provinces of Lower Saxony, by kings Geysa II. and Bela IV. of Hungary, and received special privileges and immunities to induce them to settle in the country, and improve the cultivation of the soil; and the Szeklers, or Szekhelyi, are believed to be the descendants of the once formidable Huns. The last three are the dominant races of T., and live apart from each other—the Magyars occupying the west and center, the Saxons the south and north-east, and the Szeklers the south-east. The Magyars, Bulgarians, and Armenians speak the Magyar language as used in Hungary; the Saxons employ Low German in speaking, and High-German in writing, but with a considerable mixture of Magyar in both; the Szeklers speak a Turanian dialect; and the Walachs use their own language intermixed with corrupt Latin. T. is little noticed in history till the Christian era, when part of it was occupied by the warlike Dacians, soon after whom the Sarmatian tribes of the Jazyges and Carpi settled in it. The conquest of the Dacians by Trajan, however, did not include that of the other two peoples, who proved very troublesome to the Roman settlers along the Danube, till they were conquered by Diocletian, and the Carpi carried away to Pannonia and other districts.

In the middle of the 4th c., the Goths overran the country, defeating the Sarmatians in a great battle on the Maros, in which the monarch and the chief of his nobility perished; and they in their turn were forced, in 375, to retire before the Huns and their confederates. The Gepidæ next took possession of T. till their almost complete extirpation, in 566. by the Lombards and Avars. It was conquered by the Hungarians about 1000, and was governed by Woivodes till 1526, when the death of the Hungarian monarch at Mohacs prepared the way for the union of the two countries under the Woivode, John Zapolya; but the war which thence arose with the Austrians caused their complete severance, and Zapolya's sway was, in 1535, confined to T., of which he became sovereign lord, under the protection of the Turks. T. on its conquest by the Hungarians, was only partially settled; the eastern part constituted a grazing-ground for wandering tribes who had migrated thither. The Saxons were summoned by the Hungarian monarchs to act as a counterpoise to the increasing power of the nobles; and from similar motives the Burzen land was given to the Teutonic Knights, but the arrogant bearing of those soldiers of the cross soon offended their titular lord, and they were forced to leave the country. The 'golden charter' of King Andrew II. (1224) secured a perfectly free political system to the Saxons, whose 'comes' or chief was, like the head of a clan, both judge and leader, and from whom the only appeal was to the king in person. The firm protection and generous treatment accorded to the Saxons by the Hungarian monarchs were rewarded by steadfast loyalty, and succor in men and money whenever required. During the rest of the 16th c., the country was distracted by the bitter strife between the Catholic party, who were supported by Austria, and the Protestant party, who were allied with the Turks; the latter party, headed successively by princes of the houses of Zapolya and Bathory, generally maintaining the superiority.

The next chief of the Protestant party was the celebrated Botskay, whose successes against Austria extorted from the emperor an acknowledgment of the independence of T. in 1606. To him succeeded Bethlem Gabor, the determined foe of Catholicism and Austria, who did important service during the Thirty Years' War. Between his son and successor, Stephen, and Ragotski arose a contest for the crown, in which the latter prevailed; but on Ragotski's death, the civil war was resumed, till the complete rout of the Austrians by the Turks, under Kiupruli, placed the sceptre in the hands of Michael Abaffi, who reigned, till his death in 1690, as a vassal of the Porte. The Austrians now again possessed themselves of T., despite the heroic resistance of Ragotski; and though Tekeli (q. v.) succeeded for a brief period in rolling back the invaders, the peace of Carlovitz, in 1699, again put them in possession; and after the death of Michael Abaffi II., in 1713, T. was completely incorporated with Hungary. It was erected into a grand principality in 1765. During the insurrection in 1848, the Hungarians and Szeklers joined the insurgents, and forced T. to reunite with Hungary, despite the opposition of the Saxons; and the Walachs, still little better than a horde of savages, were let loose over the land to burn, plunder, and murder indiscriminately; the prostration of the country being completed in the following year during the bloody conflicts which took place here between Bem and the Russian troops. In the same year, T. was again separated from its turbulent neighbor, and made a crown-land; the portions of it which had, in 1835, been annexed to Hungary being restored, as well as the Transylvanian Military Frontier, in 1851. In 1867 T. was again united with Hungary. It is now a province under the Hungarian Crown, and is officially styled a grand-duchy. See *Transylvania, its Products and its People*, by C. Boner (Lond. 1865).

TRAP or TRA'PPEAN ROCKS, an important section of the Igneous Rocks (q. v.), associated with Primary and Secondary strata, so called from the Swedish *trappa*, a stair, because these rocks, having resisted, from their greater hardness, the abrading influences which have destroyed the softer sedimentary strata, stand out like huge steps on the faces of the hills and mountains in some place where they occur. Unlike granite, the Trap Rocks are free from silica crystallizing as a separate constituent of the rock; from the modern volcanic rocks the structural difference is very slight, consisting only of the manner in which the silicate of magnesia and lime, common to both, it crystallized—in the older rocks appearing as hornblende, while in the newer it exists as augite.

Trap Rocks are composed of felspar and hornblende, and the different varieties founded on the chemical composition of the mass depend on the relative proportion of these two minerals. When the felspar predominates, the rock belongs to the felspathic trap or felstone series; and when the hornblende is abundant, it is a hornblendic trap or greenstone. This latter series contains the best known Trappean Rocks. The dark hornblende preponderates, and gives to the rock a dull green color, from which it derives its well-known name greenstone, a translation of the German *grünstein*. It has, however, been shown by Delesse that many Trappean Rocks owe their color to a dark variety of felspar which exists in them, and such rocks belong rather to the felspathic than to the hornblendic series. Some greenstones are very light green, others are so dark as to appear black, and all intermediate shades of color occur. These rocks vary also very greatly in texture: in some, the crystals are sufficiently large to be detected with the naked eye; while others are so fine-grained and compact that it is difficult to resolve the separate crystals even with the help of a lens.

Experiments have shown that the size of the crystal in an igneous rock increases in proportion to the length of time during which the mass remains fluid, and so permits the continued crystalline segregation of its various ingredients. The vitreous trap and obsidian would accordingly represent a speedily cooled flow of liquid rock. In fine-grained basalt, the crystalline force has been slightly developed; while greenstones of different textures exhibit its more continued operations in proportion to the coarseness of their texture. The principal varieties of hornblendic trap are greenstone, whinstone, or trap proper. When the crystals are extremely minute, and there is a tendency in the rock to become columnar, it is a basalt. If the felspar is a soda-felspar, either albite or oligoclase, it is diorite. Euphotide, diallage rock, or gabbro, is a compound of Labrador felspar and diallage, a variety of hornblende; it is a coarse, or sometimes fine-grained rock, with a granitic or porphyritic aspect. Hypersthene rock, or hyperite, is made up of Labrador felspar and hypersthene, another variety of hornblende; it is also a granitic-looking rock, very tough, and of a grayish or greenish-black color: it is very abundant in the Isle of Skye. Different varieties of hornblendic trap are based upon the structure of the rock, as well as upon its chemical composition. Trappean obsidian is not a common rock, but it is occasionally found. Prophyritic trap is more abundant; a very black variety has received the name of metaphyre. Amygdaloid is a trap with round or almond-shaped cavities, filled with agate, calcite, or other minerals, scattered through it. Trap tuff consists of fragments of scoriæ, volcanic dust, and pieces of other rocks, forming a coarse irregular mass, sometimes bound together by a calcareous cement.

The characteristic rock of the felspathic series is felstone, compact felspar, or petrosilex. It is a light-colored, greenish, or bluish, very compact, homogenous, and translucent rock, with a flinty-looking appearance. It forms a large proportion of the contemporary intruded Trap Rocks in the Silurian measures of Wales. Clinkstone, or phonolite, is a variety found in layers or slabs which give a metallic ring when struck with the hammer. Aphanite, or cornean, scarcely differs from true felstone, except that it is a more compact and tougher rock. Pitchstone, or retinite, is a vitreous felstone, less glassy than obsidian, and of a green color and resinous luster: a dyke thirty feet wide occurs on the eastern shores of the island of Arran, cutting through the sandstone rocks. When distinct crystals of one or more minerals are scattered through an earthy or compact base of felstone, a felspathic porphyry is formed. The ancient red porphyry of Egypt, known as *rosso antico*, belongs to this set of rocks; it consists of a red felspathic base, in which are disseminated rose-colored crystals of oligoclase, with some plates of blackish hornblende and grains of oxidized iron-ore.

As true igneous rocks come up from below, there is always a connection of some kind between the ejected mass and the inferior source of supply, except when the ejected materials have been subsequently arranged by atmospheric or aqueous agency. Pipes and dykes form such connections, and they are generally associated with tabular masses which have either spread themselves over the surface, or inserted themselves between the beds of the sedimentary strata. When the materials have been mechanically arranged, the igneous rocks are contemporaneous with the deposits in which they occur; but in all cases where strata are cut through by dykes or pipes, or are covered by flows of liquid rock, the igneous rocks are newer than the sedimentary strata with which they are associated.

TRA'PA, a genus of plants, of the natural order *Haloragiaceæ* (q. v.), having a 4-parted calyx, a 4-petallous corolla, and a nut on which the altered calyx appears in the form of spines; the cotyledons very unequal in size. All the species are aquatic plants, with floating habit. *T. natans*, the WATER CALTROPS, is the only European species. It is found in ditches and ponds in the south of Europe, and is grown in ponds in Holland. The floating leaves are rhomboidal, toothed, and smooth; those under water are cut into capillary segments. The fruit has four spines; the kernels are large and almond-like. They are good to eat, either raw or roasted, and somewhat resemble chestnuts in taste. They are often used in soups. The French name is *Marron d'Eau* (Water Chestnut).—*T. bispinosa*, the SINGHARA NUT, affords a great part of the food of the inhabitants of Cashmere, and a tax laid upon it by Runjeet Singh yielded a large sum annually. —*T. bicornis* is much cultivated in China, where the cultivation of aquatic plants is carried on to a degree unknown in other parts of the world, and its fruit is much used for food. In both these species, the nut has only two spines.

TRA'PANI (anc. *Drepanum*), one of the principal seaports of Sicily, on Cape Trapani, in the north-west of the island; capital of the province of that name, 40 miles west of Palermo. Pop. (1881) 31,742. The town is walled, and defended by a fortress. The streets are wide, and well paved with flagstones. There is a natural harbor, capable of admitting vessels of about 300 tons; a handsome town-house; a tower built by the Saracens; a cathedral; and many churches, some of which contain fine paintings. The inhabitants are engaged in the tunny, anchovy, and coral fisheries. The coral is brought from the coast of Barbary to T. to be cut and polished for exportation. T. is a busy town, and exports sumach, salt, soda, coral, alabaster, wine, tunny, and anchovies.

Ancient *Drepanum* was probably founded by the Carthaginians, under whom it became an important stronghold. Here took place a celebrated naval engagement between the Romans, under P. Cladius, and the Carthaginians, under Adherbal, 249 B.C., in which the former were completely beaten. In Roman history, the name scarcely appears, but it seems to have flourished in obscurity both then and during the middle ages.

TRAPE'ZIUM (Gr. *trapezion*, a little table) is the general term for a four-sided plane figure, and is synonymous with 'quadrilateral.' But since all four-sided figures which have parallel sides possess distinctive appellations, the term trapezium is frequently restricted to quadrilaterals whose sides are not parallel. The trapezium, in the restricted sense (exclusive of parallelograms), has some remarkable properties: thus, if its sides be bisected, and the adjacent points of bisection joined, the resulting four-sided figure is a parallelogram; the sum of the squares of its diagonals is equal to the sum of the squares of the sides, together with four

times the square of the line joining the middle points of the diagonals; if it can be inscribed in a circle (i. e., if its four corners are in the circumference of any circle), the one pair of opposite angles is equal to the other pair, and the sum of the rectangles by each pair of opposite sides is equal to the rectangle by the diagonals; if it can be described about a circle (i. e., if a circle can be made to touch on the interior, each of the four sides), the one pair of opposite sides is equal to the other pair.

TRA'PEZOID, a plane quadrilateral which has two of its sides parallel, and the other two not.

TRA'PPIST ORDER, The, celebrated among the religious orders of the Roman Catholic Church for its extraordinary austerities, is so called from La Trappe, an abbey of the Cistercian order, founded in the middle of the 12th century. The discipline of this monastery, in common with many others of the more wealthy monastic bodies, especially of those which, by one of the corruptions of the period, were held *in commendam*, had become very much relaxed; and in the 17th c. but little trace of the ancient religious observance remained. In the first half of that century, the abbey of La Trappe fell, with other ecclesiastical preferments, to the celebrated Armand Jean le Bouthelier de Rancé. The circumstances which led this remarkable man to undertake a reform of his monastery, and in the end the establishment of what was equivalent to a new religious order, have been already detailed in the article Rancé (q. v.). It was in the year 1662 that he entered in earnest upon his duties, and commenced his reforms. At first, he encountered decided, and even violent opposition from the brethren; but his firmness and vigor overcame it all. He himself, as an evidence of a complete change of life, entered upon a fresh novitiate in the year 1663; and in the following year, made anew the solemn profession, and was reinstalled as abbot. From this time may be dated the introduction of the new austerities which have characterized the order. The monks were forbidden the use of meat, fish, wine, and eggs. All intercourse with externs was cut off, and the old monastic habit of manual labor was revived.

The reform of De Rancé is founded on the principle of perpetual prayer and entire self-abnegation. By the Trappist rule, the monks are obliged to rise at two o'clock A.M. for matins in the church which lasts till half-past three; and after an interval occupied in private devotion, they go at half-past five to the office of prime, which is followed by a lecture. At seven, they engage in their several daily tasks, indoors or out, according to the weather. At half after nine, they return to the choir, for the successive offices of terce, sext, and none; at the close of which they dine on vegetables dressed without butter or oil, and a little fruit. This meal is succeeded by manual labor for two hours, after which each monk occupies an hour in private prayer or reading in his own cell until four o'clock, when they again assemble in the choir for vespers. The supper consists of bread and water, and after a short interval of repose, is followed by a lecture. At six o'clock, they recite complin in choir, and at the end, spend half an hour in meditation, retiring to rest at eight o'clock. The bed is a hard straw mattress, with a coarse coverlet; and the Trappist never lays aside his habit, even in case of sickness, unless it should prove extreme. Perpetual silence is prescribed, unless in cases of necessity. The minor practices and observances are devised so as to remind the monk at every turn of the shortness of life and the rigor of judgment; and the last scene of life is made signal in its austerity by the dying man being laid during his death-agony upon a few handfuls of straw, that he may, as it were, lay aside upon the very brink of the grave even the last fragment of earthly comfort to which the necessities of nature had till then compelled him to cling.

The reformed order of La Trappe scarcely extended beyond France in the first period of its institution. The inmates of La Trappe shared, at the Revolution, the common fate of all the religious houses of France: they were compelled to quit their monastery; but a considerable number of them found a shelter at Valsainte, in the canton of Freiburg in Switzerland. In the vicissitudes of the revolutionary war, they were driven from this house; and a community numbering about 250, together with a large number of nuns, who had been established for purposes of education, found refuge at Constance, at Augsburg, at Munich, and eventually, under the Czar Paul, in Lithuania and White Russia. Later in the course of the war, small communities obtained a certain footing in Italy, Spain, America, England, and notwithstanding the prohibitory law, even in France, at Mont Genevre. After the Restoration, they resumed, by purchase, possession of their old home at La Trappe, which continues up to the present time to be the head monastery of the order, and numbers nearly 200 members. During the course of the last 50 years, they have formed many establishments in France; a few in Germany; a very considerable one at Mount Melleray, near Cappoquin, in the county of Waterford, Ireland; and others with still more extensive territory annexed in Kentucky, Illinois, and other states of North America. A modification of the T. O., called 'Trappist Preachers,' was established about 30 years since, at Pierre-qui-Bire, near Avallon.—See Gaillardin's *Trappistes; ou l'Ordre de Citeaux au 19 Siècle* (Paris, 1844).

TRASH. See Sugar.

TRASIME'NUS LACUS, the ancient name of an Italian lake (*Lago Trasimeno*, or *Lago di Perugia*) lying between the towns of Cortona and Perugia. It is about 10 miles in length by 8 in breadth; the greatest depth is not above 30 feet. The lake has no apparent outlet, and the margins are flat and overgrown with reeds. It is surrounded on all sides by hills, those on the north side, extending from Cortona to the lake, being known as the Gualandro Hills—the *Montes Cortonenses* of Livy—covered at the present day with oak, vine, and olive plantations. The lake contains three islands. T. L. is memorable chiefly for the great victory obtained by Hannibal in 217 B.C. during the Second Punic War, over the Romans, under their consul, C. Flaminius. Hannibal leaving Fæsulæ, passed close by the camp of Flaminius at Arretium, laying waste the country as he proceeded in the direction of Rome. This, as the Carthaginian general intended, induced the consul to break up his encampment, and follow in pursuit. Hannibal in the meantime taking up a strong position on the hills on the north side of the lake, along which he was passing. The consul, coming up early next morning, when the whole place was enveloped in mist, saw only the troops in front on the hill of *Tuoro*, with whom he was preparing to engage, when he found himself surrounded and attacked on all sides. The Carthaginians thus had the Romans completely in their power, and took such advantage of the opportunity, that 16,000 Roman troops are said to have been either massacred or drowned in the lake, Flaminius himself being among the first who fell; 6000 troops who had forced their way through the enemy, surrendered next day to Maharbal. It is said both by Livy and Pliny that the fury on both sides was so great as to render the combatants unconscious of the shock of an earthquake which occurred during the battle.

TRAS-OS-MO'NTÉS (Beyond the Mountains), a province of Portugal, forming the north-east corner of the country, is bounded on the N. and E. by Spain, on the S. by the river Douro, and on the W. by the Portuguese province of Minho. Area, 4275 sq. m.; pop. (1878) 410,461. It is in the main a cold plateau, with bare mountain masses, broken through by deep romantic ravines; but the port-wine district, known as the *Alto-Douro*, is very pleasant. Considerable quantities of wheat and rye are raised, but the chief products are wine and oil. In several places the silkworm cultivation is prosecuted with success. Fruits, especially oranges, are produced abundantly in the valleys, and sumach on the mountains, which are also rich in unutilized metallic wealth.

TRASS, a tufaceous deposit of the extinct volcanoes of the Eifel, near Coblenz, resembling the Puzzolana of Naples. Its base consists almost entirely of pumice, in which are embedded fragments of basalt, burnt shale, slate, sandstone, &c., and even numerous trunks and branches of trees. Its formation is accounted for by supposing an eruption to have taken place, with copious evolution of gases, in a lake-basin, and a flood of the mud thus formed to have swept away whatever came before it. Large areas are covered by the T., which has choked up valleys, now partially re-excavated.

TRAVANCO'RE, a protected state in the extreme south of India, bounded on the E. by the states of Tinnevelli and Madura, and on the W. by the Indian Ocean. Area, 6730 sq. m.; pop. (1871) 2,311,379. At the southern extremity of the state is Cape Comorin (properly, Kumarin). On the elevations the soil is light and gravelly; in the valleys it is in general a deep black mould. Rice, the sago-palm, and vegetables are the principal products. Formerly, the capital was Travancore, a decayed and unimportant town; the present capital is the small town Trivanderam.

TRAVELERS, Law as to. In the United Kingdom, entire freedom of traveling is one of the rights of the subject. The rights of travelers in regard to the use of roads are stated under the head of highway (q. v.). Other rights are noticed in connection with Inn (q. v.). With regard to travelers by conveyances, whether by land or sea, if the party conveying is a public carrier, then the following are his liabilities. A public carrier having a stage-coach (and railway companies are on the same footing) does not engage or warrant to convey a traveler with absolute safety, as is the case with respect to goods, but merely to convey without negligence on his part; hence, if the conveyance meets with some accident, resulting in injury to the traveler, the right of the latter to recover damages depends on whether the carrier or railway company has been guilty of negligence. Considering that, in case of a dispute, it is always left to a jury to say whether there was negligence or not, it is a safe maxim, that there is scarcely anything in the form of an accident which is not resolvable by a jury into negligence on the part of the carrier or company; and an injured traveler has seldom much difficulty in throwing the burden on the carrier of proving that there was no negligence on his part,

and this proof, for the reasons stated, is seldom successful, at least where the accident arose from a defect in guiding the carriage.

In case of accidents not fatal, the party injured has almost always a remedy against the carrier, the chief dispute being as to the amount of damages, the amount legally demandable varying according to the position in life and injury to business caused by the accident. In case of death caused by blameable accident in traveling, there was formerly no remedy available to the executors or relatives, and there is none at the present day; but if the deceased party leave a wife, husband, parent, or child, then these, but no other relations, can sue for damages. In the case of a traveler's proceeding a great distance over several lines of railway, his remedy is entirely against the company with whom he contracted—that is to say, to whom he paid the lump sum, and from whom he obtained his ticket. A carrier may contract not merely to carry a traveler a certain distance by his own conveyance, but to carry him to any part of the world, using for that purpose various other intermediate railways or steamers for the rest of the journey; and in all such cases the only person with whom the traveler contracts is the carrier to whom he paid his fare, who is liable for any accident or negligence, whether occurring on his own part of the line, or on any other part.—As to traveler's luggage, see LUGGAGE.

TRAVELER'S TREE, or RAVENALA (*Urania speciosa*, or *Ravenala Madagascariensis*), a remarkable plant of the natural order *Musaceæ*, a native of Madagascar, and forming a characteristic feature of the scenery of many parts of that island. The stem resembles that of the plantain, but sends out leaves only on

Traveler's Tree (*Urania speciosa*).

two opposite sides, like a great expanded fan. The lower leaves drop off as the stem grows, and in an old tree the lowest leaves are sometimes thirty feet from the ground. A tree often has twenty or twenty-four leaves, the stalk of each leaf being six or eight feet long, and the blade four or six feet more. The blade of the leaf is oblong, bright green, and shining. The fruit is not succulent, but is filled with a fine silky fibre of the most brilliant blue or purple color, amongst which are about thirty or forty seeds. Forty or fifty fruits grow in a bunch, and three or four bunches may be seen at once on the tree. The leaves are much used for thatch, and for many other purposes; and the leaf-stalks for the partitions, and often even for the walls of houses. The leaf-stalks always contain water, even in the driest weather, more than a quart being readily obtained by piercing the thick part of the base of a leaf-stalk, and this water is pure and pleasant. Hence the name *Traveler's Tree*.

TRA'VEMÜNDE. See LUBECK.

TRA'VERSE, in Fortification, mounds of earth, above the height of a man, and 18 feet thick, placed at frequent intervals on a rampart, to stop shot which may enfilade the face of such rampart. A fire of this nature, in the absence of traverses, would dismount the guns, and prove altogether ruinous. The traverses also give means of disputing the progress of an assailant who has gained a footing on the wall, for each traverse becomes a defensible parapet, only to be taken by storm.

TRAVERSE, in the Law of England, means the denial of fact given by one party in an action to the pleading of his adversary.

TRAVERSING PLATFORM, an arrangement for the more rapid and easy movement of cannon in battery. The gun is either mounted on an ordinary truck-carriage, or on rollers under its trunnions. The truck or rollers work in and out on two parallel iron rails, which rails are mounted on the traversing carriage, and are 16 feet or more in length. Wheels at each end of this platform, or more frequently if the weight of the gun be very great, are placed at right angles to the direction of the rails, and run on circular tramways, which have their center in the embrasure through which the gun is fired. The rails incline upwards towards the rear, to moderate the gun's recoil. The advantages are, that the leverage for turning the gun is increased by the platform's length, while the circular rails diminish the resistance; that the gun is easily run out for firing on the upper rails; that by its own recoil it runs itself in again for loading; and that a much smaller embrasure is required to give a good compass to the muzzle.

TRA'VERTIN, the Italian name for limestone formed by springs holding lime in solution.

TRA'VESTY (Fr. *travestir*, to disguise, particularly through the effect of *contrast;* e. g., to dress in another sex's or person's clothes; Ital. *travestire*) is a term applied in literature to denote a burlesque representation of something previously executed in a serious and lofty manner. It differs from Parody (q. v.) in this respect, that while the latter changes the subject-matter and the *dramatis personæ*, but mockingly imitates the style of the original, the former leaves the subject-matter partially, and the *dramatis personæ* wholly, unaltered; producing a purely comic effect by the substitution of the mean, the frivolous, and the grotesque in action or speech, for the serious, the noble, or the heroic.

TRAVNIK, a town of Bosnia (now under Austrian administration), and recently its capital, stands on the Lasva River, 45 miles west-north-west of Bosna-Serai. Its numerous mosques and the castle, which dates from the middle ages, are the principal edifices. It contains 12.000 inhabitants, almost all Mohammedans. The principal branch of industry is the manufacture of sword-blades.

TRAW'LING, a mode of fishing by a net dragged along the bottom of the sea, behind a boat. It is much employed in deep-sea fishing on the coast of England, and by far the greater part of the fresh fish brought to the London market, herring and mackerel excepted, is now obtained by trawling. Trawling has long been practised on some parts of the south coast of England, but of late years this mode of fishing has been adopted much more extensively than before, and has been introduced where it was formerly unknown, particularly on the east coast of England, not without great opposition on the part of line-fishers and others, who have loudly complained of injury done by it to the fisheries by destruction of spawn, and otherwise. The Report of the

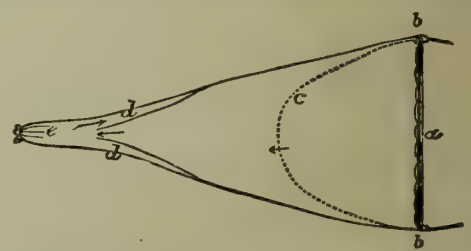


Fig. 1.—Beam-trawl Net:
a, beam; *b*, *b*, trawl-heads; *c*, outline of the ground rope; *d*, *d*, the pockets; *e*, the cod or small end of the net.

Commissioners on the Sea-fisheries of the United Kingdom, 1866, sets aside all complaints against it, however, as unfounded; whilst its great productiveness recommends it as advantageous to the public interest. The *Trawl*, or *Beam-trawl*, as it is often called, is a triangular purse-shaped net, about 70 feet long, usually having a breadth of about 40 feet at the mouth, and gradually diminishing to 4 or 5 feet at the commencement of the *cod*, or smaller end of the net, which is about 10 feet long, and of nearly uniform breadth. The upper part of the mouth is secured to a wooden beam about 40 feet long, which keeps the net open; this beam is supported on two upright iron frames, known as the *trawl-heads* or *irons*. The under side of the net corresponds with the upper, except that instead of being fastened to a beam, it is made with a deeply-curved margin attached to the *ground-rope*, the whole length of it in contact with the ground.

A trawl has also generally two *pockets*, one on each side, made by lacing together the upper and under parts, so that fish turning back from the cod may be caught in them. The meshes vary in size from four inches square at the mouth, to an inch and a quarter square in the cod. Two stout ropes, of about 15 fathoms each, are fastened, one to the front of each of the trawl-heads, the other ends united to form a bridle, to which is shackled a warp 150 fathoms long. By this warp the trawl is towed, the

quantity of rope paid out depending on depth of water, weather, and other conditions. Trawling is generally in the direction of the tide, sometimes across it, but never against it. The rate of progress is usually only from half a mile to two miles an hour faster than that of the stream. The trawl can only be used with advantage on a sandy bottom or other smooth ground. On rough ground, the net would be torn in pieces. The vessels employed in trawling on the Dogger Bank and elsewhere near the English coast vary in size from 35 to 60 tons. Many of these trawlers, however, stay out at sea for six weeks at a time in all seasons of the year; their fish being packed in ice collected by fast-sailing cutters, and so conveyed to market. Cod, haddock, and other *white-fish* are caught in great numbers by trawling; and some kinds of flat-fish, as soles, are scarcely to be obtained by any other means. Smaller trawl-nets than those above described are used in bays and estuaries.

A kind of trawl called the *pole-trawl* was formerly in use in some parts of England, but is now used only in the south of Ireland.

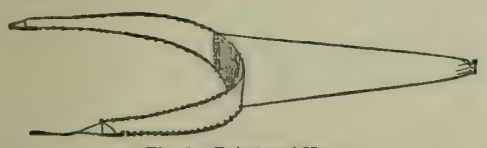


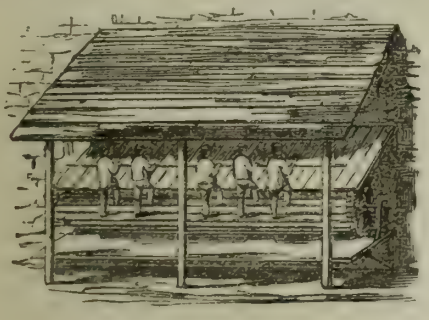
Fig. 9.—Pole-trawl Net.

It is much less effective than the beam-trawl. Instead of a beam, two poles of 25—30 feet long are used, rigged out on the sides of the vessel, to keep the mouth of the net open.

The term trawling is commonly, although incorrectly, employed in Scotland to designate a particular mode of herring-fishing, which, however, is only seine-net fishing (see NETS) on the principle of encircling shoals of fish, as has been practised in pilchard-fishing on the south coast of England from time immemorial. It is of recent introduction in Scotland, and has been opposed by the drift-net herring-fishers, from interested motives, in the same way that beam-trawling has been opposed on many parts of the English coast. The legislature too hastily accepted the views of its opponents; but a Royal Commission having been appointed to inquire into the subject, made a report decidedly favorable to it in 1863; and the judgment of that Commission was sustained by the Report of the Sea-fisheries Commission of the United Kingdom in 1866.

TREACLE. See SUGAR.

TREAD-MILL, an appliance of prison discipline, much in use some years ago in the prisons of Great Britain, the invention of Sir William Cubit, of Ipswich. It consists of a wheel in the form of a long cylinder, furnished with 24 steps round its circumference, and turned on its axis by the tread of prisoners, each of whom may be made to tread in a separate compartment, so boarded off that he can have no intercourse with the rest. The prisoners are assisted and supported by a hand-rail, and cause the wheel to revolve about twice in the minute. The tread-mill has



Tread-mill.

sometimes been made productive by being used to grind corn or turn machinery. It has been found an objection to its use, that it does not admit of being modified to meet the varying strength of individual prisoners; and as an instrument of prison discipline it has been generally supplanted by the *Crank*, a small flaked wheel, like the paddle-wheel of a steamer, which, on the prisoner turning a handle outside, revolves within a box partially filled with gravel. The amount of strength necessary to each revolution can be regulated by the quantity of gravel used, and a register placed outside the prisoner's cell records the number of revolutions made. The crank is only used when hard-labor is part of the prisoner's sentence.

TREASON (Fr. *trahison*, Lat. *traditio*, from *tradere*, to give up or betray), in the Law of the United Kingdom, is the highest civil crime which a member of the community can commit, being treachery against the sovereign. By the ancient common law of England, there was great latitude as to what was held by the judges to be treason, whereby, says Blackstone (b. iv. c. vi.), the creatures of tyrannical princes had opportunity to create abundance of constructive treasons, that is, to raise, by forced and arbitrary constructions, offences into the crime and punishment of treason, which never were suspected to be such. Thus, the accroaching, or attempting to exercise royal power—a very uncertain charge—has been treated as treason; and killing the kings's father or brother, or even his messenger, has also been so treated. The inconvenience of these constructive treasons led to the passing of the statute of 25 Ed. III. c. 2, which attempted to define treason, and it was defined in five forms. 1. When a man compasses or imagines the death of the king, queen, or their eldest son and heir. Under this clause it was held that the husband of a queen-regnant was not included; but it includes a king *de facto*, without regard to his title. The phrase 'compassing and imagining the death of a king,' has given rise to much discussion, but it has been taken to mean the mere purpose or design, as distinguished from the carrying such design into effect; nevertheless, the purpose can only be proved by some overt acts, such as providing weapons or ammunition for the purpose of killing the king, assembling and consulting on the means to kill the king, &c. The law has often, however, been strained, and in arbitrary reigns, even a sermon unpreached was held to convict Peachum; and a paper found in a closet to convict Algernon Sydney, though merely speculative in its character. 2. Another form of treason is the violation of the king's companion (i. e., wife), or his eldest daughter unmarried, or the wife of the king's eldest son and heir. 3. Another form is that of levying war against the king in his realm, either by taking arms to dethrone the king, or under pretence to reform religion or the laws; by resisting the king's forces; by joining an insurrection, with an avowed design to pull down all enclosures, all brothels, and the like; though such a conspiracy, if aimed at a particular house, would be only a riot. 4. It is also treason to adhere to the king's enemies in the realm by giving them aid and comfort, as by sending intelligence or provisions, or selling arms. 5. Lastly, it is treason to slay the chancellor, treasurer, or the king's justices of the bench, or in assize, while in their places administering justice. Besides these specific forms of treason, the statute of Edward III. enacted that, if there should be other cases not above specified, the judge should tarry without going to judgment, till the king and parliament should judge it treason or other felony—which was a safeguard against the judges indulging too much in refinements about constructive treason. At a later period, between the reigns of Henry IV. and Queen Mary, the courts returned to the system of inventing constructive treasons, and actually included as such the clipping of money, burning houses to extort money, refusing to abjure the pope, &c. These and other new-fangled treasons were totally abolished by a statute of 1 Ed. VI. c. 12. By a subsequent statute of 1 Anne c. 17, whoever endeavors to hinder the next in the succession under the Act of Settlement, from succeeding to the crown, is to be held guilty of treason; and whoever maliciously affirms another to have right to the crown, otherwise than according to the Act of Settlement, commits treason. Moreover, by 36 Geo. III. c. 7, whoever compasses or intends death or bodily harm to the person of the king, is to be adjudged a traitor. One of the characteristics of an indictment for treason is, that a copy of the indictment, and a list of the witnesses and jurors, must be delivered to the prisoner. This information, which gives the names, and also the places of abode, of all the witnesses, must be delivered to the prisoner ten days before the trial; and the prisoner is entitled to have counsel assigned to defend him. This right, which prisoners accused of other crimes have not in English law, was conferred by a statute of Will. III.

The punishment of treason was severe and even revolting. The traitor was to be drawn on a hurdle to the place of execution, hanged by the neck, his head then severed from the body, the body divided into four quarters; and the head and quarters to be at the disposal of the crown. But in 1870 these barbarities were repealed, and the sentence is now changed into hanging. The consequence of a conviction of treason was forfeiture and corruption of blood; the corruption of blood having the effect that the attainted person could neither inherit lands from his ancestor, nor transmit them to any heir. But this was altered as regards England and Ireland in 1870 by the statute 33 and 34 Vict. c. 23. The convict forfeits and is disqualified for any public office; the court may order him to pay the costs of his conviction, and his whole property is transferred to administrators named by the crown, who administer it and retransfer the surplus to his heirs and representatives.

There are certain minor offences which are called misprision of treason, being those closely bordering on treason. Such are offences which consist in the bare knowledge and concealment of treason, without any degree of assent thereto, for any assent makes the party a principal traitor. If a person, knowing of the

treason, do not forthwith reveal it to some judge of assize or justice of the peace, this is the crime of misprision of treason. The punishment of misprision of treason was loss of goods and lands during life. Another offence closely related to treason is the wilfully pointing a gun at, or attempting to strike, the person of the sovereign, with intent to injure him (or her); the offence being recently reduced, by statue 5 and 6 Vict. c. 51, to one punishable with three years' imprisonment. There is also a cognate offence created by 11 and 12 Vict. c. 12—that of intending to depose the queen, or levying war against her in order to intimidate her or the Houses of Parliament. The offence of Præmunire (q. v.) was originally the introducing a foreign power into the country, and the name was extended to similar offences. The law of treason in England and Scotland is nearly the same.

TREA'SURER, LORD HIGH, the name given to the third great officer of the crown in England, who, in former times, was sole head of the king's exchequer. In the reign of William I. a separate board and court for matters of revenue was appointed after the model of the Exchequer of Normandy, and a treasurer and other officers were appointed for transacting business relating to the royal revenue. Odo, Earl of Kent, was the earliest holder of this office; but the early treasurers were for the most part churchmen. The functions of the treasurer were often discharged by the Chief Justiciary, and the offices of Justiciary and Treasurer seem not to have been completely separated till the reign of Stephen. The office of Lord High Treasurer was for the first time put into commission by James I. in 1612; and from the accession of George I. down to the present time, it has been the practice to vest the office in a Board of Lords Commissioners of the Treasury. See TREASURY. In Scotland, a similar office existed prior to the Union; and there were also Lords High Treasurers appointed in Ireland. On the Union of 1707, the Lord High Treasurer of England became the Lord High Treasurer of Great Britain; and in 1816, by statute 56 Geo. III. c. 98, on the consolidation of the same offices in England and Ireland, he was constituted the Lord High Treasurer of the United Kingdom.

TREASURER OF THE HOUSEHOLD, an officer in the Lord Steward's department of the royal household of the United Kingdom, who bears a white staff, and ranks next to the Lord Steward, for whom he is empowered to act in his absence. He is always a member of the Privy Council; and his tenure of office is dependent on that of the ministry. In former days, this office was hereditary, but it has long ceased to be so.

TREASURE-TROVE is the finding of hidden treasure in the earth; the word treasure meaning coin, gold or silver plate, or bullion. By the law of England, he who finds such things hidden in the earth is not entitled to them, but they belong to the crown. This is an exception to the general rule, that he who first finds a thing, whose owner is unknown, is entitled to keep it; and accordingly the exception is construed strictly, so that if the coin, &c., is not hidden in and covered by the earth, the finder, and not the crown, is entitled to it. If it is treasure-trove in the strict sense above described, then it is the duty of the finder to give notice to the crown; and to conceal it or appropriate it is an indictable offence, punishable by fine and imprisonment.—In Scotland, the rule is the same, and the finder is bound to inform the sheriff of the finding. It is not so generally known as it ought to be that the crown is in the practice of paying to the finder the value of the property, on its being delivered up; from misapprehension of this matter it is believed that many curious relics are lost by their finders consigning them to the melting-pot.

TREASURY, that department of the executive of the government of the United Kingdom which has the control of the revenue and expenditure of the country. The head of the Treasury was in former times an officer called the Lord High Treasurer (see TREASURER, LORD HIGH), but his office has ever since the accession of George I. been executed by Lords Commissioners, who have become his permanent representatives. The Treasury Board now consists of the Prime Minister (generally styled First Lord of the Treasury), the Chancellor of the Exchequer, and three junior Lords of the Treasury, who have usually seats in parliament, as have also the two joint-secretaries of the Treasury. The First Lord being the head of the administration, his duties are not limited to the Treasury, which is chiefly conducted by the other members of the Board. The Chancellor of the Exchequer, who holds under a distinct patent the office of Under-treasurer, is the effective head of the Treasury, exercising the most responsible control over the expenditure of the different branches of the service, as also over all works demanding unusual outlay in the naval, military, and civil departments, either at home or in the colonies. He prepares an annual estimate of the expenses of the country, and of the ways and means by which they are proposed to be met; and this statement, known as the Budget, is submitted by him to the House of Commons. The Prime Minister, when a member of the House of Commons, has occasionally held at the same time the office of Chancellor of the Exchequer. The duties of the junior Lords are in a great measure formal: the heaviest portion of the executive functions of the Treasury devolves on the Secretaries.

The function of payment has ever since the Restoration been completely separated from the custody of the public revenue, the former only being vested in the Treasury, while the latter belongs to the Exchequer. By an arrangement effected by 4 and 5 Will. IV. c. 15, the revenue flowing into the Treasury is paid into the Bank of England, to the credit of the Comptroller-general of the Exchequer, and all payments on the public account are made pursuant to a warrant or order of the Treasury. No moneys voted by parliament can be drawn from the Exchequer without the warrant of the Treasury Board, nor can any payment be made from the civil list without its authority.

The duties of the Treasury Board are numerous. The supplies for the army, navy, and civil service are issued under its authority. In virtue of various statutes, it has the regulation of the salaries of newly created officers in other departments, and of the number of officers in the establishments for new branches of the public service. The duties of the Treasury also comprise the examination of the expenses of legal establishments, sheriffs, county courts, and criminal prosecutions. All payments for civil salaries, allowances, and incidental charges payable in England, and all payments for the army, navy, and ordnance, are made upon the special authority of the Treasury by the Paymaster-general. The Boards of Customs and Inland Revenue, and the Post-office, are subject to its general authority. The office of Woods and Forests now discharges many of the duties which formerly developed on the Treasury, but is subject to its regulations. The establishments of colonial and other offices are also subject to the control of the Treasury with regard to their expenses. The Treasury may be appealed to against the decisions of subordinate departments in all cases connected with the receipt of revenue.

The Treasury possesses the patronage of the departments immediately subordinate to it. The church patronage of the crown —except that which belongs to the Lord Chancellor—is usually disposed of on the advice of the First Lord of the Treasury; and the Foreign and Colonial Secretaries, in all important appointments falling under their patronage, are in the practice of consulting the First Lord of the Treasury.

TREATY, in public Law, an agreement of friendship, alliance, commerce, or navigation, entered into between two or more independent states. Treaties have been divided by publicists into *personal* and *real*, the difference being that the former relate exclusively to the persons of the contracting parties, for example, treaties guaranteeing the throne to a particular sovereign and his family, and the latter are treaties for national objects, independent of the rulers of the state. While personal treaties expire with the death of the sovereign, or the extinction of his family, real treaties bind the contracting parties independently of any change in the sovereignty of the states. The constitution of each particular state must be looked to, to determine in whom the power of negotiating and contracting treaties with foreign powers resides. In monarchies, whether absolute or constitutional, it is usually vested in the sovereign. By the constitution of Great Britain, the exercise of this power is subject to parliamentary censure: ministers who advise the conclusion of any treaty which shall afterwards be judged derogatory to the honor, or disadvantageous to the welfare of the nation, being liable to impeachment, a proceeding of which English history affords numerous instances; as the impeachment of De la Pole, Earl of Suffolk, in 1451, for making a convention of peace without the assent of the privy council; of Wolsey, in 1529, by the House of Lords, for making treaties without the king's knowledge; and of the Earl of Orford by the Commons, in 1701, for advising treaties for dividing the dominions of Spain.

In republics, the chief magistrate, senate, or executive council is intrusted with the exercise of this sovereign power. The constitution of the United States of America (art. ii. sec. 2) vests it in the president, with the advice and consent of the senate. No special form of words is necessary for the validity of a treaty; but modern usage requires that an agreement which has originally been verbal, should as soon as possible be committed to writing. There are certain compacts between nations which are included in the exercise of a general implied power confided to certain public agents as incidental to their official position. Such are the acts of generals or admirals limiting hostilities by truces, capitulations, or cartels for the exchange of prisoners, which do not require the ratification of the supreme authority, unless there be a reservation making that necessary. In other cases, however, a public minister or other diplomatic agent is not entitled to conclude or sign a treaty with the foreign power to which he is accredited, without a full power independent of his general letter of credence. Even in the case of a treaty concluded with full powers, it is often considered expedient to have a special ratification by the sovereign, or other proper authority of the state contracting.

A treaty is considered to be extinguished when one of the contracting powers loses its existence as an independent state, when the internal constitution of either state is changed so as to make it inapplicable; and in case of war between the contracting parties, unless the stipulations of the treaty have been expressly with a view to the rupture. As there is often a difficulty in distinguishing stipulations perpetual in their nature, from those that are extinguished by war, it is common to insert clauses in treaties of peace reviving and confirming the treaties formerly subsisting between the contracting parties.

A Treaty of Guaranty is an engagement by which one state promises to aid another when it is disturbed, or threatened to be disturbed, in the peaceable enjoyment of its rights by a third power.

Treaties of alliance may be offensive or defensive: in the former, the ally engages generally to co-operate in hostilities against a specified power, or against any power with which the other may be at war; in the latter, the engagements of the ally extend only to a war of aggression commenced against the other contracting party.

The execution of a treaty is occasionally secured by hostages; as at the peace of Aix-la-Chapelle, in 1748, when several peers were sent to Paris as hostages for the restoration of Cape Breton by Great Britain to France.

TRE'BBIA, a small but famous stream of Italy, rises in the Ligurian Appennines, near Montebruno, flows northward through a mountain valley for the greater part of its course, and joins the Po, two miles west of Piacenza. Its entire length is about 50 miles. Here Hannibal decisively defeated the Roman consul Sempronius, 218 B.C.

TRE'BIZOND, or TREBISOND (in Turkish, *Tarabezún*), is a Turkish eyalet in the nort-east of Asia Minor, stretching along the south-east shore of the Black Sea for 240 miles, with an estimated pop. of 540,000. The surface is mostly mountainous, the slopes towards the sea being thickly wooded. The eastern portion of the eyalet is known as Lazistan, from its inhabitants, the Lazi, a savage vindictive race, distinguished among their neighbors for their barbarous manners and predatory habits. The port of Batoum and a part of Lazistan on the Russian frontier were ceded to Russia in 1878. Next to Trebizond, the most important places in T. are Samsoun, Kerasun, and Gumish-Khaneh.

The chief town of the eyalet is TREBIZOND, a flourishing seaport city, on the Black Sea coast, about 110 miles north-west of Erzerum. It is surrounded by walls of great extent, which enclose numerous gardens as well as the town itself, and is inhabited by a pop. of 40,000—50,000, chiefly Moslems. Outside the walls are various suburbs, where most of the Christian inhabitants reside, and in which the principal bazaars and khans have been established. The city is defended by several forts along the walls, and by a fortified citadel perched upon a high rock on one side of the town. It possesses an excellent harbor, which, however, is only considered safe during the summer months, the roadstead of Platena, seven miles to the west, being employed for the rest of the year. There are numerous mosques and 'medresses,' ten churches for Greek Christians, copper foundries, dye-works, &c. The geographical position of T. is, in a commercial point of view, rivaled only by that of Alexandria, and has made it the great entrepôt of the commerce between Eastern Europe and Central Asia, and the second commercial city of the Turkish Empire. European goods are brought hither, since 1836, by regular services of steamers, from Constantinople and the mouths of the Danube; and those of Asia by caravans from Erzerum, Tabriz, and Syria. The value of the annual imports by sea is about £1,500,000; that of the annual exports may amount to a little over £1,000,000. The inland traffic with Anatolia is supposed also to represent a value of near £1,000,000. The goods brought overland embrace silk, wool, tobacco, wax, gall-nuts, oil, opium, drugs of various kinds, honey, timber, carpets, and shawls; and those arriving by sea are principally cotton cloths, glass, cutlery, fire-arms, as well as grain, iron, tin, spices, &c.

T. is the ancient *Trapezus*, and was founded by a colony from Sinope; it was a flourishing town under the Colchians, when Xenophon arrived there in his famous retreat from Persia. Conquered from Mithridates by the Romans, it rapidly rose in importance, became a free city, was made by Trajan the capital of Pontus Cappadocicus; and, by the same enlightened ruler, was provided with a larger and better harbor. On the capture of Constantinople by the Crusaders in 1204, and the expulsion of the Comnenian emperors, one of the imperial family, Alexis, established himself at T., where he had previously exercised the functions of governor, and founded a state known as the *Empire of Trebizond*, which stretched from the Phasis to the Halys, and maintained its independence against the Turks till 1462, when the last emperor was defeated and captured by Sultan Mohammed II.

TREBLE, the highest part in harmonized music, which in general contains the melody, and is sung by a Soprano (q. v.) voice. The treble or G clef is placed on the second line of the staff, indicating that the note G occupies the line encircled by its lower-curve. It is one of the two clefs in use in music for keyed instruments.

TRE'DEGAR, a market-town on the north-west border of Monmouthshire, 18 miles north-west of Newport. It stands in the midst of a district with extensive iron-works and coal-mines, which give employment to the great mass of the inhabitants. Pop. in 1871, 12,389.

TREDGOLD, THOMAS, a celebrated English authority on architecture and engineering, was born at Brandon, a small village 2½ miles south-west of Durham, 22d August 1788. At the age of 14 he was apprenticed for six years to a cabinetmaker; but devoted his leisure time to the study of the principles of architecture, and kindred subjects. In 1808, he went to Scotland, where he worked as a journeyman carpenter for five years; then removed to London to his relative Mr. Atkinson, the architect to the Ordnance Board, with whom he labored till 1823, by which period his private business had increased so much that he commenced business on his own account as a civil engineer. During the ten years of T.'s residence with Mr. Atkinson, he studied with redoubled zeal, and obtained a thorough acquaintance with mathematics, chemistry, mineralogy, and geology. He died from pure exhaustion of nature, 28th January 1829, at the early age of 40. T.'s scientific contributions to periodicals range over a wide field; but his great and valuable works are *The Elementary Principles of Carpentry, a Treatise on the Pressure of Beams and Timber Frames, the Resistance of Timber, the Construction of Floors, Roofs, Centers, and Bridges* (4to, 1820; 2d ed., 1828); and the *Strength of Cast Iron* (1821; 2d ed., 1824; 3d ed., 1831). His other works, the *Principles of Warming and Ventilating Public Buildings*, &c. (1824); *Practical Treatise on Railroads and Carriages* (1825); a pamphlet entitled *Remarks on Steam-navigation*, &c. (1825); and *The Steam-engine* (1827), were also received with special favor; and of the first and last of them new editions were speedily required.

TREE, the name given to those plants which live for many years, and have woody stems and branches, the stem being generally single, and bearing a head of branches and twigs; whereas Shrubs (q. v.) have generally a number of stems springing from one root. The terms tree and shrub are not, however, of very exactly defined signification; and many shrubs, under certain circumstances, assume the form of trees, either naturally or by the help of art; whilst trees are, in other circumstances, converted into shrubs. The common hawthorn, for example, is very often a mere shrub, but sometimes appears as a tree, with stem and head as perfect as the greatest monarch of the forest. The gooseberry bush is usually trained in our gardens in a tree-like habit, notwithstanding its small size, and the shortness of its stem; this, however, is entirely artificial, its natural habit being that of a shrub, to which, but for the gardener's knife, it would almost certainly relapse in a single year. The greater number of tress are exogenous. Palms are almost the only endogenous plants to which this name can be given. Very different from the ordinary exogenous trees are the Gymnogens (q. v.) of Lindley—firs, pines, yews, &c. Trees are found in all climates except the coldest, but the number of species, as well as the luxuriance of the forests, is greatest in the tropics. As we advance towards the polar regions, or ascend high mountains, trees disappear before other forms of vegetation. The different characters of trees affect very much the landscape of the countries in which they grow; some countries, and particularly in northern parts of the world, being covered with somber pine forests, whilst others abound in ash, beech, and similar trees of verdant foliage. Every kind of tree has its peculiar character, not only in its foliage, but in its general form and its mode of branching. An ash is as easily distinguished from an elm, by a practised eye, in winter, when destitute of leaves, as in the full foliage of summer.

Some trees attain a very great age, but the ordinary duration of life is very different in different species. There are trees in England which are supposed to be more than a thousand years old, and are still healthful and flourishing. Oaks and yews are amongst the trees of longest life. The Baobab of Africa is also regarded as a very long-lived tree. See EUCALYPTUS, WELLINGTONIA.

No acotyledonous plant assumes the character of a tree, except a few ferns, known as Tree Ferns.

TREE FERNS are ferns with tree-like woody stem, and a head of fronds resembling the leaves of palms. They are found only in tropical and sub-tropical countries, many of which, however, are quite destitute of them. One species, *Alsophila gigantea*, which has a thick black trunk surmounted by a feathery crown, is found in the Himalaya, at an elevation of 7000 feet, and might be introduced with some probability of success into Britain. The

soft central part of the stem of *Cyathea medullaris* is an article of food in New Zealand. Tree Ferns are a characteristic feature of the vegetation of New Zealand.

Tree Fern.

TREE-FROGS (*Hyladæ*), a family of *Batrachia* (q. v.), separated from the true frogs (*Ranidæ*) on account of the dilated discs or suckers at the tips of the toes, which are covered with a viscid secretion, and enable the animals to climb trees. Most of them are arboreal; they are of small size, more elegant in form than the true frogs, of brighter colors and more active habits. They feed on insects, which they pursue on the branches and among the leaves of trees or shrubs, stealing towards them, and suddenly springing upon them. They deposit their spawn in water, like other batrachians—some of them on the edges of leaves hanging over water—and hybernate in mud. The day is their time of activity, although they shelter themselves among leaves from very hot sunshine. Their croaking is louder than

Tree-frog (*Hyla arborea*).

th. of true frogs, and the traveler is sometimes amused by hearing it from the tops of high trees. No species of tree-frog is found in Britain; one occurs in the middle and south of Europe; it is also found in Asia and the north of Africa; the warmer regions of the Old World have numerous species, and in America they are still more abundant. Some occur in Australia. The TREE-FROG of Europe (*Hyla arborea*)—*Rainette* of the French—is found chiefly in moist woods, and in hedges near water. Although a small creature—one of the smallest of European frogs—it can make a spring of more than a yard in height to seize an insect. It becomes very noisy on the approach of rain, and is often kept in confinement, to serve as a kind of barometer. Very similar to it is the COMMON TREE-FROG of North America (*H. versicolor*), which is abundant in the middle and northern parts of the United States as far west as the Mississippi, but is replaced in the south by the GREEN TREE-FROG (*H. viridis*), whilst other species are found in different parts of the country.

TREES OF LIBERTY. The custom, common to almost all the nations of Europe, of celebrating the beginning of spring and various national and ecclesiastical festivals by setting up green boughs, led, during the war of independence in the United States, to the habit of planting poplars and other trees as the symbol of growing freedom. This example was imitated during the French Revolution. The Jacobins in Paris are said to have planted the first tree of liberty in 1790; and the custom spread rapidly through the whole of France. These trees, crowned with the cap of liberty, were soon to be found in every village, while the people danced round them, singing revolutionary songs, and regarded them as the rendezvous of the patriots. Poplars were at first employed, but afterwards oaks were substituted in their place. This custom was regulated by a decree of the Convention, and diffused over foreign countries by the republican armies. During the Reign of Terror, thousands lost their lives under the pretext of having injured a tree of liberty. During the Empire, this custom, like all others that had originated during the Republic, was completely suppressed. In the July revolution of 1830, trees of liberty were again set up, particularly at Paris; but the populace took no interest in the matter. During the February revolution of 1848, trees of liberty once more came into vogue at Paris and other places where the inhabitants held republican principles. They were generally hung with tri-colored ribbons, circles, and triangles, the symbols of unity and equality, and surmounted with the cap of liberty. In Paris, on the occasion of erecting a tree of liberty, a priest was frequently conveyed to the spot for the purpose of consecrating it. After most of the trees of liberty had fallen during the conflicts in the streets of Paris in June 1848, government issued an order for their removal from all places where they impeded traffic. Before the end of the year, they had entirely disappeared. Numerous trees of liberty were erected in Italy during the revolution of 1848 and 1849, but fell as the different insurrections were quelled. A learned and interesting treatise has been written on this subject by the Abbé Grégoire.

TRE'FOIL, a name given to many herbaceous plants with leaves of three leaflets, as Clover (q. v.), Lotus (q. v.), Medick (q. v.), Buckbean (q. v.), &c.

TREFOIL, in Heraldry, is a frequent charge, representing the clover-leaf, and is always depicted as *slipped*, i. e., furnished with a stalk.

Trefoil in Heraldry.

Trefoil in Architecture.

TREFOIL, in Architecture, a three-lobed aperture in tracery, &c.

TREGELLES, SAMUEL, LL.D., an eminent New Testament critic and editor, was born at Falmouth in 1813. He did not receive a university education, and spent the early part of his life in secular occupation, yet at the age of twenty-five he had formed the plan of a Greek New Testament, on the principles which he afterwards carried out. In preparing for his *magnum opus*, he visited the continent in search of MSS., and published, among other works, an edition of the *Codex Zacynthius*, an *Account of the Printed Text of the Greek New Testament* (1854) and an *Introduction to the Textual Criticism of the New Testament* (1856). His *Critical Edition of the Greek New Testament* was published in 1856—72, and stands, as to manner of treatment, between that of Lachmann and that of Tischendorf. T. goes further than Tischendorf in his dependence upon ancient, and rejection of modern MSS. In 1862, T. received a pension of £100, which was doubled in 1870. He died on the 24th of April 1875.

TRE'LLIS, an open grating or lattice-work, formed in wood, iron, &c.

TREMATO'DA, or TREMATODE WORMS, constitute, according to Dr. Cobbold's system, the second order of the sub-class *Sterelmintha* (Owen), of the class *Helmintha*. In ordinary zoological classification, the T. form a division of the group of *Platyelmia* or 'flat-worms,' which group is in its turn included in the class *Scolecida*—a division of *Vermes* (see ZOOLOGY). This order, as the Greek word *Trematodes* indicates, is characterized by the possession of certain suctorial pores or openings. All the animals included in it have soft, roundish, or flat bodies, and their visceral organs are lodged in the parenchyma of the body. Most of the T. are hermaphrodites. They seldom attain to a large size (the greatest length is about five inches), but are usually visible to the naked eye. Like all Scolecida, the T. possess a peculiar system of vessels ramifying through their bodies, and termed the 'water-vascular' system.

The Trematoda, or flukes, as they are popularly called, from their resemblance in form to small flukes or flounders, are not parasitic during the whole period of their existence; 'for while passing through the cycle of their life-development, they frequently change their residence, at times inhabiting either open

waters, or the dewy moisture of low pasture-grounds. They perform active and passive migrations from parasitic to non-parasitic abodes; and during their larval wanderings in search of a final resting-place which should prove suitable to their adult condition, they provisionally occupy the bodies of different kinds of invertebrata.'—Cobbold's *Entozoa*, 1864, p. 15. In his *Synopsis of the Distomidæ* (published in 1861), Dr. Cobbold recognizes 344 species of flukes, of which 126 belong to fishes, 47 to reptiles, 108 to birds, 58 to mammals, and 5 to the invertebrata. He now believes that, at the very lowest possible estimate, we must assume the order to contain 400 species, which may be divided into the five families of *Monostomidæ*, *Distomidæ*, *Tristomidæ*, *Polystomidæ*, and *Gyrodactylæ*—names which are based, except in the last case, on the number of their pores or oval suckers.

Van Beneden arranges these families into (*a*) *Monogenea* and (*b*) *Digenea*, the development in the former being simple, while in the latter there is an alternation of generation, the nurses and larvæ living chiefly in molluscs, while the adult animals chiefly live in the bodies of vertebrate animals. The *Monostomidæ* and *Distomidæ* belong to the latter, and the others to the former group. The family of *Distomidæ* embraces the principal and best-known genera of the order *Trematoda*, and its members are at once recognized by the presence of two pores or suckers; one, the anterior, being connected with the mouth; and the other, termed the acetabulum, being usually placed on the ventral surface, in the middle line.

The following members of this order are of special interest, as very liable to infest man. *Fasciola hepatica*, described and figured in the article FLUKE, is not only common in all varieties of grazing-cattle, and especially the sheep, but has been found in the horse and ass, in the hare and rabbit, in the squirrel, beaver, kangaroo, &c., and is occasionally met with in man, not only in the liver and gall-bladder, but beneath the skin in various parts, as, for example, in the sole of the foot, behind the ear, and in the scalp. For an excellent account of the anatomy and development of this parasite, the reader is referred to Cobbold, *op cit.*, pp. 147—169. See ROT. *Distoma lanceolatum* is a species which is by no means uncommon in the sheep and ox, and has been found on at least three occasions in the human subject. *Distoma ophthalmobium* has been occasionally found in the lens of the human eye. *Distoma hæmatobium*, or *Bilharzia hæmatobia*, as Dr. Cobbold terms it, is the only known trematode which is not hermaphroditic.

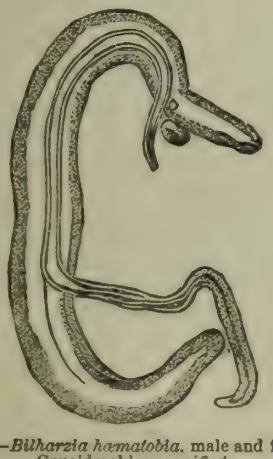


Fig 1.—*Bilharzia hæmatobia*, male and female: Considerably magnified.

The male is a cylindrical worm, measuring only about half an inch in length; while the female is filiform, longer, and much

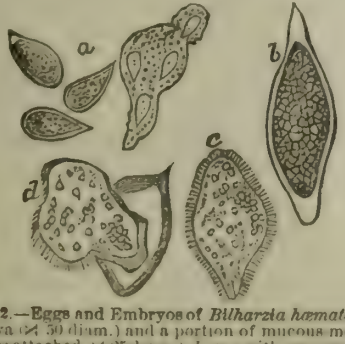


Fig. 2.—Eggs and Embryos of *Bilharzia hæmatobia*: *a*, three ova (× 50 diam.) and a portion of mucous membrane with eggs attached (× 25 diam.); *b*, egg with segmented yelk; *c*, free embryo; *d*, ruptured egg with embryo escaping (× 150 diam.).—From Dr. John Harley.

narrower than the male, being about $\frac{4}{5}$ths of an inch in length. The first specimens were found by Bilharz of Cairo in the portal system, and the worm has since been found in the veins of the mesentery, bladder, and other parts. This parasite is common not only along the borders of the Nile, but in South Africa and the Mauritius. It is so common in Egypt, that in 363 examinations of the body after death, Griesinger found it no less than 117 times.

The principal feature of the disease caused by this worm consists in a general disturbance of the uropoietic function. Diarrhœa and hæmaturia occur in advanced stages of the complaint, being also frequently associated with the so-called Egyptian chlorosis, colicky pains, anæmia, and great prostration of the vital powers. The true source of the disorder, however, is easily overlooked, unless a careful microscopical examination be made of the urine and other evacuations. If blood be mixed with these, and there also be a large escape of mucus, a minute inspection of the excreta will scarcely fail to reveal the presence of the characteristic ova of *Bilharzia*.—Cobbold, *op. cit.*, p. 202.

Dr. J. Harley has published several excellent papers 'On the Hæmaturia of the Cape of Good Hope, produced by a Distòma,' which is undoubtedly the *Bilharzia*.

Several other trematodes occasionally occur in the human subject.

TRE'MELLA, a genus of Fungi, of the division *Hymenomycetes*, soft and gelatinous, of no very determinate form, mostly growing on decaying wood. Several species are found in Britain. In some places, they receive such popular names as Witches' Meat and Witches' Butter. Superstitious notions have been connected with them, and a medicinal value altogether imaginary has been ascribed to them.

TRE'MOLITE, a mineral regarded as a variety of Hornblende (q. v.). It is composed of silica, magnesia, lime, and a very little fluoric acid.

TRE'MOLO, TREMA'NDO (Ital. trembling), in Music, an expression indicating that a note or a chord is to be reiterated with great rapidity for an indefinite number of times, so as to produce a tremulous sort of effect. In singing, *tremolo* effects may on rare occasions be introduced with advantage, but are often resorted to by inferior singers as an artifice to conceal defects of tone and style.

TRE'NAILS, pieces of wood which are used as nails in shipbuilding. They are usually about 15 or 18 inches in length, and when completed, at least 1 inch in thickness. They are made chiefly of locust-wood (*Robinia pseudo-acacia*), or of oak; the former are imported from North America, the latter from Northern Europe. Great Britain imports of these small pieces of wood as much as £5000 worth annually.

TRENCH. See SIEGE.

TRENCH, RICHARD CHENEVIX, Archbishop of Dublin, divine and scholar of the Church of England, belongs to an Anglo-Irish family of Galway, the Trenches of Woodlawn, and was born at Dublin, 9th September 1807. He was educated at Harrow and Trinity College, Cambridge, where he graduated in 1829. After traveling for a few years, he became a country curate; and in 1837 or 1838, published two volumes of poetry, which had at least the merit of imitating Wordsworth, and were favorably received. One of the poems, the *Story of Justin Martyr*, is even yet faintly remembered. In 1845, T. was presented to the rectory of Itchin Stoke; in 1847, he became Theological Professor and Examiner in King's College, London; in 1856, Dean of Westminster; and in 1864, on the death of Whately, Archbishop of Dublin. T. has written extensively and well. He has a quick, keen understanding; his scholarship is varied and choice, though not sufficiently precise or scientific for philological purposes; his fancy, sometimes poetic, and always picturesque, enables him to invest the dry discussion of words with a peculiar fascination; and if the results of his etymological inquiries are not always sure, the processes are invariably pleasant.

As a literary critic, T. is both acute and elegant. His principal works are: *Notes on the Miracles* (1846), *Notes on the Parables* (1841; 12th ed. 1874), *The Lessons in Proverbs* (1853), from all of which his professional brethren have borrowed liberally for the work of the pulpit; *The Sermon on the Mount illustrated from St. Augustine* (1844), *Sacred Latin Poetry* (1849), *St. Augustine as an Interpreter of Scripture* (1851), *Synonymes of the New Testament* (1854), *The Epistles to the Seven Churches of Asia Minor*, *An Essay on the Life and Genius of Calderon*, *Deficiencies in our English Dictionaries*, *Glossary of English Words used in Different Senses* (1859), *The Study of Words* (1851), of which last 22 editions appeared in America before 1862; a memoir of his mother (1862); and *Lectures on Mediæval Church History* (1878).

TRENCK, FRANZ and FREDERICK VON DER, were German barons and soldiers, whose adventures, recorded in autobiographies, have secured for them a world-wide fame. They were cousins, descended from an ancient house of East Prussia, and although placed from infancy under circumstances altogether differ-

ent, exhibited a striking similarity of character. Both were braggarts, both were subject to fits of uncontrollable passion, and both told premeditated lies.

BARON FRANZ was born in Reggio, in Calabria, on 1st January 1711, where his father was an Austrian general. When 17, he received a commission as a cavalry officer, fought duels, and cut off the head of a man who refused to lend him money. He had to flee in consequence, and he went to Russia, where he was made a captain of hussars. He was then a formidable young giant of 6 feet 3 inches; and it is highly probable that he knocked down his commanding officer, as he says he did, for rebuking him. He adds that he was placed under arrest while an engagement was going on; that Marshal Münnich happening to pass, he called out that if set free and pardoned he would bring back three Turks' heads in an hour; that he was set free, and brought back four Turks' heads suspended from his saddle. This story may or may not be true; but certain it is that he was cashiered not long afterwards, and returned to settle on his estates in Croatia. There it is we first meet with the T. of history. The Turkish frontier was overrun with banditti. T. armed and drilled 1000 of his tenants, whom he called Pandours, and by their means succeeded in restoring order. He then offered the services of his regiment to Maria Theresa, and his aid was accepted. In 1740, he took part in the Silesian war at the head of his men, and perpetrated the most atrocious deeds of rapine and cruelty. There had been no such monster, says Mr. Carlyle, since Attila and Genghis. On the 7th of September 1742, he attacked Cham, a fine trading town in neutral territory, this act being, of course, in defiance of all law and discipline; and he completely annihilated it.

After the battle of Sohr, in September, 1745, he offered to capture Frederick the Great, and bring him a prisoner to the Austrian camp. He failed in the enterprise, with great loss of men, but he secured the king's tent and much valuable booty. Suspicions were, however, entertained of his being in communication with the enemy, and he was tried by court martial. He was imprisoned at Vienna, but made his escape with the assistance of the Baroness Lestock, who bribed the jailers to allow him to be conveyed in a coffin as if dead, beyond the city walls, was again captured at Bruges, and reimprisoned at Grätz, where he took poison, and died on 4th October, 1747.—See Carlyle's *Life of Frederick the Great;* and *Mémoires du Baron Franz de Trenck* (Par. 1787), written by himself.

FREDERICK VON DER T. was born at Königsberg, in 1726, and was the son of a major-general in the Prussian service. He distinguished himself at the university. At 16, he became a cornet in the guards; and two years afterwards, the Princess Amalie, who saw him at a ball, we are told, conceived a violent passion for him. To this he attributed the antipathy the king afterwards entertained towards him. There was, however, a much better reason: he was detected in a correspondence with his Austrian cousin, not long before the attempt to capture the king, and arrested. Mr. Carlyle shows that the baron had been in prison three months, and was there when the battle of Sohr took place, although he vividly describes his own adventures in the fight. He was accused of this lie in his own time, and admitted that he must have made a mistake! 'He had nothing but his poor agitated memory to trust to.' He was released on 24th December, 1763, and afterwards settled at Aix-la-Chapelle, where he married the burgomaster's daughter, and went into business as a wine merchant. He published his memoirs in 1787. The book was translated into all languages, and T. became the most famous personage of his time.

The ladies at Paris, Berlin, and Vienna wore bonnets, dresses, and rings *à la Trenck;* and no less than seven plays, founded on his adventures, were brought out on the French stage. In 1792, he went to Paris, and became a zealous adherent of the Mountain party. He was, however, suspected, and thrown into prison. Soon after rumors in circulation among the prisoners, that the Prussians were advancing on Paris, and carrying all before them, were traced to T., who was in consequence condemned. He was guillotined near the Barrière du Trône, July 26, 1794. On the scaffold, although 69 years of age, he manifested the ungovernable passion which had characterized him through life. He harangued the mob; and at length the executioner had by force to hold his head by the gray hair on the block, to meet the fatal stroke.—See Chambers's *Book of Days*, vol. i. p. 260; Carlyle's *Frederick the Great*, vol. iv.; *Friedrich Trencks Merkwürdige Lebensgeschichte von ihm selbst beschrieben* (2 vols. Berl. 1787); and *Leben und Thäten der Trenke*, by Watermann (2 vols., Leip. 1837.)

TRENT, a river of the midland counties of England, rises on the north-west border of Staffordshire, about 10 miles north of Burslem, and at a height of about 600 feet about sea-level. It flows first south-east to the border of Derbyshire, and afterwards in a general north-east direction through the counties of Derby, Nottingham, and Lincoln, to a point about 8 miles east of the town of Goole, where it unites with the Ouse (q. v.) to form the Humber (q. v.). It receives the Derwent, Idle, and Tarn from the west, and the Soar from the south; its length is 170 miles, for 120 miles of which, from its mouth up to Burton-on-Trent, it is navigable for barges.

TRENT (Ital. *Trento*, Ger. *Trient*, Lat. *Tridentum*), a walled town of Austria, in the southern part of the Tyrol, capital of the circle of the same name, is situated on the left bank of the Adige (here spanned by a wooden bridge 146 feet long), in a beautiful and fertile valley, surrounded by high limestone hills, 46 miles north of Verona. In its general aspect, as well as its architecture, T. is quite an Italian town; and with its spires and towers, ruined castles and ancient embattled walls, it presents an imposing appearance from a distance. The *Piazza Grande*, near the Cathedral is adorned with a splendid fountain of red marble, surmounted by a colossal statue of Neptune with his trident. The cathedral, begun in 1212, is a beautiful specimen of the Romanesque style of Lombardy, with a few features suggestive of the contemporary German style; united to it is a fragment of the episcopal palace of the 12th century. The Church of Santa Maria Maggiore is built on the site of the council-chamber in which the famous 'Council of Trent' held its sittings. Among other public buildings are the Church of the Jesuits, ornamented with the richest foreign marble; the New Theater (holding 1400 people); the town-hall; and the Palazzo Buonconsiglio adjoining the town, a noble specimen of the feudal architecture of North Italy, now occupied as a barrack. T. carries on manufactures of silks, wine, pottery, spirits, cloth, and sugar, and has a large transit-trade. The inhabitants are quite Italian in language and habits; and the restoration to Italy of T. and the *Trentino* (district of T.) is, with that of Trieste, the chief aim of the *Italia Irredenta* agitation in Italy. Pop. (1880) 19.585.

The ancient *Tridentum*, or *Tridente*, derived its name from the *Tridentini*, an Alpine tribe, whose capital it was. Conrad the Salic bestowed on the prince-bishops of T. the temporal rule of the valley of the Adige, and under them T. rose to great prosperity. It is still the see of a prince-bishop.

TRENT, COUNCIL OF, the most celebrated of the assemblies regarded by the Roman Catholic Church as ecumenical or general, and the great repository of all the doctrinal judgments of that communion on the chief points at issue with the reformers of the 16th century. Very early in his conflict with Pope Leo X., Luther had appealed from the pope to a general council; and after the failure of the first attempts at an adjustment of the controversies, a general desire grew up in the church for the convocation of a general council, in which the true sense of the church upon the controversies which had been raised might be finally and decretorially settled. Another, and, to many, a still more pressing motive for desiring a council, was the wish to bring about the reform of the alleged abuses as well of the court of Rome as of the domestic discipline and government of local churches, to which the movement of the reformers was in part at least ascribed. But the measures for convoking a council were long delayed, owing partly, it has been alleged, to the intrigues of the party who were interested in the maintenance of those profitable abuses, and especially of the officials of the Roman court, including the cardinals, and even the popes themselves; but partly also to the jealousies, and even the actual conflicts, which took place between Charles V. and the king of France, whose joint action was absolutely indispensable to the success of any ecclesiastical assembly. It was not till the pontificate of Paul III. (1534—1549) that the design assumed a practical character.

One of the great difficulties regarded the place of meeting. In these discussions, much time was lost; and without entering into detail, it will suffice to say that the assembly did not actually meet till December 13, 1545, when 4 archbishops, 22 bishops, 5 generals of orders, and the representatives of the emperor and the king of the Romans, assembled at Trent, a city of the Tyrol. The number of prelates afterwards increased. The pope was represented by three legates, who presided in his name—Cardinals del Monte, Cervino, and Pole. The first three sessions were devoted to preliminaries. It was not till the fourth session (April 1546) that the really important work of the council began. It was decided, after much disputation, that the doctrinal questions and the questions of reformation should both be proceeded with simultaneously. Accordingly, the discussions on both subjects were continued through the fourth, fifth, sixth, and seventh sessions, in all which matters of great moment were decided; when a division between the pope and the emperor, who, by the victory of Mühlberg, had become all-powerful in the empire, made the former desirous to transfer the council to some place beyond the reach of Charles's arbitrary dictation. The appearance of the plague at Trent furnished a ground for removal, and in the eighth session a decree was passed (March 11, 1547) transferring the council to Bologna.

This translation was opposed by the bishops who were in the imperial interest, and the division which ensued had the effect of

suspending all practical action. Meanwhile, Paul III. died. Julius III., who had, as Cardinal del Monte, presided as legate in the council, took measures for its resumption at Trent, where it again assembled May 1, 1551. The sessions 9—12, held partly at Bologna, partly at Trent, were spent in discussions regarding the suspension and removal; but in the 13th session the real work of the assembly was renewed, and was continued, slowly, but with great care, till the 16th session, when, on account of the apprehended insecurity of Trent, the passes of the Tyrol having fallen into the hands of Maurice of Saxony, the sittings were again suspended for two years.

But the suspension was destined to continue for no less than nine years. Julius III. died in 1555, and was followed rapidly to the grave by his successor (who had also been his fellow-legate in the council as Cardinal Cervino), Marcellus II. The pontificate of Paul IV. (1555—1559) was a very troubled one, as well on account of internal difficulties as owing to the abdication of Charles V.; nor was it till the accession of Pius IV. (1559—1565) that the Fathers were again brought together to the number of 102, under the presidency of Cardinal Gonzaga, re-opening their deliberations with the 17th session. All the succeeding sessions were devoted to matters of the highest importance—communion under one kind; the sacrifice of the mass; the sacrament of orders, and the nature and origin of the grades of the hierarchy; marriage, and the many questions connected therewith. These grave discussions occupied the sessions 17—24, and lasted till November 11, 1563. Much anxiety was expressed on the part of many bishops to draw the council to a conclusion, in order that they might be enabled to return to their sees in a time so critical; and accordingly, as the preliminary discussions regarding most of the remaining questions had already taken place, decrees were prepared in special congregations comprising almost all the remaining subjects of controversy, as purgatory, invocation of saints, images, relics, and indulgences. Several other matters, rather of detail than of doctrinal principle, were referred to the pope, to be by him examined and arranged; and on the 3d and 4th of December 1563, these important decrees were finally read, approved, and subscribed by the members of the assembly, consisting of 4 cardinal legates, 2 other cardinals, 25 archbishops, 168 bishops, 7 abbots, 7 generals of orders, and 39 proxies of bishops—making in all 252.

These decrees were confirmed, January 10, 1564, by Pius IV., who had drawn up, based upon them in conjunction with the creeds previously in use, a profession of faith known under his name. See ROMAN CATHOLIC CHURCH. The doctrinal decrees of the council were received at once throughout the Western Church, a fact which it is necessary to note, as the question as to the reception of the decrees of doctrine has sometimes been confounded with that regarding the decrees of reformation or discipline. As to the latter, delays and reservations took place. The first country to receive the decrees of the council as a whole was the Republic of Venice. France accepted the disciplinary decrees only piecemeal and at intervals.

It would be out of place here to enter into the question as to the merits of this unquestionably great and momentous assembly, which may be said to have practically decided the religious destinies of the Western Church. It is viewed with directly opposite impressions by opposing critics, and it is commonly even said that in the Catholic Church itself the Council of Trent has met its worst adversary in the person of one of the priests of its own creed, the Servite monk, Fra Paolo Sarpi. It must be confessed, however, that the most candid of modern inquirers have shown that Sarpi cannot fairly be regarded as a Roman Catholic. His sympathies are all strongly anti-Roman, and there are abundant indications in his work of a rationalizing tendency, which plainly ought to rank him among the partisans of that free inquiry which it has been the object of Trent to repress by judgment, pronounced once for all, and excluding all controversy. See SARPI. And although there are perhaps equal exceptions against the impartiality of his rival historian and antagonist, Pallavicino, the latter is admitted by Ranke, Raumer, and others to be far more reliable in the use of documents than his Servite adversary.

The canons and decrees of the Council of Trent were issued in Latin, and have been reprinted innumerable times. They have also been translated into almost every modern language; the most approved English translation being that of the Rev. Jeremiah O'Donovan. One of the supplementary works assigned to the pope by the council at its breaking up was the completion of a catechism for the use of parish priests and preachers. This work has not all the authority of the council, but it is of the very highest credit, and is extensively used, having, like the canons and decrees, been very generally translated. Another similar work was the publication of an authentic edition of the Vulgate version of the Bible, as well as of the Missal and Breviary. All these have been accomplished at intervals; and there is besides at Rome a permanent tribunal, a congregation of cardinals, styled Congregatio Interpres Concilii Tridentini, to which belongs the duty of dealing with all questions which arise as to the meaning, the authority, or the effect of the canons and decrees of this celebrated council. See SARPI, PIUS IV., PALLAVICINO.

TRE'NTON, the capital city of New Jersey, U. S., on the left bank of the Delaware River, at the confluence of Assunpink Creek, and head of steam-navigation, 30 miles north-east of Philadelphia, and 57 south-west of New York; a well-built and handsome city, with a fine view of the river. It contains the state Capitol; state lunatic asylum, for 600 patients; state normal school; penitentiary, with 350 inmates; state library, of 20,600 vols.; 34 churches; 6 daily newspapers; extensive railway connections; and manufactories of locomotives, machinery, cannon, rifles, wire, wire-cordage, crockery, terra-cotta, cotton, woollen, paper, &c. In the war of the Revolution, T. was the scene (Dec. 25, 1776) of a night-attack by Washington upon the British troops—chiefly Hessians—whom he surprised by crossing the Delaware, then thought impassable by reason of the floating ice. Pop. (1870) 22,874; (1880) 29,910.

TRENTON FALLS, a village of New York, U. S., on West Canada Creek, 15 miles north-west of Utica, celebrated for its beautiful cascades (6 in number), with an aggregate fall of 312 feet, in a deep ravine, 2 miles long, with walls of rock in places 150 feet high.

TREPA'N. See TREPHINE.

TREPA'NG. See BECHE-DE-MER.

TREPHI'NE AND TREPHINING. (The instrument in its original form was called a *trepan*, from Gr. *trupao*, allied to Lat. *tereo*, to bore; the now usual form is called a *trephine*.) The operation of trephining consists in the perforation of a bone by means of a trephine, which is a small cylindrical or circular saw, with a center-pin on which it works. It is practised on the skull in cases of fracture: '1st, when a portion of the bone is depressed, and encroaches on the cavity of the skull, producing compression of the brain, and the fragment cannot otherwise be raised; 2dly, for punctured fractures by which the inner table is splintered, separated from the outer table, and lying loose on the dura mater; and 3dly, for effusion of blood, or of inflammatory products, between the bones and membranes, or between the latter and the brain, when it is presumed that the effused fluid may be evacuated by the opening.' —Holmes's *System of Surgery*, vol. iv. p. 1044. It has likewise been employed in epilepsy, with the view of removing an assumed local cause of disturbance; but it is not likely to be ever again used in that disease, as it is now an established axiom, that as the operation itself may destroy life, its application is not justifiable, except as the last resource of surgery in extreme cases.

Trephine.

Attempts have been made by various surgical instrument makers to regulate the action of the trephine by means of a movable collar, so as to prevent the brain from being injured after the skull has been perforated. For the method of applying the instrument, we may refer to any work on Operative Surgery.

TRE'SPASS as a legal term in the Law of England, means any wrong or injury committed upon either the person or property of an individual, not amounting to a crime. As regards a trespass to the person, the more familiar term is an assault or imprisonment; but trespass as to goods and chattels is more commonly known under the names of the remedies applied, as, for example, actions of Trover (q. v.), Detinue (q. v.). Trespass is the technical as well as popular name for that kind of injury which is done to a man's land or house by intruding into it against his will. In English law, the maxim is well known, that every man's house is his castle, and he is entitled to treat as an enemy any person who attempts to enter without his leave. There are, however, a few exceptions to this rule of the inviolability of a man's house, for it is no protection against the officers of the law when executing criminal process—for example, coming to apprehend a person charged with crime. But, as regards mere civil warrants, the officers of the law have no right to break open a man's outer door in order to effect an arrest for debt; and no civil court can give the bailiff such a power. The consequence is, that the bailiff can only wait outside or endeavor by some stratagem to get inside the house in a peaceable manner; and if once inside the outer door, he can then break his way through the house, in order to find his debtor. Such is the law as to intruding into a man's house armed with the authority of the law.

It is a general rule applicable to a man's house as well as land, that if a stranger enter without leave, and do not quit at the request of the owner (who is not bound to state any reason for his request), the owner may by force eject the intruder. In doing so, however, he must not use more force than is necessary to over-

come the resistance offered. If the intruder enter with force, the owner may turn him out without even first requesting him to depart; but if the intruder enter quietly, he must first be requested to leave before hands can be put upon him. If, in turning a stranger out, the stranger assault the owner, then the latter may defend himself; but a policeman cannot interfere, or rather it is not compulsory upon him to interfere, unless he sees an assault committed by the intruder. Sometimes it is erroneously believed that a person is entitled to go to another's house on lawful business, and insist on admission, and even to remain till he get an answer—such as a creditor to demand his money; but this is not so. A creditor may be ordered away, and has no more right to intrude than any stranger. It is also sometimes erroneously supposed that any member of the public is entitled to enter into certain public places, such as a shop or a theater; but this is not so. Any shopkeeper can turn any person he pleases, at any moment, out of his shop, and is not bound to deal with any person except he chooses. So with a keeper of a theater or other place commonly described as public places. There is an exception, however, as to an Innkeeper (q. v.), who is bound, if he have accommodation and the means, to admit a traveler requiring refreshment. As to all other places, the general rule is, that whoever is the occupier of a house, or of land, is exclusively entitled to possession, and can extrude any person who refuses on request to leave; or if he prefer to resort to his legal remedy, he can sue such intruder in an action of damages. The amount of damages recovered will depend greatly on the circumstances attending the trespass, and whether insult or outrage was an accompaniment.

It is often erroneously believed by the public, as well as by some landlords or occupiers, and it is probably a wholesome delusion, that it is a criminal offence for a stranger to trespass upon lands, and that such stranger can be given into custody for doing so; and to keep up this impression, it is common for landlords or occupiers to stick up a notice with the words: 'Trespassers will be prosecuted.' But the fact of such a notice, or of there being a fence to the land, does not make any difference with regard to the trespasser, who is just as much liable to an action of damages, but to nothing else, for the trespass, whether he knew or not of such notice; and in neither case can he be given into custody, as if for a criminal offence. If, however, a trespasser were to break the trees, or do wilful damage (other than mere walking or riding) he may be liable to be apprehended; and if he is at the time trespassing with intent to catch or kill game, he may in some cases be apprehended and given into custody. See GAME, POACHING. It is a defect in the law that owners of land have no summary remedy except physical force to turn out or keep off trespassers, and that justices of the peace have no power to impose a moderate fine upon trespassers for repeating acts of trespass after notice that the owner or occupier dislikes them.

Not only human beings are trespassers, but the word is also by analogy applied to the trespasses of dogs, cats, and other animals. The trespasses of cattle are often of importance, in consequence of the damage done by them. The rule of law which governs the rights of occupiers of land on that subject is the following. An owner is not bound to fence his land, and whether fenced or unfenced, a neighbor is bound neither to trespass himself nor allow his cattle to trespass. If, therefore, A's cattle trespass on B's land, B can impound them; that is, he can lock them up, and keep possession till the owner pay for the damage done; or, if he prefer it, he can bring an action to recover the damages; or, he may drive them off, and also bring the action, until by one or other remedy he is satisfied. With regard to dogs, cats, and similar domesticated animals, the rule is, that the owner is merely responsible for such mischief as they commit by reason of some negligence on his part. If, for example, he knows of some bad propensity they have to stray and attack or damage third persons, then it becomes his duty to take such means as will prevent their doing the mischief; but he cannot be held responsible unless and until the animals have on a former occasion done the mischief—in other words, it is only for a second and not a first offence that he can be made liable. There is one exception only to this rule, recently created by statute, viz., where dogs trespass and worry sheep; in that case, by a recent change made in the law of the United Kingdom, the owner of the dog is to pay for the damage, though he was not aware of any propensity in the dog to do such mischief.

In order to guard against trespass both of men and animals, the owners of land have sometimes resorted to spring-guns and man-traps, planted in their grounds. This practice was carried to a great height in England, as well as Scotland, about forty years ago. It was decided by the courts in England that there was nothing to prevent an owner from so protecting his land; but to put a limit to it, a statute was passed which restricted such right to dwelling-houses and gardens; so that now in England, it is illegal to place man-traps and spring-guns in open fields. As regards, however, traps to catch dogs, cats, or other animals, an owner of land is entitled to place these in his lands, and even to allure the animals with bait, so as to invite them to their doom; but this must not be done so close to a highway as to tempt a dog aside which is lawfully passing along the highway, for the owner of a dog being entitled to the use of the highway for the dog as well as himself, is entitled to have no danger placed in its way, such as a strong-smelling bait, which should operate irresistibly on its animal instincts. It is, therefore only in the open fields or woods not adjoining the highway, that these dog or cat traps can be lawfully placed for protection of game or otherwise—In Scotland, the law is substantially the same as regards trespass as it is in England or Ireland; but it was held illegal at common law in Scotland to put man-traps in lands by way of protection: and it is still illegal to do so. In Scotland, also, there is a more summary remedy against trespassers than exists in England, for an interdict may be obtained to prevent mere trespassers, irrespective of the game or fishery laws; and even justices of the peace may deal summarily with mere trespassers.

TRE'SSURE, in Heraldry, a subordinary, generally said to be half the breadth of the orle, and usually borne double, and flowered and counter-flowered with fleurs-de-lis. It forms part of the royal insignia of Scotland, which are: or, a lion rampant gules, armed and langued azure, within a double tressure flory counterflory of the second. The origin of the tressure in the arms of Scotland has been traced by the older heralds to the 9th c., when they relate that it was granted by Charlemagne to King Achaius of Scotland, in token of an ancient alliance between France and Scotland, and with the view of indicating that the French lilies would in time coming be a defence to the Scottish lion. Chalmers insinuates that these two monarchs were probably not aware of each other's existence; and, in point of fact, the double tressure is not known to have been borne earlier than the time of Alexander III., on whose seal it appears. The tressure is, however, held in great honor in Scottish heraldry, and Lyon King-of-Arms has not been permitted to grant it to any subject without a royal warrant; as a mark of especial favor, it has, however, occasionally been accorded by the sovereign to the representatives of important families directly descended by a maternal ancestor from royalty, or who had deserved well of their king and country.

TREVE'LYAN EXPERIMENT (so called from the person who first carefully studied the phenomenon). When a block of iron or copper is considerably heated, and laid on a block of cold lead, a sound of some intensity, and more or less musical, is often heard. Trevelyan, after many trials, adopted for the 'rocker,' as it is called, a form somewhat resembling a fire-shovel, with a thickish block of metal instead of the blade. This is poised delicately on the lead block, so as to bear with nearly equal pressure on two points separated by a groove; and the rounded end of the handle is also supported. The annexed fig. shows a section of the head of the rocker and of the lead block. The rocker being heated, supposed it poised so as to touch the lead at A only. It heats the lead at A, and therefore suddenly expands it near that point, since lead is a bad conductor of heat. Thus, the lead, as it were, swells up at A, and tilts the rocker over to B. There the same process takes place, and so on; and as the rocker thus moves alternately from A to B, the successive impacts, occurring at nearly equal intervals, form a musical sound. This can be altered at pleasure by loading the rocker, or by altering its moment of inertia. By proper care, almost any conducting body may be made thus to rock upon another, though, in the majority of combinations, the effect is very slight. The explanation of the phenomenon, as given above, is due to Faraday.

TRÈVES (Ger. *Trier*, Lat. *Augusta Trevirorum*), a town of Rhenish Prussia (pop. in 1871, 21,442; in 1880, with suburbs, 37,431), capital of a circle, lies on the right bank of the Moselle, in a lovely valley, between vine-covered hills, about 65 miles south-west of Coblenz. The river is here crossed by a bridge of 8 arches, 730 feet long, and 25 broad. T. is a decayed place, and covers an area large in proportion to its population, owing to the number and size of the open spaces where houses once stood. The cathedral of St. Peter and St. Helen is a very interesting structure of various antiquity, principally of the early German Romanesque style of the 11th c., but retaining considerable remains in the interior of a previously existing Roman church of the age of Constantine. It has beautiful altars and tombs; rich old chasubles and missals; famous relics, among others the 'Holy Coat' (q. v.). Adjoining the cathedral is the *Liebfrauen-kirche*, a very graceful specimen of Early German Gothic architecture, finished in 1243. The only other ecclesiastical buildings of interest now remaining, are the chapel of the Benedictine convent of St. Mathias outside the town, and the church of the Jesuits. T. contains some beautiful old dwelling-houses of Romanesque architecture. No place in Germany is so rich in remains of the

Roman period. Among these are the *Porta Nigra*, a colossal gateway, probably one of the five gates by which T. was entered in Constantine's time, the so-called Roman baths (more probably part of an imperial palace), and a basilica built of Roman brick by Constantine for a court of justice, which, after being successively the residence of the Frankish kings and archbishops, was in a great measure demolished to make room for an electoral palace erected in 1614; this has recently been removed, and the basilica restored and fitted up as a Protestant church. Beyond the walls are the ruins of an amphitheater. The piers of the already mentioned bridge, consisting of enormous blocks of lava, are also of the Roman period.

T. is the seat of a bishop, and of a provincial council, has a chamber of commerce, a priestly seminary, gymnasium, a library of 96,000 vols. and numerous MSS., a museum full of valuable antiquities—including the famous *Codex Aureus*, or MS. of the Gospels in gold letters, presented to the Abbey of St. Maximin by Ada, sister of Charlemagne—and various benevolent institutions; and it carries on manufactures of woollens, cottons, and linens, besides a brisk trade in corn, timber, and Moselle wines.

T. derives its name from the *Treviri* or *Treveri*, a Gallic, or, more probably, a Belgic people, who inhabited, in Cæsar's time, a large tract of country between the Meuse and the Rhine. Their capital, *Augusta Trevirorum*, probably became a Roman colony in the time of Augustus, and ultimately became the head-quarters of the Roman commanders on the Rhine, and a frequent residence of the emperors, particularly of Constantine. Under the Franks, into whose hands it fell 463 A.D., it continued to flourish. In 843, it passed to Lorraine; in 870, to Germany; in 895, back to Lorraine; and finally was united to Germany by the Emperor Henry I. The Archbishop of T. was, in virtue of his office of Chancellor of Burgundy, one of the electors of the Empire, a right which seems to have originated in the 12th or 13th c., and continued till the French Revolution. The ambition and talents of some of these episcopal rulers obtained for them great political weight in Germany. Since 1814, T. has belonged to Prussia.—See Haupt, *T.'s Vergangenheit und Gegenwart* (2 vols., Trier, 1822); Steiniger, *Geschichte der Trevirer unter der Herrschaft der Römer* (Trier, 1845); and Braun, *T. und seine Alterthümer* (Trier, 1854).

TREVI'SO, a town of Italy, capital of the province of the same name, on the river Sile, in a very fertile country, 17 miles north of Venice. It is the seat of a bishop, and has a handsome and but recently finished Duomo, with five cupolas, and having an altar-piece of the Annunciation by Titian; and among the other buildings are the old Gothic church of San Nicolo (with a number of excellent pictures), the public library (30,000 vols.), and a fine theater. The town is surrounded by a wall of from 24 to 38 feet in height, and strengthened by numerous bastions. Manufactures of hardware are carried on; there are also a sugar refinery, a bell-foundry, and a number of paper-mills. Pop. of town (1881) 18,301.

TREVOR, Sir John, Knight, born in 1633. In the parliament of James II. which met on 19th May 1685, he was elected Speaker of the House of Commons. 'Trevor,' says Macaulay, 'had been bred half a pettifogger, and half a gambler, had brought to political life sentiments and principles worthy of both his callings, had become a parasite of the Chief Justice' (Jeffreys), 'and could on occasion imitate not unsuccessfully the vituperative style of his patron. The minion of Jeffrys was, as might have been expected, preferred by James, was proposed by Middleton, and was chosen without opposition.'—*History of England*, vol. i. p. 508 (ed. 1849). In the same year, he was made Master of the Rolls. He contrived to maintain his political and judicial position after the revolution of 1688, and was again elected Speaker on the meeting of parliament on 20th March 1690, on an understanding with the government that he was to take the management of what may fairly be called the bribery department. At the same time, he acted as first commissioner of the Court of Chancery, in which position his integrity seems from the first to have been greatly suspected; and though he was deficient neither in learning nor in parts, his judgments were both long in being given, and contemptible when they were pronounced.

For some years he maintained both his power and position; but his greed and venality at length became so notorious that respectable gentlemen of all shades of political opinion were ashamed to see him in the chair. In March 1695, a Committee of the House of Commons was appointed to investigate into the truth of certain charges of bribery brought against their Speaker. Within a week, the Committee reported, that in the preceding session, Sir John T. had received 1000 guineas from the city of London for expediting a local bill. As soon as the report had been read in the House, it was moved that the Speaker had been guilty of a high crime and misdemeanor. He had himself to stand up and put the question. There was a loud cry of 'Aye.' He called on the 'Noes.' Scarcely a voice was heard. He was forced to declare that the 'Ayes' had it. Even his 'callous heart and brazen forehead' were unable to stand the unspeakable ignominy of his position. Had he returned to the House on the following day, he would have had to put the question on a motion for his own expulsion; he pleaded illness, and shut himself up in his bedroom. A few days afterwards, he was formally expelled. He still, however, retained the Mastership of the Rolls, 'to the great encouragement,' says North, 'of prudent bribery for ever after.' 'His profligacy and insolence united,' says Macaulay, 'had been too much even for the angelic temper of Tillotson, who had been heard to mutter something about a knave as the Speaker passed him.' There are anecdotes of him in Noble's continuation of Granger's *Biographical History*, vol. i. p. 172. He died 20th May 1717, and was buried in the Rolls' Chapel.

TRI'ADS (in Chemistry). Until recently, the terms *equivalent number* and *atomic weight* were usually regarded by chemists as synonymous. Many recent writers, amongst whom Laurent (see his *Chemical Method*, translated by the Cavendish Society) stands pre-eminent, have, however, shown that there is an essential difference between them: and this difference is fully recognized by Professor Miller, who, in the latest edition of his *Chemical Physics*, 1863, thus defines it: 'The equivalent or combining proportion is an experimental constant which is independent of theoretical considerations; but the relative atomic weight is necessarily a matter of inference, and may be a number, often a multiple of the equivalent, and selected by the chemist from theoretical considerations, which, being based partly upon the law of gaseous volumes, partly on chemical grounds, partly on the phenomena of specific heat, seem to require that the atomic weights of a large number of the elements, if compared with the atomic weight of hydrogen, should be double of those commonly given.'—P. 22. Most chemists of the modern school now agree in arranging the elementary bodies in four groups; namely, 1. *Monad* or *Uniequivalent* Elements (or *Monads*), one atom of which in combination is equivalent to H_1, or one atom of hydrogen. In these, the atomic and equivalent numbers are identical. They are twelve in number, and include hydrogen, chlorine, bromine, iodine, silver, &c. 2. *Dyad* or *Biequivalent* Elements (or *Dyads*), each atom of which, in combining with other bodies, is equivalent to H_2, or two atoms of hydrogen. In these, the atomic number is double the equivalent number. This group embraces twenty-five elements, including oxygen, sulphur, selenium, iron, zinc, &c. 3. *Triad* or *Terequivalent* Elements (or *Triads*), each atom of which, in combining with other bodies, is equivalent to H_3, or three atoms of Hydrogen. In this group, which embraces nine elements, including nitrogen, phosphorus, arsenic, &c., the atomic and equivalent numbers are regarded as identical, except in the case of aluminium and rhodium, when the atomic number is doubled. 4. *Tetrad* or *Quadrequivalent* Elements (*Tetrads*), each of which, in combining with other bodies, represents H_4, or four atoms of hydrogen. Their atomic number is double the equivalent number. They are eight in number, including carbon, silicon, tin, &c.

This arrangement of the chemical elements, which is being adopted in all the most recent text-books, has led to the insertion of what are termed *dashed symbols*, in which the number of dashes which are attached to the symbol for the atom of an element indicates its equivalency or interchangeable value for hydrogen. Thus, Ag is marked with a single dash, to show that silver is a monad, or, in other words, that the atom of silver may be substituted for an atom of hydrogen, so as to combine with an atom of chlorine, the resulting compound being Ag′Cl (Chloride of silver); Cu is marked with two, Bi with three, and Si with four dashes, to indicate that they are dyads, triads, and tetrads respectively, or that the atoms of copper, bismuth, and silicon may be substituted for two, three, and four atoms respectively of hydrogen, so as to combine with two, three, and four atoms of chlorine, forming $Cu''Cl_2$ (chloride of copper), $Bi'''Cl_3$ (chloride of bismuth), and $Si''''Cl_4$, or $Si^{(iv)}Cl_4$ (chloride of silicon). These dashed symbols are rapidly coming into general use.

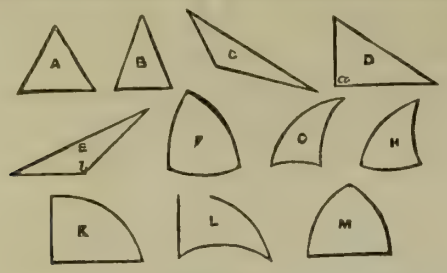
TRIAL, as a Legal term, applies most frequently to trial by Jury (q. v.), whether in a civil or criminal matter. See Prosecutor.

TRIAL AT BAR is a jury trial which takes place before the full court of four judges, instead of one judge only. It is seldom resorted to, and leave must be given in each case on special grounds.

TRI'ANGLE (*tres*, three, *angulus*, a corner), the most simple of geometrical figures, is a figure having three angles; but, oddly enough, it is generally defined by geometers as a figure of three sides, and its property of being three-angled is put in the subordinate position of a necessary consequence. It may be that this arises from Euclid's use of the word *tripleuron* (three-sided) in the definitions *prefixed* to his *Elements;* while *trigonon* (three-angled) is employed in the work itself.

In plane geometry, a triangle is bounded by three straight lines;

and triangles are classed according to the relative length of their sides, into *equilateral* (A), or equal-sided; *isosceles* (B), or having two sides equal; and *scalene* (C), or unequal-sided, the equality or inequality of the sides carrying with it the equality or similar in-



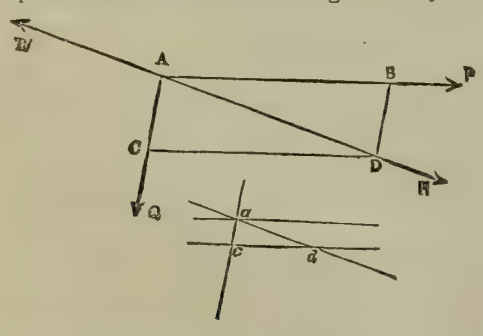
Triangles.

equality (of *greater* or *less*) of the angles respectively opposite to these sides, though the *ratio* of inequality of the sides by no means corresponds to that of the angles. Considered with reference to the size of its angles, a triangle is *right-angled* (D) when one of its angles (*a*) is a right angle (90°); *obtuse-angled* (E), when it has one angle (*b*) greater than a right angle; and *acute-angled* (A or B), when it has no angle so great as a right angle; the well-known property, that the sum of the angles of a triangle is equal to two right angles, preventing the possibility of more than one of them being as great as a right angle. For the relations between the sides and angles of a triangle, see TRIGONOMETRY.

The triangle being the fundamental figure of plane geometry, through which the properties of all other figures have been arrived at, the investigation of its properties has always been held to be of primary importance. Of the immense number of results obtained by investigation, we can notice only two or three in this place. The lines joining the angles of a triangle with the points of bisection of the opposite sides, intersect at the same point, as also do the perpendiculars from the angles on the opposite sides, the lines bisecting the angles, and the perpendiculars from the middle points of the sides. The point of intersection of the first series of lines is the center of gravity of the triangle; those of the third and fourth series are the centers of two circles, the former of which touches the sides internally, and the latter passes through its three angular points. Another remarkable property of triangles, known as Napoleon's problem, is as follows: if on any triangle three equilateral triangles be described, and the centers of gravity of these three be joined, the triangle thus formed is equilateral, and has its center of gravity coincident with that of the original triangle. See also TRIGONOMETRY and HYPOTHENUSE. The area of a triangle is half of that of a parallelogram which has the same base and altitude, and is thus equal to half the product of the base into the altitude; it may also be expressed by the formula $\sqrt{S(S-a)(S-b)(S-c)}$, where a, b, c, are the lengths of the sides, and S is half their sum.

In the geometry of the sphere, a triangle is a figure bounded by three arcs of circles (as F, G, H, K, L, and M).

TRIANGLE OF FORCES, in Mechanics, is the name given to a proposition which is merely a formal modification of the *Parallelogram of Forces* (q. v.), and as generally stated, is its converse. The parallelogram of forces enunciates that, if two forces, P and Q (fig.)—represented in direction and magnitude by AB and AC



—inclined at an angle to each other, act on a point A, their resultant, R, is represented in direction and magnitude by the diagonal, AD, of the parallelogram formed on the two lines AB and AC. Now, as the resultant, R, is equivalent to the combined action of P. and Q, it would exactly counterbalance them if acting in the opposite direction AR', but would still be fully represented by the diagonal line AD, taken as from D to A. Also, instead of AB, CD may be taken to represent P. Hence as the sides of the triangle ACD completely represent the three forces, we have the proposition, *that if three forces in the same plane be in equilibrium on a particle, and if in that plane any three mutually intersecting lines be drawn parallel to the directions of the forces, the lengths of the sides of the triangle thus formed will be proportional to the magnitudes of the forces.* Its proof rests upon the previously ascertained fact, that R', P. and Q, three equilibrating forces at A, are proportional to AD, CD, AC, and on the geometrical theorem, that a triangle whose sides are respectively parallel to those of another triangle, has its sides proportional to those of the latter; and consequently, the ratio and relative direction of the forces R, P, and Q, are fully represented by *ad*, *cd*, and *ac*, the sides of the triangle *acd*. Again, as the sides of a triangle are to one another as the sines of the opposite angles, so also are the forces which the sides represent. Hence

$$P : Q : R' :: CD : AC : AD$$
$$:: \text{sin. } CAD : \text{sin. } ADC : \text{sin. } ACD$$

(and substituting the sines of the supplementary angles)

$$:: \text{sin. } QAR' : \text{sin. } PAR' : \text{sin. } PAQ;$$

that is, each force is proportional to the sine of the angle between the directions of the other two.

TRIA'NGULAR NUMBERS. See FIGURATE NUMBERS.

TRIANGULA'TION is the operation of dividing any portion of the earth's surface into triangles of as large a size as possible, which may be called primary, and which must be afterwards subdivided into triangles of a smaller size, forming a great network of secondary or subsidiary triangles, which serve as a means of working down from great to less, and finally completing, by a system of scientific checks, an accurate map or delineation of the region covered by such triangles, forming the geodesical process called a trigonometrical survey. See TRIGONOMETRICAL SURVEY, ORDNANCE SURVEY. The same operation is used in the measurement of an arc of the meridian, for the purpose of ascertaining the length of a degree of latitude or longitude on any part of the earth's surface; but in this case, only primary triangles are necessary, as no topographical detail is required, and the positions of the apexes of the triangles are astronomically fixed in the most careful manner, which is not always done in the triangles of a trigonometrical survey.

In carrying out a system of triangulation, much judgment and an accurate local knowledge of a country are necessary; and it very often happens that a more extensive range of angles can be obtained from a comparatively low station, than from the tops of the highest mountains. The angles of each triangle should be as near equal as possible, and unless local circumstances render it unavoidable, very acute or obtuse angles should not be used. The sides of the primary triangles should be as long as can be conveniently observed, but in practice they vary from 80* miles or more to 4 miles, or even less. The angles are generally determined by a large theodolite, of as simple and strong a construction as possible, which is fixed on the most elevated points of mountain-ranges, &c.

When the apexes of the triangles are very distant, heliostats, or mirrors reflecting the sun's rays, are often used, and in dark or cloudy weather the Drummond light has been employed. The primary triangles being fixed on the spherical surface of the earth, certain formulæ, according to the rules of spherical trigonometry, must be applied to reduce them to the simple calculations for ascertaining, from certain known data, the sides and angles of plane triangles. The whole of those calculations are dependent on the accurate measurement of a base or fundamental line. The instruments invented by Captain Drummond, R.E., with which he measured the base line of the Irish survey at Lough Foyle, and which were afterwards employed by Sir T. Maclear in verifying Lacaille's base-line on the plains of Malmesbury, in the Cape triangulation, appear to have been as nearly perfect as possible. The length of base-lines used in modern surveys varies from 3 to 7 miles; General Roy's original base line of the English survey was 5·19 miles.

At the end of a large triangulation, a second or testing base-line is always measured at a distance from the original one; if the measured length of this agrees with that ascertained by calculation, it may be considered a proof of the accuracy of the work in general. In the survey of Great Britain by Mudge and Colby, bases of verification were measured for at least every 200 miles, except in Scotland, where only one was measured near Aberdeen.

The triangles of the English survey have been extended to and connected with those of France, Russia, &c., as far east as Siberia, and south to Algeria; and it is not at all improbable that the triangles of the Russian survey will eventually be connected at one side with those of the great survey of India, which already has the apexes of many of its triangles on the summits of the Tibetan Himalaya, and to the eastward across Behring's Strait, with those of British America and the United States.—See Yolland's *Account*

* In the survey of India, and also in the process of connecting the triangulation of Ireland with that of Great Britain, many of the sides of the triangles greatly exceeded this length.

of the Measurement of the Base of Lough Foyle (Lond., Longmans, 1847); Colonel Portlock's *Life of Colby;* and art. 'Celestial Measurings and Weighings,' by Sir John Herschel, *Good Words* (1864).

TRI'AS, the oldest group of the Secondary strata, formerly associated with the Permian rocks under the name of the New Red Sandstone (q. v.). The term Trias, or the Triple Group, has been given to these beds by German geologists because they are separable into three distinct formations: the Keuper, Muschelkalk, and Bunter-sandstein; and the name has been generally adopted, as the beds are more fully developed in Germany than in England or France. The German beds have consequently been accepted as the types of the group, and the deposits in Britain and elsewhere are correlated with them.

The typical beds are divided into—1. Keuper (q. v.), with a maximum thickness of 1000 feet; 2. Muschelkalk (q. v.), with a maximum thickness of 600 feet; 3. Bunter Sandstein (q. v.), with a maximum thickness of 1500 feet.

In England, the principal Triassic deposit occurs in a great basin of the palæozoic strata in Lancashire, Cheshire, Shropshire, Staffordshire, and Leicestershire. The eastern base of the great central Pennine range of hills is composed of Triassic beds, which, beginning in Leicestershire, run northwards through Nottingham and York to the coast of Durham. From Staffordshire, another series of these beds may be traced along the valley of the Severn, and crossing the Bristol Channel, through Somerset and Devon, to the southern coast.

TRIBE (Lat. *tribus*, a division, originally perhaps a third part, in reference to the three cantons whose coalescence formed the germ of Rome, q. v.), an aggregate of stocks—a stock being an aggregate of persons considered to be kindred—or an aggregate of families, forming a community usually under the government of a chief. The chief is possessed of despotic power over the members of the tribe. It is commonly said that he has 'patriarchal' power—such power, that is, as fathers in early times exercised over their children. The tribe has been the earliest form of the community among all the races of men.

In a very large proportion of existing tribes, the tribe is an aggregate of several stocks or distinct bodies of kindred. The persons of whom the tribe consists are included in stocks which are, or are accounted, distinct from each other. This organization is sustained by two tribal customs—(1) persons of the same stock are forbidden to intermarry; and (2) kinship is reckoned through females only, so that children are accounted of the stock of their mother. Persons of the same stock, too, owe duties to each other, and are to some extent sharers in each other's liabilities. Thus, an injury done by a man is an injury done by his stock, which may be avenged upon any member of it; an injury done to a man is an injury done to his stock, for which every member of it is bound to seek vengeance. In consequence of the customs above mentioned, a husband must be of a different stock from his wife or wives; he must therefore be accounted of a different stock from his children; and when he has wives of different stocks, their respective children are accounted of different stocks. More than one stock is thus represented in every household; and since a man owes duties to his stock—the duties of acknowledged blood relationship—while to those of his family who are not of his stock, nothing but the accident of birth (only accident) unites him, the family among these tribes has necessarily little cohesion.

The tribal customs which have been referred to, ignore the family altogether; they are founded upon the idea of stock. They are the customs of people with whom the conception of stock was a powerful social influence, when that of the family was impotent—of people who must have been divided into stocks at a time when, possibly, they had *no* family system. It is inconceivable that such customs should have arisen in the face of a family system anything like that which prevails among civilized peoples, or even of such an approach to the family as many of those tribes now possess. And it follows that the family has *grown* among these tribes. It is obviously now growing among them. Now, in many cases, the only obstacle to its rapid development is the firm hold which the idea of stock has taken of the tribal life. On the other hand, the prevalence of customs founded upon the idea of stock proves a prior existence of stocks, or bodies of kindred. The separation into stocks must be older than the customs, at least as customs associated with the idea of stock. And keeping this in view, and considering how difficult it is to conceive of several stocks herding together at the early time when every stranger was an enemy, unless there was some natural connection between them—such a connection as the marriage-law and the system of kinship, when they arose, would establish—it may safely be concluded that each stock was originally a separate tribe. Into the tribe conceived of as a single stock, the marriage-law and system of kinship would gradually bring a variety of neighboring stocks; and thus the tribe would become what it is—an aggregate of stocks. The progress of such tribes appears to have been from the tribe conceived of as a group of kindred to the tribe consisting of several stocks or groups of kindred; and now, though the family is not yet fully developed among them, they seem to be tending to become aggregates of families. The tribes of Australasia are the most perfect examples of the organization above described; but it also exists (or it existed) among the tribes of North, and most of those of South America, among a majority of the known tribes of Africa, and a large proportion of the ruder tribes of Asia.

Suppose male kinship (which must come with the growth of the family) introduced among tribes such as have been spoken of, containing different stocks. First, the stocks existing within the tribe would be fixed, stereotyped, within it; second, the growth of the family would be greatly promoted, and the influence of the idea of stock proportionately diminished. The family would in time rise to the importance originally possessed by the stock; and at length the tribe, still divided into stocks, would become, politically, an aggregate of families. The tribe would thus assume the exact shape which it had in the early ages of Greece and Italy, when it was an aggregate of families included in clans or bodies considered kindred (*gentes*); the exact shape which it now has among the most advanced of existing tribes. Since a tribe of the Australian type might thus develop into a tribe of the classical type, is it not probable that the latter really was the result of such a process of development? Regarded as a hypothesis, this view will be found to fulfil all the conditions of a good hypothesis. And if the circumstances of tribes which have what is popularly termed the marriage law of caste—among the greatest of which a division corresponding to the Roman *gens* prevails—can be reconciled with it, or with an extension of it, we shall have got a hypothesis capable of explaining the formation of tribes in general. The tribes above referred to, whether divided into clans or not, consider themselves of a common stock. They restrict marriage to the stock; but they always forbid marriage within certain degrees of relationship; and in numerous cases—among them, those of the most numerous caste peoples—they also forbid marriage within the clan or body considered peculiarly kindred. It will be convenient, for want of a better word, to speak of this marriage law as caste. And by caste tribes, in what follows, are to be understood tribes which have this marriage law.

Seeing that the law forbidding marriage within the tribe, and the law restricting marriage to the tribe, have both been widely prevalent among human races, both must be conventional, produced by circumstances; and if in their origin they are equally ancient, men, at the first, in respect of their circumstances, must long have been divided into two bodies very differently placed. This, however, is very improbable. There is no evidence for it; there is some evidence against it. The circumstances, too, capable of producing caste must have been isolating circumstances. The effect of an isolated position in producing an approach to caste may be seen in the case of the royal houses of Europe. Excepting, perhaps, mere physical isolation, it is difficult to conceive of isolating circumstances which could operate in the earliest times. Those which can be conceived of, and which are also known to have operated among caste peoples—the pride of conquerors, peculiarities of religion, the sentiment of an aristocracy or a priesthood, hereditary occupations—could only exist when society is somewhat advanced. It thus becomes highly probable that caste did not prevail in the earliest times—was not the original law of any tribes. There is strong corroboration of this in the fact, that it is found imperfectly established—in coures of being established—among not a few existing tribes; and in the fact, that it became the law of peoples—for example, the Hebrews—whose ancestors, according to tradition, followed a different practice. In connection with these considerations, there is conclusive reason for holding that caste was not an original law, in the law of incest which prevails among the greatest of caste peoples, by which marriage is forbidden, not only within certain degrees of relationship, but also within the clan or body of kindred denoted by a family name. The existence of any law of incest among a caste people requires explanation. But how could a prohibition of marriage within the clan arise among people whose principle it was to marry within the kindred? This can only be referred to circumstances which preceded the origin of caste. Does it not, then, suggest the establishment, through the force of isolating circumstances, of caste—the restriction of marriage to the tribe, or to particular tribes—among tribes divided into stocks which had forbidden marriage within the stock? This would, at any rate, account for the facts. The original prohibition, upon this view, is still represented by the prohibition of marriage within the clan. But as tribes advanced, the family usurped the place of the stock; there sprung up a belief in the common origin of the tribe; and the law of succession to family property gave a new importance to near relationships. The law of incest would naturally tend to follow the practically important limits of relationship; and it might, being still applicable to the stock, be held specially binding within those limits; or it might be confined to them, for in the case of small

and simply-constituted bodies, within which the differences of condition and of employment were few and slight, the stocks —pressed, on the one hand, by the growth of the family, on the other, by the growing belief in the common descent of the tribe — would be apt to disappear altogether. The absence of the stock or clan in the case of some of the smaller caste tribes, and the two laws of incest found among caste peoples—one of which, at least, seems otherwise inexplicable—can thus be accounted for consistently with the hypothesis of such peoples having progressed from the organization of the Australian tribe. And it having been shown that caste is not an original law, all other circumstances of caste tribes will be found consistent with that hypothesis. The belief which many tribes have had in their descent from one progenitor, is not corroborated in any case. It cannot prove its own truth. In many cases, it can be shown to be a fiction; it is presumably so in all cases, and it does not afford an argument for or against any theory of the origin of tribes.

The hypothesis of development, as it may be called, is thus capable of connecting together all the varieties of the tribe, the simplest with the most advanced; and it gives us, as the earliest and simplest idea formed of the tribe, that it was a body of persons who conceived themselves to be of a common stock. It is in the favor of this hypothesis that it affords an easy and natural explanation of the peaceable political union and fusion into one people of neighboring tribes; and of the fact, that a population is divided into a greater or less number of tribes, according as it is less or more advanced. Neighboring tribes would contain the same stocks; they would thus be really homogeneous, and related; they would be ready for union as soon as their circumstances brought them into close contact, and made a political union desirable.

There are facts and arguments by which this hypothesis may be raised to so high a degree of probability, that its soundness can scarcely be doubted. A single example of them must suffice. It is the received opinion that among the advanced tribes containing gentes, property was originally vested in the gens, and was only by slow degrees wrested from it by the family. It is involved in this, that at one time the gens was everything, the family nothing, in the organization of the tribe; that the latter grew, and that as it grew, the former sunk in importance. The tribe, when property was exclusively vested in its gentes, must have been an aggregate of gentes, not an aggregate of families. All this is consistent with, and corroboratory of, the hypothesis of development; in particular, it strongly corroborates the view that the tribe at an early period consisted of several bodies of kindred, accounted distinct from each other, and each of which held property in common. It has never been accounted for upon any other view.

The only other theory which has been formed of the origin of tribes—commonly called the patriarchal theory—is, that a tribe consists in the main of the descendants of a single family, descent being chiefly, if not exclusively, reckoned through males; and that the gentes found within the tribe consist of the descendants of individual sons or grandsons of the common progenitor. It is evident that this theory does not explain the organization of the numerous class of tribes first considered. It has been formed upon observation of the advanced tribes of the classical type, but it does not consist with the history of property (to test it at a single, but a vital point) even among them. It might account for property being vested in the tribe; it does not account for it being vested in the gentes. It can only do so by the aid of the assumption that, though the sons and grandsons of the original progenitor had the desire for family property, and divided his property, or accumulated property of their own, their descendants suddenly lost that desire, and began to hold in common. But such a supposition is too improbable to be entertained. This theory is also excluded in the case of all polyandrous peoples, for it assumes that society began with monandric marriage, a perfect idea of the family and male kinship—all conditions the very opposite of those which must at one time have prevailed among such peoples. And polyandry can be shown to have prevailed so widely, that it is probable it has been the earliest practice of every human tribe. However this may be, a theory which is contradicted by a great proportion—much the greatest number—of the cases to be accounted for, and is in important respects not consistent with any class of cases, cannot be a good hypothesis; and therefore the patriarchal theory has no title to be accepted as explaining the normal history of the formation of tribes, or of any class of tribes. Its fundamental assumption, indeed—the segregation of individuals who became progenitors of tribes—seems to be at variance with the nature of man, which all experience has shown to be social and gregarious, and to be the most averse to separate and independent action, when society is the least advanced. It should also be stated that it fails to do what a sound theory of tribal formation must do—to account for the fusion of neighboring tribes, independently of conquest, into one people. To account for this, it has been customary to suppose that neighboring tribes, wishing to unite, adopted one another; but there is no evidence of such adoption having ever been practised, and the supposition seems entirely improbable.

The patriarchal theory was, until recently, the received account of the formation of tribes. The theory which has here been styled the hypothesis of development was first propounded, though without elaboration, in a work published in 1865, *Primitive Marriage*, by J. F. M'Lennan.

TRIBONIA'NUS, a very eminent Roman jurist of the 6th c. of Macedonian parentage, but born in Pamphylia. He held, under the Emperor Justinian, the offices of quæstor, master of the imperial household, and consul. But he is famous chiefly through his labors in connection with the Code (q. v.) of Justinian (q. v.) and the Pandects (q. v.). T. died in 545.

TRI'BUNE. See ROME.

TRI'CHECUS. See MORSE.

TRICHI'ASIS (Gr. *thrix*, gen. *trichos*, of a hair) consists in a growing inwards of the eye-lashes; three or four of them (sometimes only one) presenting their points towards the globe of the eye, while all the other hairs retain their natural position. The disease is exceedingly common among the lower classes, and especially the Irish. This affection causes great annoyance, by exciting a pricking sensation, and by the constantly irritable and watery state of the eye which it induces. The treatment consists in plucking out the offending hairs (if they are few in number) from time to time, each hair being removed by hair-forceps with a slow steady pull. If they form a little group, they must be removed by dissecting out the small portion of lid in which they are implanted, and uniting the wound with a suture. In other cases, it may be necessary to remove the entire margin of the lid.

TRICHI'NA SPIRA'LIS, the name given to a peculiar Nematoid worm, which, in its sexually immature state, inhabits the muscles, usually of the pig. It was discovered in 1835, Mr. Wormald, then Demonstrator of Anatomy at St. Bartholomew's, giving to Professor Owen four microscopical specimens of speckled muscle from a subject that was then in the dissecting-rooms; and Mr. Paget, then a first-year's student, simultaneously investigated the question. Professor Owen, to whom the discovery of the trichina is generally referred, soon afterwards communicated to the Zoological Society his 'Description of a Microscopic Entozoon infesting the Muscles of the Human Body,' in which he describes the speckles as capsules containing a spirally-coiled microscopic worm, to which he gave the generic name trichina (Gr. *thrix*, a hair), and the specific name *spiralis*, from its coiled arrangement. Mr. Paget had independently arrived at similar results, with the aid of Robert Brown of the British Museum, and read a paper on the subject to the Abernethian Society a week before Professor Owen's memoir was read to the Zoological Society; so that his name should always be *at least* associated with that of Owen, in reference to the discovery of this worm. From the date of this discovery to the present time, the *trichina* has been a fertile source of discussion. In 1845, the idea was mooted by various naturalists that the trichina was the undeveloped or sexless form of some other worm; and in 1855 (after the transformation of the cysticercus into the tapeworm was discovered), various suggestions were made on this subject; but it was not till 1860 that Virchow and Leuckart, by feeding animals on flesh containing trichinæ, arrived independently at the correct conclusion, that the parents of the encysted trichinæ are small nematoid worms, which had never previously been described, Leuckart's experiments being made with human flesh containing these parasites.

The young trichinæ, as they are seen in the human muscles, present the form of spirally-coiled worms, in the interior of small, globular, oval, or lemon-shaped cysts, which appear as minute specks scarcely visible to the naked eye. These cysts are more or less covered externally with calcareous matter, according to the length of time they have remained in a fixed position, and the degree of degeneration which their walls have undergone. The trichina measures, according to Cobbold, on an average $\frac{1}{78}$th of an inch in length, and $\frac{1}{180}$th of an inch in breadth. The cysts are sometimes altogether absent, and hence they must be regarded as abnormal formations, resulting from local inflammation set up by the presence of the worm, which in this larval condition of existence measures $\frac{1}{78}$th of an inch in length, and $\frac{1}{830}$th of an inch in breadth. These larval worms exhibit a well-marked digestive apparatus, and afford evidence of the presence of reproductive organs, which are often sufficiently developed to enable the observer to determine the sex of the organism. The number of larval trichinæ that may simultaneously exist in the muscles of a single man or animal is enormous. In a cat on which Leuckart experimented, a single

Fig. 1.
The worm lying coiled up in muscle, the outside of the cyst supporting fatty tissue, vessels, &c. [magnified.]

ounce of flesh was estimated to contain 325,000 trichinæ; and if all the voluntary muscles of a human body of ordinary size were similarly affected, the number of worms would exceed 1950 millions! Dr. Cobbold believes that there can be no doubt that the number in a single 'bearer' (as he terms the sufferer) may *actually* amount to at least 20,000,000.

We now proceed to the consideration of the mature worms. When an animal is fed with flesh containing the larval worm already described, and is killed a few days afterwards, a large number of minute worms are found mixed with the contents of the small intestines. On closer examination, they are found to be of two kinds—the larger and more numerous ones being the females, and the smaller and rarer ones the males. At the second day after their introduction, these intestinal trichinæ attain their full sexual maturity; and in six days, the females contain perfectly developed and free embryos in their interior.

The female is a slender round worm, varying in length from $\frac{1}{3}$th to $\frac{1}{4}$th of an inch. The anterior end presents a bead-like

Fig. 2.

Sexually mature female *Trichina spiralis* (highly magnified).

appearance, from which the intestinal canal proceeds. The posterior three-fourths are mainly occupied by the reproductive organ, which is filled partly with free embryos, and partly with eggs in various stages of maturity. When these embryos have attained their full size within the uterus of the parent, they pass out at the genital aperture, and commence life on their own account.

The accompanying diagram shows these embryos (highly magnified) in various stages of development. They are little worms

Fig. 3.

with rounded ends, and presenting no indications of any internal organs. Before entering into the history of their migrations, we may mention that the male worm is seldom more than two-thirds

Fig. 4.

Sexually mature male *Trichina spiralis* (highly magnified).

the length of the female. It presents the same bead-like arrangements as the female, and a reproductive organ whose aperture apparently coincides with the anus; while the female sexual aperture is comparatively near the head-end of the worm. The body terminates with two hooks (of which only one is seen in the figure), which are doubtless subsidiary to the reproductive process. The males are less numerous and shorter lived than the females, and probably die after having discharged their natural function. The females continue bringing forth young for a period of two or three weeks. The embryos, according to Leuckart, Cobbold, and all our best helminthologists, penetrate the walls of the intestine, and pass directly into the muscles of their 'bearers' or 'hosts,' where, if the conditions are otherwise favorable, they are developed into the form originally observed by Owen and Paget. In this way, by proceeding along the course of the intermuscular connective tissue, some of them reach the muscles of the extremities and other distant parts; but the majority of the wandering embryos (according to Virchow) 'remain in those sheathed muscular groups which are nearest to the cavity of the body (abdomen and thorax), especially in those which are smaller and most supplied with connective tissue.'

These embryos penetrate into the interior of the separate muscular bundles, and in the course of 14 days acquire the size and organization of *Trichina spiralis*. The surrounding tissues soon become disorganized, and the spot inhabited by the coiled-up worm is converted into a spindle-shaped widening, within which the previously described cyst is formed by a hardening and calcification of the exterior. A point of great importance in relation to the distribution of this parasite, and as having a practical bearing upon the disease known as *Trichiniasis* (q.v.), has been established by the experiments of Davaine—viz., that while in the adult condition, trichinæ perish in cold water in about an hour, and cannot survive the decease of their host for more than six hours, the larvæ remain alive in water for a month, and will live for a long time in flesh which has become putrid. In this way, 'a carcass near a marsh or rivulet may communicate the parasites to the ruminants that drink the water, or to pigs.'

In the same year (1860) in which Virchow and Leuckart proved, that by feeding an animal on flesh containing the *Trichina spiralis*, intestinal trichinæ were produced, and watched the transformation of the young of the latter into muscular trichinæ, a very important corroborative medical case was observed and recorded by Zenker. In this case, the patient was a servant-girl, aged 20, and the principal symptoms were loss of appetite, prostration, violent pains and contraction of the limbs, and finally œdema, which, with a certain amount of pneumonia, terminated fatally in the course of a month. After death, numerous larval trichinæ were found in her muscles, while the intestinal canal contained sexually mature worms.

Three weeks previously, before the girl had taken ill, she had assisted in killing pigs and making sausages. It was further ascertained that, a few days before her illness commenced, she had eaten some of the meat in a raw state. On examination, it was found that the pork (both hams and sausages) contained numerous encysted trichinæ. It was, moreover, ascertained that the butcher and several members of the girl's family (to whom she had probably given sausages) were attacked with symptoms similar to those which, in her case, proved fatal. How the pig acquires its trichinæ is unknown; but that the larval trichinæ contained in putrid flesh, &c., may easily gain admittance to the pig's alimentary tract, is a supposition at once feasible and of likely kind. Beet-root, earth-worms, moles, and rats have been suggested as their infectors; but on this subject see the advice given by the French commissioners in the next article. The adult trichina is liable to infest the intestinal canal of all animals in which the larvæ have been found in the muscles. In this category must be placed man, the dog, cat, rabbit, rat, mouse, mole, hedgehog, and badger. Whether birds ever contain trichinæ is doubtful, and reptiles and fishes are quite free from this parasite.

TRICHINIASIS is the name of the diseased condition which is induced by the ingestion of food containing *Trichina spiralis* in large quantity. The first recorded case, as occurring in the human subject, is that of Zenker, which has been already noticed in the article TRICHINA; but there can be no doubt that the disease has long existed, although its origin was previously unsuspected. The first symptoms of this disease, as it occurs in the human subject, are loss of appetite, followed by nausea and a sense of fatigue, prostration, and general indisposition. This stage lasts about a week. Pain and stiffness of the limbs, accompanied by swelling of the face, and fever of a peculiar type, characterized by a very frequent pulse, moderate thirst, and copious perspirations, now show themselves; the commencement of the second stage of the disease being thus synchronous with the migration of the trichinæ brood into the muscles, there to become encysted. During this stage, pressure, or any attempt to move the parts under the control of the swollen muscles, is intensely painful, and even the normal respiratory movements cause such constant pain as to render sleep impossible. In severe cases, the patient lies on his back like a paralyzed person. The tongue presents much the same appearnce as in ordinary gastric fever.

The bowels are most commonly constipated, but in some of the worst cases, there is continuous diarrhœa. The swelling which began in the face now disappears, and is replaced by swelling of the feet, which gradually rises to the trunk. In about the fourth week of the disease, the trichinæ may be regarded as permanently settled, and as having completed their destructive action on the muscles. This is the beginning of the third stage, which is mainly characterized by extreme weakness. The gastric symptoms abate, the appetite returns, and, in favorable cases, the muscular pains and swelling gradually diminish, while, in severe cases, this third stage is the most dangerous part of the disease;

the diarrhœa being severe, and accompanied with tenesmus, and often with the involuntary discharges of the fæces and urine, while the skin exhibits extreme palor, and is enormously distended with effused serum. Moreover, pneumonia often supervenes at this period. The fourth and last stage is that of convalescence. This may begin at the fifth week, or later, and may last from three weeks to as many months. In mild cases, it is impossible to draw a definite line between this and the preceding stage. Death may occur at any period. It has been observed as early as the 5th, and as late as the 42d day of the disease.

A single trichinous pig, if its flesh is eaten without being previously submitted to such culinary processes as to destroy the vitality of the larval trichinæ, may establish a local epidemic of this disease. The most important of those epidemics have occurred in Germany, and are noticed by a German physician, Dr. Thudichum, in 'The Seventh Report of the Medical Officer of the Privy Council,' 1865. Of these, the second or great epidemic at Hettstädt was the most severe. It commenced in the second half of October 1863, and affected 158 persons, of whom 28 died. All these persons were found to have been eating trichinous pork, either perfectly raw, or in the form of smoked or fried sausage, meat-balls, brawn, black-pudding, &c.

As soon as a case of suspected trichiniasis comes under the notice of the physician, attempts should be made to remove the mature worms from the intestine by active purgation. For this purpose, calomel, in scruple doses, is more serviceable than any other purgative. Two or three such doses should be given at intervals of 24 hours. No special directions can be given for the treatment of the fever. If there is any appetite, the diet should be light, and at the same time nourishing. Liebig's Extract of Meat has been found very serviceable in keeping up the strength. The most effectual remedy for the sleeplessness was found to be the cold wet sheet, in which the patient should be wrapped repeatedly during the day. The preparations of opium only aggravate the discomfort. The other symptoms must be treated by the ordinary rules of therapeutics.

Considering the gravity of this disease, it would be of the greatest importance to be able to decide, during its life, whether a pig were trichinous or not. On this point there is some difference of opinion; but Professors Delpech and Reynal, who were charged by the French government to report upon this disease, assert that 'the animal, while living, shows no signs of the presence of trichinæ, nor can they be detected in the meat with an ordinary lens, but a powerful microscope renders them at once visible.' In Hanover, out of 25,000 pigs, 11 were found trichinous; in Brunswick, 16 were affected out of 14,000; while in Blakenburg, 4 were diseased out of 700. The French commissioners assert that a temperature of 167° F. is sufficient to kill the parasites, and that meat thoroughly salted is also perfectly safe; they advise that smoke-dried sausages, though probably safe, should be well boiled. They further attribute the spread of the disease among pigs to the fact that they are foul feeders, and will eat any offal, such as the dead bodies of rats and other animals, which are known to be liable to the disease. They recommend farmers to be very cautious in feeding their pigs to avoid giving them flesh without first boiling it; to destroy rats and small carnivorous animals, and never to leave human or other excrements in places where pigs can reach them. Finally, they advise all experimenters to burn trichinous flesh when their investigation is completed, and not to throw it away; for a fragment of it might possibly be eaten by a rat, the rat devoured by a pig, and the pig thus become the medium of the disease to man. This utter destruction of the parasites is a point on which our countryman, Dr. Cobbold, has long insisted. In 1863, a trichinous pig from Valparaiso, killed on board a merchant-vessel on the high seas, caused the death of two of the crew; and in 1864, there was a slight trichinous epidemic at Cheektowaga, New York. Probably trichina-disease is a common ailment in this and other countries; its symptoms, save in very severe cases, attracting no special notice, from their similarity to those of rheumatic disease and acute febrile attacks. The disease has been known to occur in the N.W. of England in a mild form; but helminthology, and the detection of parasites of all kinds, requires still much cultivation at the hands of the medical profession. In 1835, Mr. Wood of Bristol published, in the *Medical Gazette*, a case of acute rheumatism, accompanied by pneumonia, in which trichinæ were discovered after death; thus *all but* anticipating Zenker in discovering a new disease.

TRICHINO'POLY (more correctly, TRICHINAPALLI), the capital of a collectorate of British India of the same name with an area of 3515 sq. m., on the right bank of the Kaveri, 30 m. W. of Tanjur. The fort, which includes the old town, stands on the rugged slope of a steep granite rock, 500 feet in height, which from some points resembles Edinburgh Castle. The walls of the fort, which are now demolished, had a circuit of two miles, and this area is inhabited by a dense population, dwelling in low, closely-packed huts. The streets are tolerably regular, and are crowded at all hours of the day with multitudes of passengers, bullock-carts, and cattle. Beyond the walls is St. John's Church, containing the tomb of Bishop Heber, who was buried here in 1826. The climate during eight months of the year, is exceedingly hot, nevertheless T. is the headquarters of the south division of the Madras army; there are several barracks, and the lines for the men and the officers' houses cover a space of ground six miles in circumference. Cheroots are manufactured in large quantity, from excellent tobacco grown in the vicinity. Manufactures of hardware, cutlery, and jewelry, especially gold chains, harness, and saddlery, are extensively carried on. A railway to Madras was opened in 1875. Pop. in 1871, 76,530. Pop. of district (1871) 1,200,408.

TRICHOCE'PHALUS (derived from the Gr. *thrix*, gen. *trichos*, a hair, and *cephale*, the head) is the name given to a genus of intestinal worms, of which one species, *T. dispar* (described by the older writers, who mistook its head for its tail, as *Trichuris* and *Ascaris trichiura*), infests the human intestinal canal. Dr. Cobbold describes it as a small nematoid worm, the male measuring 1½ inches, and the female fully 2 inches in length; it is characterized by an extremely long hair-like head and neck, occupying about two-thirds of the entire length of the body. This parasite is comparatively rare in this country, while, according to M. Davaine, not less than one-half the inhabitants of Paris are infested by it. Its presence is attended with little or no inconvenience. Its development and mode of gaining access into the body are subjects to which much attention has recently been paid, but which are by no means as yet cleared up. Davaine finds that the eggs are not developed within the host's intestines, but are discharged *per anum*, in the immature condition in which they escape from the parent; and it further appears, that after their expulsion, a period of six months must elapse before embryonic formation commences. As in the more common instance of *Ascaris lumbricoides*, it is probable that they complete their development in open water, from which they are transferred to the human stomach.

For further information on the genus *Trichocephalus* generally, we may refer the reader to Part I., chap. v. of Dr. Cobbold's *Entozoa;* while the species considered in this article is fully discussed in Davaine's *Traité des Entozoaires.*

TRICHO'PTERA. See CADDICE.

TRICK, a term used in Heraldry to denote a mode of representing arms by sketching them in outline, and appending letters to express the tinctures, and sometimes numerals to indicate the repetition of changes.

TRICLI'NIUM, the apartment in a Roman house in which the meals were eaten.

TRI'COLOR means literally no more than a flag in three colors, which is the case of almost every national ensign; but the applied sense limits it to flags having three colors in equal masses. The principal European tricolor ensigns are: France—blue, white, red, divided vertically. German Empire—black, white, red, divided horizontally. Italy—green, white, red, divided vertically. Belgium—black, yellow, red, divided vertically. Holland—red, white, blue, divided horizontally. The tricolor took its rise at the commencement of the French Revolution as the badge of the National Guard. The red and blue were selected as the arms of Paris, and the white was added, as the color of the army, to show the intimate union which should subsist between the people and the armed force.

TRICOUPIS, SPIRIDION, a modern Greek statesman and author, son of a primate of Missolonghi, was born in that town in 1791. After completing his studies in France and England, he went to the Ionian Isles, where he aided Lord Guilford in the foundation of the university of Corfu (1820); but on the outbreak of the war of independence in the following year, he hastened to enrol himself among the patriots, and played an important part in the great struggle. From 1821, except during the presidence of Capo d'Istria, he was continually employed in administrative and diplomatic business. During the reign of King Otho, he was thrice sent to London (1835—1838, 1841—1843, and 1850—1855) as envoy-extraordinary; he was Minister of Foreign Affairs and of Public Instruction (1843); vice-president of the Senate (1844—1849); and envoy-extraordinary to Paris (1850) on the occasion of the blockade of the ports of Greece by England. In the grave political vicissitudes he had his share, and in 1862 declined to form a ministry on account of ill health. He died in 1873.

T. enjoyed a great reputation in his own country as an orator and historian. His funeral oration on Lord Byron (whose friend and comrade he had been), delivered in the cathedral of Missolonghi, some days after the poet's death, has been translated into most European languages. Many other orations, partly religious and partly political, spoken by T. in the course of the revolution, have been collected and published (Paris, 1836). Besides these, we must mention a martial poem on the Klephts (*Poiema Kleph-*

tikon, Par. 1820); but his masterpiece is his History of the Greek Revolution (*Historia tes Hellenikes Epanastaseos*, Lond. 1853—1854), a work which is praised for its accuracy, impartiality, and style.

TRIDA'CNIDÆ, a family of lamellibranchiate molluscs, having the shell open, the valves equal, the foot small, and furnished with a byssus. *Hippopus maculatus*, the BEAR'S-PAW CLAM (q. v.), is prized for its beauty. *Tridacna gigas* is remarkable for its great

Tridacna gigas.

size, exceeding that of any other bivalve. The shell of a single specimen has been known to weigh more than 500 lbs. The valves are sometimes used in Roman Catholic churches for holy-water vessels. They are also used as an ornament for grottoes and fountains. They are deeply furrowed and beautifully grooved. This great mollusc is a native of the East Indies, and is found in shallow water. It is used for food, and one suffices for a number of persons.

TRI'DENT, in classic Mythology, is used as the symbol of Neptune's sovereignty over the sea. It consisted of a staff, armed at one end with three short prongs, with double barbs at the points, resembling the *fuscina* used by the Italians in catching large fish, particularly the sword-fish, from which we may perhaps infer that Neptunus was originally the god of fishermen. It was customary among the Grecian states to place the figures of their patron deities, or their appropriate symbols, on coins; hence, we frequently meet with the trident on ancient coins, such as those of Saguntum, &c.; likewise on the Sicilian coins of Hiero, &c.

TRIE'NNIAL PRESCRIPTION, in the Law of Scotland, is a limit of three years imposed on all creditors to bring their actions to recover a certain class of debts and damages—such as actions to recover merchants' accounts, servants' wages, house-rents (where the lease is verbal), debts due to tradesmen, lawyers, and doctors. So actions to recover damages for wrongous imprisonment must be brought within three years.

TRIÉ'ST, or TRIË'STÉ (Slav. *Térst*), the most important seaport of the Austrian monarchy, and the most considerable trading town on the Adriatic, stands at the head of the Gulf of Triest, an arm of the Gulf of Venice, 90 miles south-west of Laibach, on the Vienna and Triest Railway. It is an imperial free town, and attached and belonging to it is a territory 46 sq. m. in extent, consisting of the slopes of the *Triestiner Karst*, which decline somewhat abruptly toward the Adriatic shore. The city of T., in which the population of the district is almost wholly massed, the other places being only small villages, consists of the old town, the new town, or Theresienstadt, and the two suburbs, Josefstadt and Franzenstadt. The old town, built on the slope of a steep hill, surmounted by a castle, forms about a fourth of the whole city, and is distinguished by its narrow streets and black walls. It contains the cathedral, an early Byzantine edifice of uncertain date, into the walls of which stones bearing Roman inscriptions and carving have been built, and the tower of which is said to rest on the foundation of a temple of Jupiter. The new town, with broad streets built in regular parallelograms and handsome houses, occupies the plain that fronts the sea. Between these two divisions runs the *Corso*, the chief thoroughfare of the city.

The *Tergesteum*, in the new town, is a splendid modern edifice, built in 1842, and containing a bazaar, a grand concert and ball room, exchange and reading rooms, and the offices of the Austrian Lloyd's, the largest establishment in Europe for sea-steamers. To the north, on the sea-shore, is the new and magnificent Lazaretto, with a harbor in which 60 vessels can perform quarantine at once. There are numerous churches for Greeks, Jews, Roman Catholics, and Protestants. The population includes Germans, Americans, Italians, Greeks, Jews, Armenians, Dalmatians, &c.; but Italian is the prevailing language. T. was, till 1882, a free port; the harbor, the entrance to which is uninterrupted by islands or sandbanks, is well protected. The manufactures carried on here are very extensive. There are upwards of 40 establishments for shipbuilding, and several soap-works and rope-works. Rosoglio, white-lead, and leather are manufactured, and wax-bleaching is carried on. The value of the imports is about £14,000,000; that of the exports, £10,000,000. A great agricultural exhibition was held at T. in 1882. Pop. in 1880, 74,544; of the city with the surrounding district of T., about 133,000.

T., the ancient *Tergeste* or *Tergestum*, was of importance under the Romans, and first receives historical mention 51 B.C., when it was overrun and plundered by neighboring tribes. It was much improved by Augustus; and, in 1382, finally passed into the hands of Austria. It owes its prosperity chiefly to the Emperor Charles VI., who constituted it a free port, and to Maria Theresa. Since the year 1816, T. has borne the title of 'The most Loyal of Towns.'

TRIFLE, a supper-dish at evening entertainments. It consists of two parts. The lower is usually made of sponge-cakes, ratafias, or macaroons, soaked in sherry or Madeira, and placed in the bottom of a proper glass-dish; over these is then poured a mixture of fine boiled custard and of cream, in equal parts; and sometimes another layer of the cakes is laid, well soaked in sherry. A whip, or syllabub, is then made with sugar, cream, white of egg, and sometimes a little white wine and brandy, the froth of which, as it is formed by the whisk, is removed, and placed over the soaked cakes, and forms the second part of light froth of the trifle. Almost every cook has some variation in the manufacture of this dish.

TRIFO'LIUM. See CLOVER.

TRIFO'RIUM, the arcade over the arches of a church between the central and side aisles. It is usually a dark gallery, being the wall-space against which the lean-to roof of the aisles rests. In the later styles, the side-aisles were covered with independent roofs, so as to allow the triforium arches to be filled with glass.

TRIGGER. See LOCK.

TRI'GLA. See GURNARD.

TRI'GLYPH, the ornament in the frieze of the Doric Style (q. v.). It is supposed to represent the ends of the beams in the original wooden temples. It is always divided into channels or flutes, with guttæ or drops below—see illustration.

Triglyph.

TRIGO'NIA, a genus of mollusca, represented at the present day by only three species, natives of Australia, but remarkably abundant in the secondary rocks. Upwards of 100 species have been described from strata between the Trias and the Chalk inclusive, but not a single species is known from any Tertiary deposit. The shell is trigonal (whence the name), thick, and tuberculated, or ornamented with radiating or concentric ribs. The interior is nacreous. The external ligament is small and prominent, and the huge teeth are large, diverging, and transversely striated. The animal has a long, pointed, and powerful foot, with which it is able to make considerable leaps. The gills are ample, and united behind the body to each other and to the mantle.

TRIGONOCA'RPON, a common fruit in the Coal-measures, occurring in all the strata except the underclays and limestones. Some six or eight species have been established, which differ from each other in size and shape—some being as small as a pea, and others as large as a walnut. They are marked, when preserved in the round, with three longitudinal ridges, and from this character the name was derived. They have never been found attached to any plant. From their shape, and their occurring in such quantities in some localities that they might be gathered by the bushel, it was at first thought that they were palm-fruits; but Dr. Hooker, from the examination of several specimens which exhibit structure, has shown that they are not unlike the structure of *Salisburia*, a drupe-bearing coniferous tree, a native of China and Japan. He found that they were composed of four distinct integuments, and a large internal cavity filled with carbonate of lime, but which, he supposed, originally contained the albumen and embryo. The determination of the affinities of this fruit is the more important, as the existence of conifers in the Coal-measures was known from the occurrence in them of disc-bearing woody-tissue; and the absence of linear leaves and cones makes it the more likely that they belonged to the drupe-bearing division of the order. It is probable that the trunk, to which the generic name *Dadoxylon* has been given, and the casts of the large pith of which is known as *Sternbergia*, had for its leaves the fern-like fossils named *Noggerathia flabellata*, and *Trigonocarpon* for its fruit. Dr. Dawson has, however, recently referred some *Trigonocarpa* to *Sigillaria*, and he considers the anomalous organism called *Antholites* to be the bud-form of the fruit. He has never found them in contact with *Sigillaria*, and it is much more probable that this was a cryptogamous tree, and consequently had spores, and not seeds, for its fruit.

TRIGONOCE'PHALUS, a genus of extremely venomous serpents, of the family *Crotalidæ*, nearly allied to rattlesnakes, but

having the tail terminated with a spine instead of a rattle. The head is covered with plates or shields; the dorsal scales are keeled. *T. rhodostoma* may be mentioned as an example. It is found in Java, and preys chiefly on frogs. *Cenchris*, *Craspedocephalus*, and other genera have recently been separated from trigonocephalus. The Mokassin Snake of the southern states of North America belongs to the genus *Cenchris*. One of the most dangerous serpents of the West Indies is *Craspedocephalus lanceolatus*.

Trigonocephalus rhodostoma.

TRIGONOME'TRICAL SURVEY. Trigonometrical surveying is that higher branch of measurement of the earth's surface in which the use of angular instruments, such as the theodolite, altitude, and azimuth instrument or sextant, is indispensable in forming the network of triangles, on the accuracy of which the correctness of the survey depends. In the article TRIANGULATION, the necessary operations have been briefly adverted to, and in ORDNANCE SURVEY will be found a sketch of the history of the principal modern trigonometrical surveys executed, or now being made.

In the *Aide Mémoire of Military Sciences*, conducted by officers of the corps of Royal Engineers, a very full and complete article will be found on this subject; and the government blue-books, from time to time issued on the surveys both of this country and India, afford much valuable information on the internal economy and arrangements necessary for carrying on such vast works.

When it is necessary to fix the astronomical position of the stations, of course, the transit, zenith, sector, and other instruments used in the observatory, must be transferred to situations very often difficult of access, exposed to strong winds, &c., which adds much to the difficulty of getting correct observations. Meteorological and magnetic observations are often taken simultaneously with the astronomical; and, indeed, are now considered as nearly indispensable in modern operations. See SURVEYING, TRIANGULATION, &c.

TRIGONO'METRY (Gr. *trigonon*, a triangle, *metria*, measurement), the measurement of triangles. This definition, though expressing correctly enough the scope of trigonometry in its early stages, is now wholly inapplicable, as trigonometry, like geometry, has far exceeded its primitive limits; and though the original name is, for convenience, retained, the science may be more properly defined as the 'consideration of alternating or periodic magnitude.' Trigonometry, within the limits of its earlier definition, is geometrical; its advance beyond these limits is due to the introduction of purely algebraic methods.

The quantities with which geometrical trigonometry has to deal are certain lines definitely placed with respect to an angle, and consequently varying with it. These lines, generally denominated *trigonometrical functions* of the angle, are the sine, cosine, tangent, cotangent, secant, and cosecant; and are represented in the accompanying figure. The angle BAC is placed at the center of a circle, called the circle of reference; its *sine*, CD, is the perpendicular let fall from the extremity of one radius upon the other; the *cosine*, DA, is that part of the radius between the foot of the sine and the center; the *tangent*, BE, is drawn at right angles to one radius to meet the other produced; the *secant*, AE, is the radius produced to meet the extremity of the tangent; the *cotangent*, FG, is drawn from the extremity of a radius at right angles to one of the former, to meet the other produced; and the *cosecant*, AG, is the radius produced to meet the extremity of the cotangent.

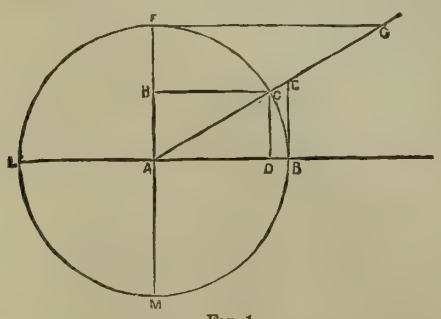


Fig. 1.

Other functions, as the *versed sine*, DB, which is the distance from B to the foot of the sine, and its counterpart, the *coversed sine*, FH, have been occasionally introduced and defined, but they are of no practical use. EAF, the angle which must be added to BAC to make up a right angle, is called the *complement* of BAC; and CAL, the defect of BAC from two right angles, is called its *supplement;* and by inspection of the figure, we can see at once that the sine of BAC, CD, is equal to AH, the cosine of its complement; that the cosine of BAC, AD, is equal to CH, the sine of its complement; and that generally any function of an angle is the co-function of its complement, and *vice versâ;* also, that CD, the sine of CAB, is also the sine of its supplement; AD, the cosine of CAB, is the cosine of its supplement; and that generally the function of an angle is the function of its supplement. If a right angle be added to BAC, then we have the triangles ADC, ABE, shifted so as to be situated in the same relative position to AF as they now are to AB, and each line is consequently at right angles to its former position; hence the sine of BAC is the cosine of (90° + BAC), and similarly of the others. By an extension of this process of investigation, we arrive at the general conclusions, that *if an angle be added to or taken from one or an odd number of right angles, the function of the original angle is the co-function of the one so derived;* and that *if an angle be added to or taken from an even number of right angles, the functions of the original angle are the functions of the derived one.* But since a function of an angle is the same function of its supplement, a knowledge of the function would not enable us to determine to which of the two angles it belonged, unless we possessed some knowledge of more than the mere magnitude of the function.

This desideratum is supplied in the following manner: B is taken as the zero-point of reckoning, the radius BA, which is thus supposed to be fixed, is one of the bounding lines of every angle, the other side being supposed to move in the direction BFL, as the angle increases. Let the radius AC be supposed to sweep round the circle in a left-hand direction (viz., towards F), then, as it approaches F, the sine CD increases, till, on reaching F, the sine coincides with the radius; passing F, and moving towards L, the sine diminishes, till, on reaching L, it becomes zero. Continuing its progress round the circle, the angle BAC becomes *re-entrant* (viz., greater than two right angles); and its sine again increases, becoming equal to the radius at M, and diminishing in the fourth quadrant till it becomes zero at B. While the angle increased from B to L, the sine was drawn *downwards;* for the other half of the revolution, it was drawn *upwards*; hence, in the first and second quadrants, the sine is said to be *positive*, and in the third and fourth, *negative*, the position of a function in the first quadrant being adopted as the standard. The following table shows the variation (increase or decrease, and between what limits, as well as the sign affecting it) of each of the functions as the angle increases.

Angle.	Sine.	Cosine.	Tangent.	Secant.	Cotangent.	Cosecant.
0° to 90°	inc. 0—R, +	dec. R—0, +	inc. 0—∞, +	inc. R—∞, +	dec. ∞—0, +	dec. ∞—R, +
90° " 180°	dec. R—0, +	inc. 0—R, —	dec. ∞—0, —	dec. ∞—R, —	inc. 0—∞, —	inc. R—∞, +
180° " 270°	inc. 0—R, —	dec. R—0, —	inc. 0—∞, +	inc. R—∞, —	dec. ∞—0, +	dec. ∞—R, —
270° " 360°	dec. R—0, —	inc. 0—R, +	dec. ∞—0, —	dec. ∞—R, +	inc. 0—∞, —	inc. R—∞, —

We here observe that all the functions increase and decrease alternately as the angle of which they are the functions passes from one quadrant to another; also that the sine and cosecant are affected by the same signs, as also are the cosine and secant, and tangent and cotangent.

Again, from fig. 1 we obtain, from the properties of right-angled and of similar triangles, the following relations between the functions: $\text{Sin.}^2 + \text{Cos.}^2 = R^2$, $\text{Tan.}^2 + R^2 = \text{Sec.}^2$, $\text{Cot.}^2 + R^2 = \text{Cosec.}^2$, Tan. : R : : Sin. : Cos., Sec. : R : : R : Cos., Cot. : R : : Cos : Sin., Cosec. : R : : R : Sin., and Cot. : R : : R : Tan. From these eight relations, we can easily obtain any one function in terms of any other, both as regards its magnitude and sign.

The reason why the circle and its radius are employed in the definition of the functions is, that we may obtain some invariable standard by which to estimate them, for while, as the angle increases from 0° to 360°, its functions are in a state of constant change, their standard of reference, the radius, remains ths same. For greater simplification, the radius is taken as unity, and the relations become $\text{sin.}^2 + \text{cos.}^2 = 1$, $\text{tan.}^2 + 1 = \text{sec.}^2$, $\text{cot.}^2 + 1 = \text{cosec.}^2$, and (by the reduction from the proportional to the div-

isional form of the other five relations) $\tan. = \frac{\sin.}{\cos.}$, $\sec. = \frac{1}{\cos.}$, $\cot. = \frac{\cos.}{\sin.}$, $\text{cosec} = \frac{1}{\sin.}$, $\tan. = \frac{1}{\cot.}$; the various functions being expressed in terms of the assumed unit. Thus, in the right-angled triangle ABC (fig. 2), if AC be radius, BC = sin., and AB = cos., of the angle A; but if the radius be assumed as unity, $\sin. A. = \frac{BC}{AC}$, $\cos. A = \frac{AB}{AC}$ and similarly from the above relations, $\tan. = \frac{BC}{AB}$, $\sec. = \frac{AC}{AB}$, $\cot. = \frac{AB}{BC}$, and $\text{cosec} = \frac{AC}{BC}$, and in algebraic trigonometry these latter are the definitions of the trigonometrical functions.

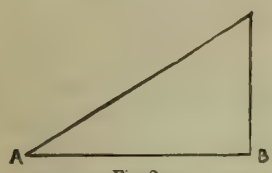


Fig. 2

The only angular functions which geometry enables us to determine with accuracy are those belonging to the angles of an equilateral triangle (Euc. I. 1), an isosceles right-angled triangle (Euc. II. 9), and an isosceles triangle which has each of the angles at its base double of the third angle (i. e., base angles each 72°, vertical angle, 36°) (Euc. IV. 10); and from these, by means of a proposition (demonstrated in all text-books on the subject) which determines the functions of the angle (A + B) from a knowledge of the functions of A and of those of B; and also, as a corollary to the preceding, the functions of 2A, 4A, 8A, &c., and inversely of ½A, ¼A, &c., from a knowledge of those of the angle A, have been obtained and tabulated the functions of all angles from 1′ to 45°, the functions of angles from 45° to 360° being, as is evident from the above remarks respecting complementary and supplementary angles, merely repetitions of these.

The relations between the angles and sides of a triangle (fig. 3) are three in number, and are obtained from simple geometric considerations; they are—(1) AB : AC : : sin. C : sin. B; (2) $\cos B = \frac{AB^2 + BC^2 - AC^2}{2\,AB\,.\,BC}$; (3) AB + AC : AB − AC : : tan. ½(B + C) : tan. ½(B − C). From these relations, in conjunction with the fact that the three angles of a triangle collectively amount to 180°, it is possible, having given any three (one being always a side) of the six elements (three sides and three angles) of a triangle to determine the other three. It is this that constitutes trigonometry in its primitive and elementary form. If the triangles be right-angled, only the first relation, and the property of the sides of a right-angled triangle are necessary for the complete solution. Further information on this subject will be found in any text-book.

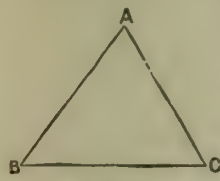


Fig. 3.

Algebraic trigonometry is one of the most important branches of analysis, but is too extensive and varied to be even sketched here; suffice it to say, that in it the trigonometrical functions are not considered as geometrical magnitudes, but as numerical quantities having certain relations to each other, and that the circle as well as the angular functions are treated as multiples or submultiples of the radius. Many important results, such as the approximate estimation of the circumference of a circle, the completion of the solution of cubic equations, &c. have been obtained by its means; and a thorough knowledge of its modes and results is absolutely necessary to an acquaintance with higher mathematics.

Spherical trigonometry is plane trigonometry applied to spherical triangles. See any text-book.

TRI′KHALA, or TRIKALA, a town of the kingdom of Greece, 33 miles west-south-west of Larissa. It is built on the slope of a hill, manufactures cotton and woollen stuffs, and has a large transit-trade. The neighboring plains, which are watered by the Salambria (anc. *Peneus*), are rich in all sorts of fruits. Pop. about 6000. T. is the *Trikka* of Homer, and was celebrated for its temple of Æsculapius. T. was ceded to Greece, along with South Thessaly, in 1881.

TRILLIA′CEÆ, a small natural order of plants belonging to the class Dictyogens (q. v.) of Lindley. They are herbaceous plants, with tubers or root-stocks, whorled leaves, hermaphrodite flowers; perianth of six leaves, the three inner leaves sometimes colored; six, eight, or ten stamens, the filaments extending beyond the anthers in awl-shaped points; the ovary free, 3—5-celled, with numerous ovules; the fruit succulent. The order is characterized by narcotic properties. The genus *Paris* (q. v.) belongs to it.

TRI′LOBITES, an order of fossil crustacea entirely confined to the palæozoic rocks. They are specially abundant in the Silurian period, and disappear in the lower members of the coal-measures.

The body was covered with a chitinous shield, which consisted of a large united cephalic shield, a variable number of body segments, and a tail or pygidium, composed of a number of joints, more or less anchylosed. The eyes were sessile and compound. The lenses are frequently beautifully preserved, and in some species are so large that they can easily be seen with the naked eye. In *Asaphus caudatus*, each eye had at least 400 facets; and in the large *A. tyrannus*, it is estimated that there are no fewer than 6000.

In some species, a bifurcated plate has been found in the region of the mouth, which is believed to be a labrum, but no antennæ or limbs have been yet detected in any specimen. They may have been entirely destitute of attennæ, as in some living animals to which they are nearly related these organs are very rudimentary; and their feet were probably soft and leaf-like appendages, bearing the gills, which would speedily perish, and leave no traces in a fossil condition. The sexes are believed to be indicated by variations in the length of the cephalic and caudal spines, and in the prominence of the head lobes. The members of the order varied greatly in size, some species being scarcely larger than a pin's head, while others, like *Asaphus gigas*, attained a length of 18 inches. It is probable that many named species may be only larval or transition forms of others. The minute *Agnosteus* is frequently found in such quantities as to indicate that it lived in shoals, as if it were the larval form of some large trilobite. Burmeister considers that trilobites have their nearest allies in the minute Phyllopoda, a section of entomostracous crustacea, which live in stagnant water, and are never at rest, but continually swimming at various depths on their backs, some being so near the surface of the water that their feet touch it. He consequently supposes that trilobites lived gregariously in shallow water close to shore, moved only by swimming near the surface, and could not creep at the bottom; that they swam in an inverted position, with the belly upwards; that they made use of their power of rolling themselves into a ball as a defence against attacks from above; and that they lived on smaller water-animals.

Asaphus tuberculatus.

About 400 species have been described, and grouped into 50 genera. Of these, 46 are Silurian, 22 Devonian, and 4 Carboniferous.

TRI′LOGY, the name given by the Greeks to a group of three tragedies, either connected by a common subject, or each representing a distinct story. A satyric drama was customarily added as a termination, whence the whole was sometimes termed a *tetralogy*. Every tragic poet that wished to take part in a poetic contest had to produce a trilogy along with a satyric drama at the Dionysiac, Lenæan, and Anthesteriac festivals. We possess only one perfect specimen of the classic trilogy—the *Oresteia* of Æschylus, which embraces the *Agamemnon*, the *Chœphoræ*, and the *Eumenides*. Beaumarchais' three comedies form a comic trilogy; Schiller's *Wallenstein* is a trilogy; and so are Swinburne's *Chastelard*, *Bothwell*, and *Mary Stuart*.

TRIMETHY′LAMINE, or TRIMETHYLIA, is a remarkable organic base, with an extremely powerful fishy odor. It is obtained as a colorless gas, readily soluble in water, and having a strong alkaline reaction. With acids, it readily forms soluble salts. It occurs in large quantity in the pickle in which herrings (especially their roes) have been lying, and in the spirit in which old anatomical preparations have been long suspended; and (strange as it may appear) it imparts to the leaves of *Chenopodium olidum* their atrocious odor, and to the flowers of *Cratægus oxyacantha* (the common hawthorn), their agreeable fragrance. It is obtained by distillation from ergot of rye, from guano, the juice of the leaves of red beet-root, and from putrid yeast, and has been detected in small quantity in human urine and in the blood of the calf. It may be formed artificially by the action of iodide of methyl on dimethylamine; but the source from which it may most readily be derived is herring-brine.

TRIMMER, a political term in use in the reigns of Charles II. and William III., originally applied to certain politicians of Charles's time, of whom the chief was Charles Montagu, Earl of Halifax, who held opinions half-way between the extreme Whigs and Tories. Halifax adopted the name Trimmer as a title of honor, maintaining that everything good was a medium between extremes.—The same term was applied more generally by Dryden and other writers of the same period to all who, professing to be friends to monarchy, were at the same time enemies to the Duke of York, and who were equally obnoxious to the court and to the fanatical republicans.

TRIMMER, Mrs. Sarah, was born at Ipswich on 6th January 1741. Her father was a Mr. Joshua Kirby, a man of intelligence

and piety, who removed to London about 14 years after, and became tutor to the Prince of Wales, afterwards George III., in the science of perspective, a subject in connection with which he was favorably known by several ingenious works. Among other distinguished persons with whom his daughter had now the advantage of meeting, was the great Dr. Johnson, with whom she speedily became a favorite. In 1759, her father was appointed Clerk of the Works at Kew Palace, whither he went to reside; and here Miss Kirby became acquainted with Mr. Trimmer, to whom, in 1762, she was married. It was not till the year 1780 that she came before the world as an authoress, by the publication of her *Easy Introduction to the Knowledge of Nature*, intended for the use of young people. The success of this little work encouraged her to further efforts in the same field; and during the next few years, she issued in succession six volumes of *Sacred History, selected from the Scriptures, with Annotations and Reflections adapted to the Comprehension of Young Persons.*

Her next work was the *Economy of Charity*, addressed to benevolent people of her own sex, which went through several editions. She edited subsequently in succession *The Family Magazine*, and the *Guardian of Education;* a selection of her contributions to the first of which was issued under the title of *Instructive Tales:* her chief papers to the other being collected in the volume published after her death as *An Essay upon Christian Education.* Besides this, she labored assiduously in the preparation of school-books for the Society for Promoting Christian Knowledge, intended to supersede the imperfect manuals then in use; and did much miscellaneous work of a somewhat cognate kind. She died quite suddenly on Dec. 15, 1810. Her works for the young, though now for the most part superseded, were excellently adapted for their purpose, and for a long time had an extensive popularity. Her *History of the Robins* is still a favorite.

TRIMURTI (from the Sanscrit *tri*, three, and *mûrti*, form) is the name of the Hindu triad, or the gods *Brahman* (masculine), *Vishn'u* and *S'iva*, when thought of as an inseparable unity, though three in form. The *Padma-Purân'a* (see PURAN'A), which, being a Purân'a of the Vaishn'ava sect, assigns to Vishn'u the highest rank in the T., defines its character in the following manner: 'In the beginning of creation, the great Vishn'u, desirous of creating the whole world, became three-fold: creator, preserver, and destroyer. In order to create this world, the supreme spirit produced from the right side of his body himself as Brahman; then, in order to preserve the world, he produced from the left side of his body Vishn'u; and in order to destroy the world, he produced from the middle of his body the eternal S'iva. Some worship Brahman, others Vishn'u, others S'iva; but Vishn'u, one, yet threefold, creates, preserves, and destroys; therefore, let the pious make no difference between the three.' And the *Matsya-Purân'a*, where speaking of *Mahat*, or the intellectual principle of the Sânkhya philosophy (see SANKHYA), says that 'Mahat becomes distinctly known as *three* gods, through the influence of the three qualities, goodness, passion, and sin; being one person and three gods—viz., Brahman, Vishn'u, and S'iva.' Apart, therefore, from sectarian belief, which makes its own god the highest, and gives him the attributes also of the other gods, *Trimûrti* implies the unity of the three principles of creation, preservation, and destruction, and as such belongs more to the philosophical than to the popular belief. When represented the T. is one body with three heads: in the middle, that of Brahman; at its right, that of Vishn'u; and at its left, that of S'iva. The symbol of the T. is the mystical syllable *om*, where (*o* being equivalent to *a* + *u*) *a* means Brahman; *u*, Vishn'u; and *m*, S'iva. See OM.

TRINCOMALEE', a seaport town and magnificent harbor on the north-east coast of Ceylon, in 8° 34' N., and 81° 12' E. The town is built on a bold peninsula, which divides the inner and outward harbors. It is a place of great antiquity, but its ancient renown was due more to religious than political or geographical considerations, for it was here that the Malabar invaders of Ceylon built one of their most sacred shrines—the 'Temple of a Thousand Columns,' to which pilgrims flocked from all parts of India. This celebrated shrine was demolished by the Portuguese, who fortified the heights with the materials derived from its destruction, 1622 A.D. It was next held by the Dutch; but in 1672, during the rupture between Louis XIV. and the United Provinces, the French took T., which was abandoned by the Dutch in a panic.

In 1782, the French admiral, in the absence of the British commander, took possession of the fort, and the English garrison retired to Madras. It was restored to the Dutch the following year, and they retained it until the capture of Ceylon by the British in 1795. The modern town is in no way remarkable, and, with the exception of the official buildings, makes a poor appearance. There are Hindu temples in barbarous taste, and religious festivals and processions to which a similar epithet may be applied. The Bay of T. is land-locked, and presents a scene of tranquil beauty; its fine expanse of water is still as an inland lake, and equally sheltered. 'On comparing this magnificent bay,' says Sir J. E. Tennent, 'with the open and unsheltered roadstead of Colombo, and the dangerous and incommodious harbor of Galle, it excites an emotion of surprise and regret that any other than Trincomalee should have been selected as the seat of government and the commercial capital of Ceylon. As a harbor, Trincomalee is renowned for its extent and security; but its peculiar superiority over every other in the Indian seas consists in its perfect accessibility to every description of craft in every variation of weather.' The mean temperature for the year at T. is 81°·4. Pop. about 15,000.

TRINCOMALEE WOOD. See HALMALILLE.

TRING, a town of Hertfordshire, England, 32 miles north-west from London, near the right bank of the Ouzel, a branch of the Ouse. It is a neatly built town; has manufactures of silk, canvas, and straw-plait, and is a station on the London and North-western Railway. The Grand Junction Canal passes not far from it. Pop. (1871) 4045; (1881) 4354.

TRI'NGA. See SANDPIPER.

TRINIDA'D, an island belonging to Great Britain, and the most southerly of the West India Islands, being in latitude 11° north. It is about 50 miles long, varying in breadth from 30 to 35 miles, and the area amounts to 1755 square miles. It is separated from the mainland (Venezuela) by the Gulf of Paria, and the extreme points on the west coast are only 13 and 9 miles respectively from it. The Dragon's Mouth entrance, to the north, is the deepest channel to the harbor; and the southern, or Serpent's Mouth, is shallow, owing to the deposits brought down by the Orinoco. The gulf itself is shoaling up from the same cause. The aspect of the island of T. is different from that of the Caribbean Islands generally: the mountains are not so lofty, and they extend in an east and west direction along the northern coast, clothed with stately forests, and their margins fringed with overhanging mangroves, dipping into the sea. From the double-peaked mountain called Tamana, are seen the lovely and fertile valleys and plains with which the other part of the island abounds. The island has several good harbors, and some tolerably large rivers.

The chief town, Port of Spain, is one of the finest towns in the West Indies. It was originally built of wood, but was burned down in 1808, and the town has since been rebuilt of the good stone procured in the neighborhood. The streets are long, wide, well-paved, clean, and shaded with trees. There is another town called San Fernando, with two or three pretty villages.

A remarkable phenomenon is a pitch lake near the village of La Brea, composed of bituminous matter floating on the surface of fresh water, about 3 miles in circumference, and 80 feet above the sea. The mineralogy of the island is but little known. The soil is very rich and productive. The climate is hot and moist; the thermometer ranges from 75° to 85°, and sometimes 90°; and the rain-fall is about 75 inches.

The most important products are cocoa, sugar, rum, molasses, coffee, cotton, arrow-root, cocoa-nut, oil, hides, &c. The value of the exports in 1880 was £2,185,512; imports, £2,382,632. The trade is mainly with the United Kingdom, the exports thither in 1880 having a value of £1,163,791; the imports thence, £830,799. Pop. (1871) 109,638; (1881) 155,128, the increase being occasioned principally by the voluntary immigration from the neighboring colonies and from India. T. is a crown colony, ruled by a governor, an executive council of 3, and a legislative council of 13 members. The first railway in T., from Port of Spain to Arina, was opened in 1876.

T. was first discovered by Columbus in 1498, and thus named by him because three mountain summits were first seen from the mast-head when discovered; but no permanent establishment was founded there until 1532 by the Spaniards. In 1783, it first fell into the hands of the British, who were confirmed in possession of it in 1802.

TRI'NITY, a river of Texas, U. S., formed by the union of two streams, West Fork and Elm Fork, which rise near the northern boundary of the state, and unite 150 miles south-east, the main stream flowing thence 550 miles in the same general direction to Galveston Bay, about 40 miles north of the city of Galveston. It is navigable 300 to 500 miles.

TRINITY, a river of California, rising near the coast-range, and flowing through a country of rich gold-mines, into the Klameth River.

TRINITY, THE DOCTRINE OF THE, is the highest and most mysterious doctrine of the Christian religion. It declares that there are three Persons in the Godhead, or divine nature—the Father, the Son, and the Holy Ghost, and that 'these three are one true, eternal God, the same in substance, equal in power and glory—although distinguished by their personal properties.' The most elaborate statement of the doctrine is to be found in the

Athanasian Creed, which asserts that 'the Catholic faith is this: That we worship one God as Trinity, and Trinity in Unity—neither confounding the persons nor dividing the substance—for there is one person of the Father, another of the Son, and another of the Holy Ghost. But the Godhead of the Father, and of the Son, and of the Holy Ghost is all one; the glory equal; the majesty co-eternal.'

It is admitted that the doctrine is not found in its fully-developed form in the Scriptures; but it is supposed to be clearly revealed in its elements in the New Testament, and also to be indicated in many of the statements and revelations of the Old Testament. The form of expression in speaking of God in the Old Testament Scriptures—the plural *Elohim*, coupled with a singular verb; the apparent distinction recognized in the revelations to the Patriarchs and Moses between Jehovah and 'the Angel of Jehovah;' the mode in which 'the Spirit' and 'Word' of God, and 'Wisdom' (Proverbs viii.) are spoken of; and the gradual unfolding of the doctrine of a 'Messiah,' are all supposed to be indications from the earliest times of the truth of a plurality of persons in the Godhead; and in the New Testament Scriptures the doctrine is represented as clearly taught in the Trinitarian formula of baptism—the general character of the claims and prerogatives of Jesus Christ, especially the ascription to Him of the designation 'the Son of God,' and in the functions attributed to the Holy Spirit. The evidence is held conclusive of the equal divine nature and yet distinct personality of the Son and the Spirit along with God the Father. It is generally conceded, however, that the Christians of the 2d. and even of the 3d c., were far from having a clearly understood and recognized doctrine on this high subject. They were content for the most part to use Scriptural expressions in speaking of the Father, and the Son, and the Spirit, without defining articulately their relation to one another.

It was not till the progress of opposing heresies sought, on the one hand, to degrade the divine dignity of Christ (Ebionitism in its various forms, and Arianism); or, on the other hand, to confound the personality of Christ with God the Father—a heresy known in its special form as Patripassianism—that the church was led to define in the Nicene Creed the relation of the Son to the Father; and further, in the Nicæno-Constantinopolitan Creed, the relation of the Spirit to the Father. This creed was specially directed against the opinions of Arius. A further clause was afterwards added, known as the *filioque* clause, which determined the procession of the Spirit from the Son as well as the Father; but this clause, and the doctrine which it embodies, was never accepted by the Eastern Church, to whose finer speculative genius is owing the determination of the controversies which began in the 3d c. regarding the Divine nature. The Western or Latin Church had a far less refined genius for such speculations; and in so far as it meddled with them, has imparted to them a coarser and more contradictory aspect. What is known as the 'Athanasian Creed,' which is now well understood to be of Latin, and not of Greek origin, is a sufficient illustration of this.

It is not our part here to criticise the evidence for the doctrine of the Trinity, or the validity of the doctrine itself; it is enough to say that the evidence which we have briefly sketched in outline, has been accepted as satisfactory, not only by the Roman Catholic and oriental communions, but also by all the great Protestant communions. The only exception in modern times to the reception of the doctrine is in the case of the Socinians or Unitarians, who occupy in their teaching very much the position of the ancient Humanitarians (Ebionites). They reject the doctrine of the Trinity as incredible, and regard Christ merely as a higher prophet. There have, however, been various thinkers within the Christian church, such as Dr. Samuel Clarke in the beginning of last century, who, while accepting generally the doctrine of the Trinity, have rejected the special terms in which it is defined in the Creeds, and whose views have been known as semi-Arianism.

TRINITY COLLEGE, Cambridge, was founded by King Henry VIII., in 1546, upon the site, and partly out of the revenues, of several more ancient foundations. The names of these were King's Hall, Michael House, Fyswicke's Hostel, Hovinge Inn, Gregory's, Margaret's, Catherine's, Gerard's, and Tyler's hostels. Of these, the first two deserve special mention. King's Hall (*Aula Regis*) was so called after its founder, Edward III., whose father, Edward II., had maintained 32 scholars, called king's scholars, but had died before completing his intentions. The Hall was founded in 1337. The master's stipend was fourpence, and that of each scholar twopence, per day, with two robes at Christmas. The revenues of King's Hall at the time of its surrender to Henry VIII. amounted to £214 per annum.

Michael House was founded 1324 A.D., by Hervey de Stanton, who was Chancellor of the Exchequer to Edward II. He dedicated his college to the Trinity, the Virgin Mary, St. Michael the Archangel, and All Saints. When Henry VIII. united these smaller foundations into the one great college, henceforth called TRINITY COLLEGE, besides other endowments, he added the estates of twenty-seven dissolved monasteries, which made up the gross revenues to about £1700 per annum. Queen Mary added very largely to these benefactions, and provided for 20 additional scholars, 13 poor scholars or sizars, 4 chaplains, and a choir. Queen Elizabeth gave to the college a new set of statutes, by which the college was governed until the reign of Queen Victoria, when these statutes were revised. Subsequently, under the Cambridge University Commission (1859—1860), new statutes have again been given, by which several important changes have been introduced. Such Fellows as fill the office of bursar, tutor, or lecturer in the college, or professor in the university, are exempt from the necessity of taking holy orders, which must otherwise be done by all Fellows within seven years of taking the degree of Master of Arts. Marriage also is permitted to Fellows in a few exceptional cases, and to the chaplains and librarian. The Master of the college must be in holy orders, and the appointment is in the gift of the crown. The following are some of the more eminent names in the list of Masters: John Whitgift, who was raised to the see of Worcester; Thomas Nevile, Dean of Canterbury, who built the greater part of the cloistered court known by his name: he died 1615. To Dr. Barrow, who was made Master in 1672, the college owes the finishing of Nevile's Court, and the erection of the Library, for which the designs were furnished by Sir Christopher Wren. The famous Dr. Bentley was Master from 1700 to 1742.

The late William Whewell was one of the most distinguished men that this college has produced, and one of the best of its Masters. He was a munificent benefactor to the college, to which he added one new court during his life; and at his death bequeathed his large fortune to the building of another, and to the founding of a professorship of International Law. See WHEWELL. To these may be appended the following few names of popular interest, with the dates of their death: Lord Bacon, 1626; Sir Edward Coke, 1634; Cowley, the poet, 1667; Lord William Russel, executed 1683; John Dryden, 1701; Samuel Pepys, the diarist, 1703; SIR ISAAC NEWTON, 1727; Richard Porson, 1808; Lord Macaulay, 1859. Of living men, it will not be invidious to select only the names of Alfred Tennyson, the Laureate, and Professor H. A. J. Munro, editor of *Lucretius*.

The foundation now consists of a Master, sixty Fellows, and seventy-four Scholars. The present Master is the Rev. William Hepworth Thompson, D.D.

With the exception of the Hall and the Library, the college buildings are not of any architectural pretensions. The statue of Newton by Roubiliac, in the ante-chapel, is one of the finest modern statues.—See Cooper's *Annals and Memorials of Cambridge;* Dyer's *History;* and the *University Calendar*. The judges, when on circuit, have the right of being entertained at this college.

TRINITY COLLEGE, Oxford. In 1290, Richard de Hoton, Prior of Durham, founded Durham College at Oxford, for the education of the student-monks of Durham. At the dissolution of the monasteries, the property of this institution was transferred by Henry VIII. to the newly erected chapter of Durham Cathedral. Its site and buildings, however, passed into the hands of Sir Thomas Pope, who, in 1554, obtained a license from Philip and Mary to found a college on the spot, to be called T. C., for the maintenance of 20 scholars, of whom 12 were to be Fellows, and 8 scholars, properly so called. The scholars were to be elected from the founder's manors, and the Fellows from the scholars. In 1557, Sir Thomas Pope added four scholarships; and about the same time another was added by a Mr. Blount. There are also two exhibitions. By the ordinances issued by the commissioners under 17 and 18 Vict. c. 81, the fellowships and scholarships are thrown open without restrictions; the latter are tenable for 20 terms, value £80 a year, besides rooms. This is the first college, after Balliol, which was founded by a layman, as were all colleges subsequent to this date. It is also remarkable as having been, like St. John's, founded by a Roman Catholic after the Reformation. It presents to 11 benefices.

TRINITY HALL, Cambridge. This college, which is distinct from Trinity College, was founded 1349—1350 A.D. for Scholars of Canon and Civil Law, as well as for the education of clergy, by William Bateman, Bishop of Norwich, who was also co-founder of Gonville and Caius College. It appears that the bishop was induced to found the college in consequence of the great pestilence which had recently swept away most of the clergy of his diocese, so that there could not be found sufficient to supply the parochial cures. In a bull of Pope Clement VI., dated at Avignon, 1349, it is stated that there were at that time no less than 1000 parishes in the diocese void of incumbents. The first Master was Robert de Stratton. There are thirteen fellowships, of which ten may be held by laymen for ten years, and are not vacated by marriage. There are also five law-studentships, sixteen scholarships, and two exhibitions.—See Cooper's *Memorials and*

Annals, and Dyer's *History of Cambridge;* also the *University Calendar*.

TRINITY HOUSE (properly called, The Corporation of the Elder Brethren of the Holy and Undivided Trinity), a corporation intrusted with the regulation and management of the light-houses and buoys of the shores and rivers of England. In 1518, a society under the above name was founded at Deptford by Sir Thomas Spert, Knight, and incorporated by Henry VIII. Its privileges were confirmed in 1658; and in 1680, its first light-house was erected; all the light-houses which had previously existed on the English coast having been built by private individuals under patents from the crown. By 6 and 7 Will. IV. c. 79, and the Merchant Shipping Act, 1854 (17 and 18 Vict. c. 104), private rights in light-dues were abolished, and the exclusive right of lighting and buoying the coast committed to the Board of Trinity House. The power of Trinity House to appoint and license pilots for the English coast is also regulated by this last-named statute. The Cinque Ports pilots, who had formerly been under control of a separate society, were, by 16 and 17 Vict. c. 129, and the Merchant Shipping Act, 1854, placed under the jurisdiction of Trinity House. Trinity House was in the practice of distributing certain funds arising from light and pilotage dues, and from the sale of ballast, for certain charitable purposes; but the right which the society possessed to the surplus of light-dues was done away with by the Merchant Shipping Act 1854. This same act gave Trinity House a general supervision over the Commissioners of Northern Lights and the Ballast Board of Dublin, the corporations which have the charge of the light-houses and buoys of Scotland and Ireland respectively, subject to an appeal to the Board of Trade, to whose general superintendence Trinity House is also subject in matters relating to England. The light-houses of the Isle of Man are, by special arrangement, under the charge of the Commissioners of Northern Lights.

The corporation of Trinity House consists of a master, a deputy-master, nineteen acting elder brethren, eleven honorary elder brothers, and an unlimited number of younger brethren. The master and honorary elder brethren are chosen on the ground of eminent social position. The younger brethren all belong either to the naval service or the mercantile marine, and are admitted by the court of elder brethren. The deputy-master and acting elder brethren are elected by the court of elder brethren from such of the younger brethren as are possessed of the qualifications of having obtained the rank of commander in the navy four years previously, or having served as master in the merchant service on foreign voyages for at least four years. The Board discharges its duties by means of committees and sub-committees for special purposes, whose proceedings are, when necessary, subject to confirmation by the general court. Two elder brethren of Trinity House assist the Court of Admiralty at the hearing of every suit for collision, and occasionally in suits for salvage. Their duty is to guide the court by advice only; though influential, their opinion is not legally binding on the judges. The gross income of Trinity House greatly exceeds the expenditure. The surplus income is chiefly devoted to the extinction of the debt incurred in pursuance of the act of 1846 for the purchase of private rights in light-houses.

TRINITY SUNDAY, the Sunday immediately following Pentecost Sunday, so called as being set aside for the special honor of the Blessed Trinity. The date of the origin of this festival has been a subject of much controversy. No such festival as Trinity Sunday was known to the Fathers of the early centuries. The most decisive evidence of its non-acceptance by the general church up to the 9th or 10th c., is the absence even to this day of any corresponding festival in the separated Greek Church; and although it seems quite certain that the festival was introduced in certain particular churches of the West, at earlier and varying dates, the general establishment of Trinity Sunday as a common festival of the whole Western Church, dates from a decree of John XXII., who died in 1334. Nevertheless, the mass and office peculiar to the day are of much greater antiquity, and may be traced, at least in part, in several sacramentaries and other liturgical books of the earlier centuries.—See Benedict XIV., *De Festis*, i. 2, 10; Binterim, *Denkwürdigkeiten Christ-katholisch. Kirche*, vol. v. part 1.

TRINO'DA NECE'SSITAS, three species of contributions, to which, in Anglo-Saxon times, all the lands of England, whatever their tenure, not excepting those of the church, were subject; viz., *Bryge-bot*, for keeping the bridges and highways in repair; *Burg-bot*, for keeping the fortresses in repair; and *Fyrd*, for maintaining the military and naval force of the kingdom.

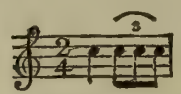
TRI'O, in Music, a composition for three voices or for three instruments. The same term is also applied to a movement in ¾ time in a different key, which follows a minuet or other movement, and always leads back to the previous movement in the original key.

TRIPE DE ROCHE, a name originally given by the Canadian hunters to certain lichens, species of *Gyrophora*, which they are often forced to use as food, and now very generally in use as the designation of these plants. They are nutritious, but bitter, nauseous, and purgative. They have a leafy peltate thallus, variously lobed and notched—in *G. proboscidea* of a smoky-brown color, and in *G. erosa* almost black; the shields are round, without stalks, covered with a black membrane, and marked with circles and plaits upon the surface. These lichens grow on rocks in northern regions, or on high mountains. They are to be found in abundance in Spitzbergen, and a species, well known as a native of the Scottish mountains, is found in the Himalaya at an elevation of more than 18,000 feet.

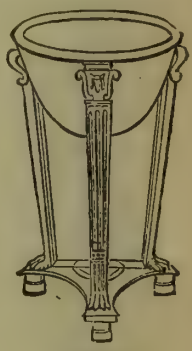
TRIPIT'AKA. See PIT'AKA.

TRIPLE ALLIANCE, the name by which two different treaties are known in history; viz. 1. A treaty concluded in 1668 at the Hague between England, Holland, and Sweden, having for its object the protection of the Spanish Netherlands, and the checking of the conquests of Louis XIV. 2. An alliance concluded in 1717 between Britain, France, and Holland against Spain, which included among its stipulations that the Pretender should quit France, and that the treaty of Utrecht should be carried into effect as regards the demolition of Dunkirk. The Protestant succession was guaranteed by this treaty in England, and that of the Duke of Orleans in France.

TRI'PLET, in Music. When a note is divided into three in place of two parts—as when a minim is divided into three crotchets, a crotchet into three quavers, &c.—the group is called a triplet, and it is usual to place the figure 3 over it. Thus—



TRIPOD (Lat. *tripos*, Gr. *tripous*, three-footed), any article of furniture supported on three feet. Three-legged caldrons and bronze altars more especially came under this denomination in classical times; many of them are of exquisite workmanship, and richly decorated. The sacrificial tripod in its earliest form resembled the caldron, with the addition of three rings at the top to serve as handles. Of this description seems to have been the tripod at Delphi, from which the Pythian priestess delivered her oracles, with the addition, however, of a round flat plate on the top, on which the priestess sat while giving the response, while a laurel wreath lay on it at other times. Tripods of a similar form were given as prizes at the Pythian games; and at Athens, a tripod was considered an appropriate reward for a successful choragus. Some beautiful tripods were found at Pompeii; and there are several very interesting specimens in the British Museum. Analogous to the classic tripod, is Thor's *kettle* in Scandinavian mythology, which was probably the origin of the witches' caldron.


Tripod.

TRI'POLI, or TRIPOLIS (in its modern Arabic form, *Tarâbulus*), the ancient *Tripolis*, a seaport, and one of the chief commercial towns of Syria, capital of a pashalic in the eyalet or government of Sidon, is situated near the coast, on the eastern border of a small triangular plain running out into the Mediterranean, and on both sides of the river Kadisha. The town is substantially built of stone, with many remains of medieval architecture, and is supplied with excellent water by an aqueduct. It is surrounded by gardens of orange, lemon, mulberry, apricot, and other fruit trees, which are planted also in the town itself, and give the place a rich and picturesque appearance; but the low marshy neighborhood renders it unhealthy. On the left side of the river stands the castle built by Count Raymond of Toulouse, in the 12th c., when the city was taken by the Crusaders. At the north-west apex of the plain already mentioned lies the port of Tripoli, called El-Mîna (the landing-place), or the Marina, a small fishing village about 1½ miles distant from the town. The harbor, like other harbors on the Syrian coast, scarcely deserving of the name, is formed by a line of low rocky islets stretching north-west from the point. The trade of the place has of late much declined, being superseded by that of Beirût; its exports now consist chiefly of silk, sponges, and tobacco: there are also manufactures of soap. Pop. variously stated at 13,000 and 20,000, and consisting of Mohammedans and Greek Christians. It is the see of a Greek bishop. T. is regularly visited by the steamers of the French Messageries.

The ancient city of T. was situated on the plain, where immense numbers of granite shafts and other relics of antiquity are still

found. Its name (the *Three Cities*, or the *Triple City*) was derived from the circumstance of its being founded by the cities of Tyre, Sidon, and Aradus, as an entrepôt for trade, and a point of federal union. It was for many centuries a place of great commercial importance.

TRIPOLI, a regency of the Ottoman Empire, and the most easterly of the Barbary States, North Africa, is bounded on the W. by Tunis, on the S. by the Libyan Desert and Fezzan, on the E.—if we include the plateau of Barca (q. v.)—by Egypt, and on the N. by the Mediterranean. Area roughly estimated at 200,000 sq. m.; pop. uncertain, but believed to be about 1,000,000. T. is less mountainous than the rest of Barbary, the Atlas range terminating here in a couple of chains running parallel to the coast, and never exceeding 4000 feet in height. There are no rivers in the country, and rain seldom falls during the long hot summers, but the dew is copious, and supports vegetation in favored spots. The coast region (about 1100 miles in length) is very fertile about Tripoli and Mesurata, where all sorts of tropical fruits, grain, wine, cotton, madder, &c., are produced; but further east, along the shores of the Gulf of Sidra, sandy desolation reigns. The interior yields senna, dates, and galls; the carob and lotus are indigenous.

Sheep and cattle are reared in great numbers, and T. is also noted for its small but excellent horses, and its strong and beautiful mules. The commerce of the country consists in exporting, principally to Malta and the Levant, the products of the country and of the interior of Africa (gold-dust, ivory, natron), which are brought hither in caravans across the desert. The imports (which consist chiefly of European manufactures) have been declining gradually of late years, owing mainly to two causes. The *first* is the new direction which the trade of Central Africa is assuming. By the Niger and its great tributary, the Benue, European manufacturers are more rapidly and more economically conveyed to the northern intertropical regions than by the tedious overland route of the Great Sahara. The *second* cause is the abolition of the slave-trade, which, of course, has stopped the demand for all the commodities that alimented the traffic.

T. is subdivided into four *livas*, or provinces—Tripoli, Benghazi, Mesurata, and Gadames. The governor-general has the title, rank, and authority of a pasha of the Ottoman Empire. He is appointed by the sultan, and in his turn appoins the subordinate governors of the Tripolese provinces, who bear the title of beys. The military force of the country consists of a body of Turkish soldiers, some 10,000 in number, whose business is to keep down insurrections, but who were formerly wont to vary it by by creating them. The natives (who comprise Libyan Berbers, Moors, and a few Arabs) pay to the imperial government, by way of tribute, a tenth of all the products of the soil; and there is, besides, a special tax imposed on every olive tree and date tree, on every camel, on all horned cattle, on sheep and goats, and on Jewish residents. Little wisdom and less justice are shown either in the imposition or collection of the taxes.

In ancient times, T. (when we first read of it) appears to have formed the most westerly portion of the territory of Cyrenaica (Barca), or at least to have been tributary to the Cyrenæans, from whom, however, it was wrested by the Carthaginians. It next passed to the Romans, who included it within the province of Africa, and gave it the name of *Regio Syrtica*. About the beginning of the 3d c. A.D., it became known as the *Regio Tripolitana* (on account of its three principal cities, Œa, Sabrata, and Leptis, which were leagued together; whence its present name Tripoli), and was probably raised to the rank of a separate province by Septimius Severus, who was a native of Leptis. Like the rest of North Africa, it was conquered by the Arabs (see Barbary), and the feeble Christianity of the natives was supplanted by a vigorous and fanatical Mohammedanism. In 1552, the Turks got possession of it, and have ever since been the rulers of the country, though the authority of the sultan, up till 1835, had been virtually at zero for more than a century. In that year, however, an expedition was despatched from Constantinople; the ruling dey, Karamanli (in whose family the sovereignty had continued uninterrupted since 1714) was overthrown, and imprisoned; a new Turkish pasha, with vice-regal powers, was appointed, and the state made an eyalet of the Ottoman Empire. Several rebellions have since taken place (notably in 1842 and 1844), but they have always been suppressed.

TRIPOLI, called by the Turks *Tarabúlús*, and probably the *Œa* of antiquity, the capital of the foregoing state, lies on a bit of rocky land projecting into the Mediterranean, and forming a bay. It is surrounded by high walls with bastions, and is irregularly built, but has beautiful gardens. There are 12 mosques, 3 synagogues, and 2 Christian churches. Pop. about 24,000. Though the majority are Moslems, nearly all the trade is in the hands of Jews and Christians. The overland trade to Sudan has greatly fallen off. The exports have an annual value of about £500,000.

TRIPOLI (*Tarabúlús*), a seaport of Syria, is 40 miles N.N.E. of Beyrout. The houses are mostly of stone. In and around the town are many remains of antiquity and traces of middle-age architecture. Originally an important maritime city of Phœnicia, the ancient *Tripolis* was besieged and taken by the Crusaders in the 12th century. The harbor is small and shallow. Fruit is exported to the annual value of £120,000; also oil, grain, silk, tobacco, and sponges. Pop. (chiefly Greek) about 25,000.

TRIPOLI, a mineral substance employed in polishing metals, marble, glass, &c., so named because it was originally brought from Tripoli in Africa. It is a siliceous rock, composed of very minute particles, somewhat loosely held together, so as to yield readily to the nail, and to crumble down in water like rotten-stone. It has a coarse, dull, earthy fracture, is rough to the touch, and is of a gray, yellow, or red color. The particles which entirely compose it are the siliceous frustules of *Diatomaceæ*, which occur unaltered in it, and are united together without any visible cement. Ehrenberg estimated that every cubic inch of Bilin Tripoli weighing 220 grains, contained 41,000,000,000 of these minute waterweeds. Deposits of Tripoli occur in the Tertiary rocks in every quarter of the world.

TRIPOLI'TZA ('three cities'), a town of Greece, under the Turkish rule capital of the Morea, now the chief town of the government of Mantinea, lies 22 miles south-west of Argos, and 39 south-west of Corinth, in a plain 3000 feet above the sea. It derives its name from being near the sites of the three ancient cities, Tegea, Mantinea, and Pallantium. In 1821, it was stormed by the Greek insurgents; and in 1828 razed to the ground by the troops of Ibrahim Pasha; it has since, however, been rebuilt. Previous to 1821, it had 20,000 inhabitants; in 1879 the pop. was 10,057.

TRI'PPANT, in Heraldry, a term analogous to Passant (q. v.) but applied to animals of chase.

TRI'PTYCH (Gr. *tris*, thrice, and *ptysso*, I fold), a set of tablets consisting of three leaves, each painted with a distinct subject, but joined together by hinges, and capable of being folded so as to present a new face. The general character of such tablets has been explained under DIPTYCH (q. v.), the difference of name, 'triptych,' 'polyptych,' being taken from the number of the leaves. In ecclesiastical use, the diptych has been already explained as commonly meaning rather the register of names inscribed on the tablets than the tablets themselves. The triptych, on the contrary, generally speaking, contained sacred pictorial representations rather than written registers or records.

TRI'REME (from *tres*, three, and *remus*, an oar) is the designation given in ancient times to a galley having three banks of oars. It is said to have been first employed by the Corinthians in their war with Corcyra, 664 B.C. In the Persian and Peloponnesian wars, triremes were the largest vessels employed; but at the time of Alexander, we find that galleys, with four and five banks had gradually come into favor. In the Punic wars, the Carthaginians generally employed quinqueremes; and as the Roman triremes could have no chance against vessels with such high bulwarks, the Romans henceforth constructed their war-vessels after the model of the Carthaginian quinquereme.

The banks of oars were elevated above each other, but not perpendicularly; and the lowest rank of rowers having the shortest oars and easiest work, had the least pay. The trireme or quinquereme was also provided with a square sail, which was used when the wind was favorable for voyaging, to relieve the labor of the rowers, but it was not employed in action. The crew consisted of about 200 men; and on a smooth sea, in speed and accuracy of manœuvring, the trireme was little inferior to a modern steamboat. In the earlier times, before the Persian war, and even later, victory depended more upon the number and valor of the soldiers on board, than upon the skill of the seamen. Herodotus mentions that besides the crew there were 40 marines serving on board each Ionian trireme. The Athenians improved this system by decreasing the number of fighting men, and trusting more to the skilful management of their vessels. In a fight, the aim of each trireme was not, as before, to grapple with its opponent, but to dash with the greatest momentum possible with its beak against the enemy's vessel, and strike it amidship, or, at any rate, disable his banks of oars on one side. Fighting men were not so much wanted for these tactics; and so we find later on, in the Peloponnesian wars, the number of marines in each ship reduced to ten. It is singular to see this system of ram-fighting coming once more into vogue. A contrivance for strengthening the prow of the trireme, and increasing its efficiency as a ram, gave the Syracusans their final victory over the Athenians in the harbor of Syracuse.

TRISA'GION, or TRISHAGION (Gr. *tris*, thrice, and *hagios*, holy; Lat. *tersanctus*, thrice holy), one of the doxologies in use in the Greeek Church, which is repeated in the form of versicle and responses by the choir in certain parts of the liturgy. The words of the Trisagion are: '*Hagios O Theos, Hagios Ischuros, Hagios*

Athanatos, eleison hemas!' (O Holy God, O Holy Mighty One, O Holy Immortal, have mercy on us!) This doxology, in its original Greek form, is one of the few fragments of the Greek liturgy which (like the *Kyrie Eleison*) are retained in the original language in the Roman mass. It occurs in the service of Good Friday in the procession and veneration of the cross. See GOOD FRIDAY.

TRISMEGI'STUS (Gr. Thrice-greatest), an epithet applied to the Egyptian Hermes (q. v.), or Thoth (q. v.) by the Neo-Platonists, and the devotees of magic, alchemy, and mysticism generally, who looked upon him as the source of all mysterious doctrines. See HERMETIC BOOKS.

TRI'SMUS NASCE'NTIUM is a form of lock-jaw occurring in newly-born children, in consequence mainly of impurity of the atmosphere. In Iceland, this disease annually carries off a large proportion of infants between the fifth and twelfth days after birth; in some parts, the mortality being nearly *two out of three*. It is also very frequent and fatal in the West Indies, where it is known as the 'ninth-day disease.' Another of its names is 'the jaw-fall,' from the circumstance of the jaw relaxing and dropping on the breast shortly before death. The complaint used to be common in hospitals when ventilation was less attended to than at present; but with the introduction of a better system of ventilation, the mortality has been very much reduced. In so fatal a disease, it is almost unnecessary to refer to treatment. Immediate removal to a pure air, a warm bath, and a dose of castor-oil should be tried.

TRISTAN DA CUNHA, an island in the South Atlantic Ocean, lies midway between the coast of South America and the Cape of Good Hope, in 37° 6′ S. lat. It is about 20 miles in circumference. In 1816, a company of British artillery was stationed on the island for the purpose of keeping a watch on Napoleon, at that time a prisoner in St. Helena, from which T. is distant about 1300 miles. On the death of Napoleon in 1821, the soldiers were withdrawn, with the exception of a corporal named Glass, and one or two companions, who were left in charge of the small fort that had been erected. These men finding the soil very fertile, proceeded to cultivate the island, and their efforts were attended with marked success; insomuch that they were enabled to carry on a brisk trade in the produce with any passing ships that might stand in need of fresh provisions. The colony flourished, and in 1829 numbered 27 souls. When visited by H.M.S. *Challenger* in October 1873, the place was found to be still thriving; the inhabitants numbered 80, and the cattle had increased to 600, with an equal number of sheep. In the vicinity of T. are two other islands—one of them, Inaccessible Island, 20 miles distant, possessing a special interest from the circumstance of its having harbored two Germans of the name of Stoltenhoff, who underwent a kind of Robinson Crusoe experience there. They were landed on this desolate island on November 27, 1871, when making their way to the larger island of T., and determining to settle there, experienced many privations, being sometimes reduced to great extremities; though, unlike Robinson Crusoe, they had more than one opportunity of quitting the island in the course of their two years' sojourn. They were at length, however, fain to take advantage of the opportunity afforded them by the *Challenger* of leaving the island, which they accordingly did on the 16th October 1873.

TRISTRAM is the hero of a British legend, which originally had no connection with the stories of King Arthur and the Round Table, although later minstrels sought to interweave them. Briefly, the legend goes as follows.

T., son of Rouland Rise, Lord of Ermonie, and Blanche Fleur, sister of Mark, king of Cornwall, having lost both parents at the period of his birth, is brought up for the first fifteen years of his life at the court of the monarch who had slain his father, after which he proceeds to Cornwall, and is acknowledged by his uncle, who appoints him his heir and successor. Having received a severe wound in a duel, he is cured by Ysolt or Ysonde, daughter of the queen of Ireland; and on his return to Cornwall, informs his uncle of the marvelous beauty of the Irish princess. Mark is charmed, and sends his nephew to Dublin, at the head of a select body of knights, to solicit her hand in marriage. The king's suit is successful, and T. escorts her on her voyage to England; but both having unwittingly partaken of a love-potion (which was intended for Mark), they are immediately inflamed with a criminal passion for each other, which is the source of all their subsequent misfortunes. Ysolt is married to the king of Cornwall; but, by the help of her clever maid, Brenqwain, she contrives to have numerous secret interviews with her lover, and for some years succeeds in allaying the jealousy and suspicions of her husband. At last, however, T. is banished from Cornwall, and goes to Wales, where he performs prodigies of valor. His uncle again becomes reconciled to him, and invites him back to his court, where the amours of the incorrigible lovers are renewed.

A renewed banishment is the consequence, and T. goes abroad to Spain, Ermonie, Brittany, in the last of which countries he marries another Ysolt, called, for distinction's sake, Ysolt *with the white hand*, daughter of the Duke of Brittany. In one of his exploits, he is desperately wounded, and can only be cured by Ysolt of Cornwall. He despatches a messenger to the princess, telling him that on his return he is to hoist a white sail as he approaches the coast of Brittany, if Ysolt accompanies him; but if not, a black sail. The Queen of Cornwall hastens to save her lover; and as the vessel nears the shores of France, T.'s wife, Ysolt *with the white hand*, recognizes the white sail, and, fired with jealous hate at the thought of a rival's approach, hurries to her husband's chamber, and tells him the messenger's ship is coming in with black sails spread. T., in an agony of disappointed love, sinks back and expires. When the queen of Cornwall lands, and hears of his death, she rushes to the castle, throws herself on his corpse, and dies beside him. King Mark subsequently learns the story of the love-potion, and buries the twain in one grave, planting over Ysolt a rose-bush, and over T. a vine, which grew up so inextricably intertwined that no man could ever separate them.

The popularity of the story in the middle ages was unbounded. The scene of the principal exploits, and the residence of the principal personages is Cornwall, from which one is disposed to claim a British or Welsh paternity both for the legend and the literature; and this is the view that underlies Sir Walter Scott's argument in behalf of the purity of the metrical version of *Sir Tristram* which he published (ed. 1806) from the Auchinleck MS., and which is considered to be the composition of Thomas the Rhymer (q. v.). As early as the middle of the 12th c., however, the legend had become a favorite throughout the whole of France; and it subsequently found its way into Spanish, Italian, German, Scandinavian, Slavic, and Greek literature. *Tristan und Isolde* is the subject of one of Wagner's operas. See Michel's *Tristan* (1835), and Bossat's (1865).

TRI'TICUM. See WHEAT and COUCH GRASS.

TRI'TON, in Greek Mythology, a son of Poseidon and Amphitrite, who dwells with his parents in a golden palace at the bottom of the sea. He usually figures as an attendant on his father, riding over the Mediterranean on a horse or other sea-monster, and soothing the turbulent waves by blowing his shell-trumpet—

Triton.

his 'wreathed horn,' as Wordsworth calls it. The later poets speak of Tritons, in the plural, as a race of subordinate sea-deities, who are described by Pausanias as having sea-green hair and eyes, gills below the ears, human noses, broad mouths with the teeth of animals, scales on their bodies, and instead of feet, a tail like that of a dolphin. They were frequently represented in works of art.

TRI'UMPH (Lat. *triumphus*) was the name given in ancient Rome to the public honor bestowed on a general who had been successful in war. It consisted in a solemn procession along the *Via Sacra* up to the Capitol, where sacrifice was offered to Jupiter. The victor sat in a chariot, drawn by four horses—his captives marching before, his troops following behind. Certain conditions had to be fulfilled before a triumph could be enjoyed, and it was the business of the senate to see that these were enforced. Under the Empire, generals serving abroad were considered to be the Emperor's lieutenants, and therefore, however successful in their wars, they had no claim to a triumph. They received instead *triumphal decorations* and other rewards.

The appearance that Rome presented on the occasion of a triumph, especially in later times, was joyous in the extreme. All work was suspended; the temples were thrown open, and decorated with flowers; the populace were clad in holiday attire, and crowded the steps of all the public buildings in the *Via Sacra*, and the forum, or mounted the scaffoldings erected for the purpose of viewing the procession; banquets were spread before every door. As for the *imperator* himself, after having pronounced a eulogy on the bravery of his soldiers, he ascended his triumphal car, entered the city by the *porta triumphalis*, where he was met by the senate, and now the procession began.

First marched the senate, headed by the magistrates; next came a body of trumpeters; then a train of carriages and frames laden

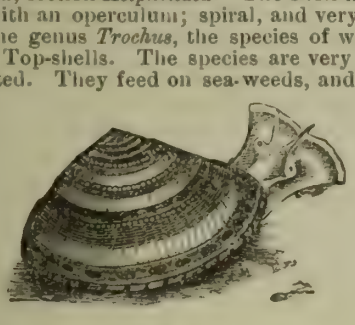
with the spoils of the vanquished; then a body of flute-players, followed by the oxen doomed to be sacrificed, and the sacrificing priests, &c.; then the distinguished captives with bands of inferior prisoners in chains; after whom walked the lictors of the imperator, having the fasces wreathed with laurel. Next came the hero of the day—the imperator, in a circular chariot, attired in an embroidered robe (*toga picta*) and flowered tunic (*tunica palmata*), bearing in his right hand a laurel bough, in his left, a sceptre, and having his brows garlanded with Delphic laurel. He was accompanied by his children and his intimate friends. His grown-up sons, the legates, tribunes, and equites, rode behind; and the rear was brought up by the rest of the soldiery, singing or jesting at their pleasure, for it was a day of carnival and license. When the procession had reached the Capitoline, some of the captive chiefs were taken aside, and put to death; the oxen were then sacrificed, and the laurel wreath placed in the lap of Jupiter. In the evening, the imperator was publicly feasted, and it was even customary to provide him a site for a house at the public expense.

The *ovation*, or lesser triumph, differed from the greater chiefly in these respects: that the imperator entered the city on foot, clad in the simple *toga prætexta* of a magistrate; that he bore no sceptre, was not preceded by the senate and a flourish of trumpets, nor followed by his victorious troops, but only by the equites and the populace, and that the ceremonies were concluded by the sacrifice of a sheep instead of a bull, whence, doubtless, the name *ovation* (from *ovis*, a sheep). The ovation, it is scarcely necessary to add, was granted when the success, though considerable, did not fulfil the conditions specified for a triumph.

TRIU'MVIRATE (Lat. a union composed of *three* men) is the name given in Roman history to the private league entered into between Pompey, Crassus, and Cæsar—the three most powerful men of their time; the object of which was to carry out their own schemes of political aggrandisement, in spite of the opposition of the senate. This compact was not a triumvirate, in the proper sense of the term: it had no legally constituted existence: it was, in fact, only a treasonable conspiracy of three men against the legitimate authority of the state. The term is less incorrectly applied to the division of government between Octavian (Augustus), Mark Antony, and Lepidus in the civil wars that followed the murder of Cæsar—an arrangement sanctioned, and therefore legalized by the senate. The former is usually called the *first*, the latter, the *second* triumvirate.

TRI'VIUM (Three Roads), the name given to the lower section of the Seven Liberal Arts (see ARTS), constituting the circle of study in the middle ages. It embraced Grammar, Logic, and Rhetoric.

TRO'CHIDÆ, a family of gasteropodous molluscs, of the order *Pectinibranchiata*, section *Asiphonata*. The shell has the aperture entire, closed with an operculum; spiral, and very generally top-shaped, as in the genus *Trochus*, the species of which are popularly known as Top-shells. The species are very numerous, and widely distributed. They feed on sea-weeds, and some of them



Trochus.

are found on rocks between high and low water mark. Many of them are very beautiful, and some of the small kinds are often employed to adorn headdresses, and for other ornamental purposes, the epidermis and outer layer being removed. Several species are frequent on the British shores. Some of the tropical ones attain a comparatively large size. The T. are very closely allied to *Turbinidæ*.

TRO'CHILUS AND TROCHI'LIDÆ. See HUMMING-BIRD.

TRO'GLODYTES (Gr. *Troglodytai*—Gr. *trogle*, a hole, and *dyo*, to get into; hence cave-dweller), the name given by the ancient Greeks to various tribes or races of uncivilized men, who dwelt either in natural caverns, or in holes which they had dug for themselves in the earth. They are mentioned by Strabo as existing as far west as Mauretania, and as far east as the Caucasus; but perhaps the best known T. of ancient times were those of Southern Egypt and Æthiopia, where a considerable district of country was called *Regio Troglodytica*. They could not speak articulately, but shrieked or screamed like the lower animals; though it ought always to be remembered that the Greeks, from whom we have such statements, are not very trustworthy authorities in the matter of language, accounting every dialect which they did not understand, a barbarous jargon.

The chief occupation of the T. was herding cattle, though we also read that they were hunters and robbers. They are likewise mentioned as serving among the light troops in the army of Xerxes. Their habits of life were rude and debased; they are reported to have eaten not only the flesh, but the bones and hides of their cattle; their drink is said to have been a mixture of milk and blood; and they had a community of wives. The wives tattooed their bodies; and the men, if not clothed in cattle-skins, went about *in puris naturalibus*. But the most revolting and unnatural of their practices was their treatment of the dead. They are reported to have bound the corpse neck and heels together, affixed it to a stake, pelted it with stones, amid shouts of laughter; and after they had buried it beneath a cairn of missiles, to have placed a horn on the top, and gone away!

What measure of truth there may be in such stories, it is now impossible to say; but archæological investigations into the prehistorical life of our own and other countries, have led to the conclusion, that a race of cave-inhabiters preceded in most countries the races that lived in houses built on the surface of the earth; and perhaps we shall not be far wrong if we regard Troglodytism as the primitive state of all, or the greater part, of mankind.

TROGO'NIDÆ, a family of birds, ranked by some naturalists, on account of their habits, in the order *Insessores*, and tribe *Fis-*

Resplendent Trogon (*Colurus resplendens*).

sirostres; but more generally, on account of the formation of the feet—two toes before, and two behind—placed in the order *Scansores*. The T. are remarkable for the beauty of their plumage, which is soft, full, and brightly colored. The bill is short, strong, with a wide gape; the tail generally long, in some species very long; the feet small, and in many, feathered almost to the toes. All the T. are tropical; they belong chiefly to the south-eastern parts of Asia, the Indian Archipelago, and South America. They abound most of all in South America. They inhabit forests, where they sit motionless on branches, waiting for insect prey, darting upon insects as they fly past. They make their nests in the hollows of decayed trees. Their flesh is highly esteemed for its delicacy and flavor. They are all of small size. In brilliancy of plumage, some of them are excelled by no birds except humming-birds.

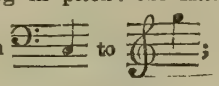
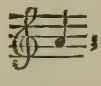
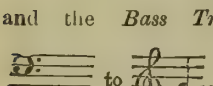
TROIZK, a town of Eastern Russia, on the border of Siberia, in the government of Orenburg, stands on the Oug, 420 miles south-west of Tobolsk. It is the seat of considerable commerce, especially during the summer months, at which season a large trade is carried on with the Kirghis and the Bokharians, who arrive in caravans from Central Asia. Pop. (1880) 8298.

TROLLOPE, MRS. FRANCES, a novelist and miscellaneous writer of some eminence, was born in the year 1780. Her father was an English clergyman. In 1809, she was married to Mr. Anthony Trollope, a barrister-at-law. In 1829, she went to America; and during a three years' residence in the United States, amassed the materials of her first book, *Domestic Life of the Americans*, published in 1832. This work attracted great attention; and the severity of certain of its strictures was much resented by our sensitive cousins over the water. From this time forward, the literary activity of Mrs. T. was nearly uninterrupted, and her name became one of the more notable of the time. Novels of Society and Impressions of Travel make up the sum of her works. Of her novels, the most successful is, perhaps, *The Widow Barnaby*

(3 vols., 1839); with its sequel, *The Widow Married* (3 vols., 1840); followed by *The Barnabys in America, or Adventures of the Widow Married.* Mrs. T. was a woman of strong talent, and her works are full of shrewd observation, and true, if at times somewhat coarse, humor. They were popular in their day, and very well deserved their popularity; but already they are well nigh forgotten. No list of them in detail seems needed. During the life of her husband, Mrs. T. resided chiefly at Harrow. During her later years, much of her time was passed in Italy, where her eldest son, Thomas Adolphus, had taken up his abode. She died at Florence, 6th October 1863.

TROLLOPE, ANTHONY, second son of Mrs. Frances Trollope, and one of the most popular novelists of the day, was born 24th April 1815. He was educated at Winchester, and subsequently Harrow. While filling a responsible official situation in the Post-office, he found, or made, leisure to amuse the public with a long series of novels, of very remarkable merit. The first work which decisively drew attention, *The Warden*, was followed by a continuation, *Barchester Towers*, which remains, perhaps, the cleverest of all his books. In rapid succession to these, came *Doctor Thorne*, *The Bertrams*, *The Three Clerks*, *Castle Richmond*, *Framley Parsonage* (originally published in the *Cornhill Magazine*), *The Kellys and the O'Kellys*, *Orley Farm*, *The Small House at Allington* (contributed to the *Cornhill Magazine*), *Rachael Ray*, *Miss Mackenzie*, *Can You Forgive Her?* *Ralph the Heir*, *The Golden Lion of Granpere*, *Ayala's Angel* (1881). Besides these, Mr. T. has published volumes on *The West Indies and the Spanish Main*, on *North America*, on *Australia*, and on *South Africa* (1878), a Life of *Cicero* (1881), and sketches of *Thackeray* (1879) and *Palmerston* (1882). T., who died 6th December 1882, is one of the most popular of modern novelists. He sketches the superficial aspects of society with a charming lightness and facility of touch, and is unfailingly agreeable and amusing.

His elder brother, THOMAS ADOLPHUS, has lived for many years at Florence, and is favorably known to the public by his *Girlhood of Catherine de Medici*, *A Decade of Italian Women*, and a number of novels such as *La Beata; Marietta*; *Lindisfarn Chase; Gemma; The Garstangs; The Dream Numbers.* He has also written a *History of Florence*, and in 1877 the *Life of Pius IX.*

TRO'MBONE (Ital. great trumpet), a large deep-toned brass instrument, of the trumpet species, but consisting of two separate parts, so constructed that the two ends of one fit into those of the other, and consequently, by sliding the one part in or out, the tube through which the air passes may be shortened or lengthened, and the pitch changed at pleasure. Three kinds of trombone are in general use, differing in pitch: the *Alto Trombone*, with a compass extending from  to ; the *Tenor Trombone*, with a compass from to  ; and the *Bass Trombone*, whose compass extends from  to . The music for these instruments is written on the alto, tenor, and bass clefs respectively. There is also a *double-bass* trombone, which is but rarely used. The trombone, if judiciously employed, is a very effective instrument in an orchestra—the tone is grander and more powerful than that of the trumpet.

TROMP, MARTIN HARPERTZOON, a celebrated Dutch admiral, was born at the Briel in 1597. When a boy, he went to sea with his father, a commander in the Dutch navy. In an engagement off the coast of Guinea with an English cruiser, his father was killed, and young T. made prisoner. His captors compelled him to serve as a cabin-boy for two years and a half, after which his history becomes for some time obscure. In 1622 we find him a lieutenant on board a Dutch ship-of-the-line; and two years afterwards, Prince Maurice gave him command of a frigate. In 1629 the famous admiral Peter Hein took command of T.'s ship, and was killed by his side. Disgusted by some real or imaginary slight, T. about this time retired from the service. In 1637, he returned, and was created Lieutenant-admiral, by the Stadtholder, Frederick Henry. He was appointed to the command of a squadron of eleven ships. He now prosecuted a vigorous naval war against the Spaniards, taking in one celebrated action, fought on October 21, 1639, 13 richly laden galleons. But the events which were to render the name of T. immortal did not occur until the commencement of hostilities between England and Holland in 1652. On May 19 of that year, he encountered the English fleet under Admiral Blake. The Dutch were defeated with the loss of two ships of war. T. was for a while superseded in command by Ruyter and De Witt, but he was soon afterwards reinstated.

On November 29, same year, he again encountered Blake in the Strait of Dover. This time, success was decidedly with the Dutch. The English fleet was obliged to retire; and T. sailed up the Channel with a broom at his masthead, to denote that he had swept his foes from the seas. They were, however, not long in returning. On the 18th of February 1653, Monk and Deane having been united in command with Blake, they attacked T. near Portland, and defeated him, though only after a contest memorable for its obstinacy. It lasted three days, at the close of which Blake had taken or destroyed 11 ships of war and 30 merchantmen, killed 2000 of the enemy, and captured 1500. On June 2 and 3 following, another terrific battle took place off North Foreland, in which six Dutch vessels were captured, 11 sunk, and the remainder driven into Calais roads. On July 31, the warfare was again renewed off the coast of Holland. On this occasion, the Dutch lost 30 men-of-war, and Admiral T. was killed.

T. was a thorough seaman, homely in manner, benevolent in disposition, and enthusiastic in his calling. He was buried at Delft with great pomp and solemnity.

TRO'MSÖE, a small island on the north-west coast of Norway, in Finmark, lies between the island Kvalö and the mainland. It is four miles long, and about a mile and a half broad. On the eastern side of the island is the small but thriving town of the same name, the seat of a bishop. Russian vessels from Archangel and the White Sea visit this town, and bring corn, which they exchange for dried fish. Pop. about 3000.

TRON or TRONE weight, the most ancient system of weight used in Scotland, is so called from *trone*, a species of heavy beam or balance set up in the market-place, and employed for the weighing of heavy wares. The weights employed in the public markets formed the most convenient reference, and consequently tron weight became the standard. The tron lb. contained 20 oz., but from the custom of giving 'one in' to the score, was always reckoned at 21 oz.; this was the most general value; but it varied in the different market-towns between this and 28 oz. The later tron stone or standard weight contains 16 tron lbs., each lb. 16 tron oz., and each tron oz. 16 drops; the tron lb. is estimated to be equivalent to 1·3747 lbs. avoirdupois.

TROON, an important seaport in the county of Ayr, Scotland, 8 miles south-west of Kilmarnock, and 6 north of Ayr. The greater part of the town (which is not older than the present century) occupies a bare and level promontory; but along the broad and beautiful strand of Ayr Bay, known as the 'South Beach,' stretches, for nearly half a mile, a row of handsome villas and cottages, built chiefly for the accommodation of summer visitors. The place is yearly becoming more attractive as a sea-coast residence, partly on account of its extreme salubrity, and partly on account of the ample scope afforded by its wide stretch of sands for the simple amusements of the sea-shore. The harbor, which occupies the extremity of the promontory, is secure and spacious, and is much frequented. The principal exports are coal and iron, of which Ayrshire yields an abundant supply. Pop. (1881) 2383.

TROOP, in Cavalry, the unit of formation, forming the command of a captain, consisting usually of 60 troopers, and corresponding to a company of infantry. The officers of a British troop are the captain and two lieutenants. Two troops form a squadron. The trooper's pay is 1*s.* 5*d.* a day.

TROO'PIAL (*Molothrus*), a genus of birds of the family *Sturnidæ* (see STARLING), having a short, thick, conical bill; long, pointed wings; and a slightly rounded tail. The Cow T. (*M. pecoris*), also called Cow Blackbird, Cow-pen Bird, &c., is common in North America, passing the winter in the southern parts of the continent, and migrating northwards in spring. Its plumage is of a shining black color except the head and neck, which are black-

Troopial (*Molothrus pecoris*).

ish brown. It is very generally to be seen in attendance on cattle, picking up the insects which they disturb, or which are attracted by their droppings. Like the cuckoo, it makes no nest of its own, but deposits its eggs in the nests of other birds.

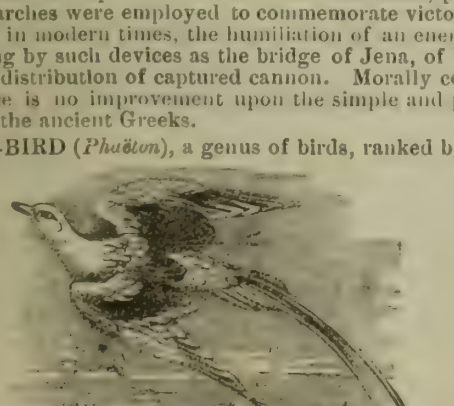
TROPÆ'OLUM, a genus of plants of the natural order *Tropæolaceæ*. This order is allied to *Balsaminaceæ* and *Geraniaceæ*. The species are not numerous, and are all natives of South America. They are smooth herbaceous plants, somewhat succulent, with an acrid or pungent taste, trailing or twining stems, and alternate simple or divided leaves, destitute of stipules. The species of the genus T. form the greatest part of the order, and have usually simple peltate leaves. *T. majus* is the well-known INDIAN CRESS of our gardens, the unripe fruit of which is often used to give pungency to pickles, under the name of *Nasturtium*. It is a native of Peru, and has long been much cultivated in Britain as an ornamental plant, climbing amongst bushes or on trellises, and taking hold by the curving stalks of its leaves; its stems from six to ten feet long, its foliage abundant, and its flowers large, orange, or dark red. The young leaves are used in salads. The Indian cress is really a perennial, although it flowers within a few months from the time of sowing, and in Britain is always treated as an annual, not being able to endure the winter. *T. minus* is very similar, but of weaker growth, and its flowers smaller. *T. peregrinum*, although much more recently introduced into Britain than the Indian cress, has now become almost equally common, and is a great favorite in flower-gardens. It is popularly called the CANARY PLANT. Its stems are long and slender, and it speedily covers a high trellis. Several other species are frequent and fine ornaments of gardens and greenhouses. The tubers of *T. tuberosum* are eaten in Peru. Their taste is peculiar.

TROPE (Gr. *tropos*, a 'change,' a 'turning') is the name of a figure of speech which does not appear to differ from Metaphor (q. v.)

TROPHO'NIUS, in Greek legend, was the most skilful architect of his day, and was the son of Erginus, king of Orchomenus, or of Apollo. Along with his brother Agamedes, he built the temple of Delphi and the treasury of King Hyrieus in Bœotia, which the two are said afterwards to have plundered. After his death, he was worshiped as a hero, and had a celebrated oracle at Lebadeia (Livadia) in Bœotia. 'The entrance to the oracle was a very narrow aperture on the summit of a mountain, protected by a marble parapet about two cubits in height, and by brazen spikes above it.' The votary who wished to enter the 'Cave of Trophonius,' in order to consult the oracle, after preparing himself for several days previously by purification and sacrifice, lay prone on his back, and put his feet into the cave, when he was caught by some unseen force, and violently pulled inside.

TRO'PHY (Lat. *tropæum*, Gr. *tropaion*, from *trepo*, to put to flight—the latter *h* in the English word being an intrusive letter) was a memorial of victory erected on the spot where the enemy had turned to flight. Among the Greeks (with the exception of the Macedonians, who erected no trophies), one or two shields and helmets of the routed enemy, placed upon the trunk of a tree, served as the sign and memorial of victory. After a sea-fight the trophy consisted of the beaks and stern-ornaments of the captured vessels, set up on the nearest coast. It was considered wrong to destroy such a trophy, and equally wrong to repair it, when it had fallen down through time, for animosity ought not to be perpetual. In early times, the Romans never erected trophies on the field, but decorated the buildings at Rome with the spoils of the vanquished. Of this practice, we have a familiar instance in the *rostra* or beaks set up in the forum. In later times, pillars and triumphal arches were employed to commemorate victories. Besides these, in modern times, the humiliation of an enemy is rendered lasting by such devices as the bridge of Jena, of Waterloo, and by the distribution of captured cannon. Morally considered, this practice is no improvement upon the simple and perishable trophies of the ancient Greeks.

TROPIC-BIRD (*Phaëton*), a genus of birds, ranked by some in



Tropic-bird (*Phaëton æthereus*).

the family *Pelecanidæ*, by others in *Laridæ*. The bill is strong, pointed, and almost arched; the head completely feathered; the wings long; the tail short, except two feathers, which are very long and slender. Only two species are known, both tropical, and often seen very far from land. The COMMON TROPIC-BIRD (*P. æthereus*) is about the size of a partridge, white, with curved lines of black on the back; some of the quill-feathers black, tipped with white. It is found in the Atlantic Ocean; whilst in the Indian and Pacific Oceans, the other species (*P. phœnicurus*) appears, which is of a pale rose color, with black wing coverts, and the long feathers of the tail red. The tropic-birds breed on high cliffs.

TRO'PICS (Gr. turning-points or limits) are two parallels of latitude on the terrestrial globe, passing through the most northerly and southerly points on the earth's surface at which the sun is vertical. On the Armillary Sphere (q. v.), consequently, the ecliptic (the representation of the sun's path) touches but does not cross the tropics. The tropics include between them all those points on the earth's surface at which the sun is ever vertical. The tropic north of the equator is called the Tropic of Cancer, because the sun at the summer solstice (at which time he is vertically over that tropic) enters the constellation of Cancer; and the southern one is, for a similar reason, denominated the Tropic of Capricorn. The tropics are not absolutely fixed at a uniform distance from the equator, but the limits of their variation are extremely narrow. For 1st Jan. 1882, the *Nautical Almanac* gives their position in 23° 27′ 16″·60 N. and S. respectively.

TRO'PPAU, the capital of Austrian Silesia, on a tributary of the Oder, is a well-built town, 184 miles north-east of Vienna by railway. It is the seat of the provincial government, and has a castle, cathedral, several palatial buildings, churches, and public schools, a library of 32,000 volumes, a museum of Silesian antiquities, important manufactures of machinery, cottons, linens, and beet-root sugar, and an active transit trade. Pop. (1880) 20,562. A diplomatic congress was held here in October and November 1820, which was subsequently removed to Laibach (q. v.).

TROU'BADOUR (Provençal, *trobar;* Fr. *trouver*, to find, of unknown derivation). In Provençal poetry (see TROUVERE), a troubadour was a polished and cultivated poet—what the Germans call a *Kunstdichter* (art-poet)—who did not make a trade of his muse, in opposition to the musician and jongleur, who wandered about the country singing for money. Yet this distinction only gradually showed itself. At first, all classes of the community were nearly equally rude, and what pleased the peasant in the shape of song, pleased the prince also; but by degrees, a superior refinement and sensibility manifested themselves in the tastes and manners of courts, and this superiority found poetical expression in a more artistic kind of verse than had hitherto prevailed.

Great nobles, princes, and kings who practised verse-making for their pleasure, or out of chivalrous gallantry, were always called troubadours; while inferior knights, court-attendants (M. Lat. *ministeriales;* hence *menestrels*, minstrels), and even citizens and serfs who lived by their art, or at least took money for the exercise of it, were sometimes called troubadours, and sometimes jongleurs. Under this last name were classed the musicians, singers, jugglers (a word, in fact, which is only a corruption of *jongleur*), &c.; all, in short, who did not themselves make or invent (*trobar*) poems, but only recited or chanted them, or whose business it was to accompany the singer on some musical instrument. The more celebrated troubadours had one or several such jongleurs in their service, as it was considered *infra dig.* for a poet to be his own fiddler. This new troubadour poetry (*art de trobar*), which it may be remarked was *lyrical*, while the popular minstrelsy was mainly of the *epic ballad* sort, exercised a considerable influence on the advancement of literature and culture generally; yet those who practised it never formed themselves into a guild, or into special schools, but preserved a certain free individualism, which gives a fine picturesqueness to the outlines of their history.

At all the courts (great and small) in Southern France, Northern Spain and Italy, they were esteemed a brilliant ornament of society; princes and fair dames (often themselves troubadours, as has been remarked) were proud of their praise, and their service of gallantry, or dreaded the biting raillery of their satiric muse; while, on the other hand, the majority of the troubadours gladly attached themselves to the court of a great prince or noble, sometimes praising their master in *sirventes* (service-songs), sometimes censuring him, but at any rate, always selecting some lady as the 'mistress of their heart,' to whom they, under a general or allegorical name, addressed their love-songs (*cansos*), whose cruelty they bewailed in songs of lamentation (*planes*), or whose death they mourned in sorrowful threnodies. Although the 'love-service' of the troubadours was often nothing more than an artificial gallantry, having more *esprit* than heart in it, yet not unfrequently the sport passed into fatal earnest, and adultery, murder, and revenge were the consequences.

Further, when, as often happened at great court-festivals, several troubadours were present, the latter used to indulge in competitions or verse-battles (*tensons*) among themselves, for the gratifica-

tion of the high society assembled there; mostly on questions selected by the ladies from the 'Laws of Love;' one or more of these ladies sitting as umpires at such poetic jousts, and deciding who were the victors. But although the troubadours as a rule monotonously confined themselves to themes of gallantry, yet sometimes their muse, especially in its satiric moods, ventured into higher regions, and glanced at the general conditions of society, or the graver evils of the times—as the wars between the English and French armies in Southern France; the persecution of the Albigenses; the degeneracy of the clergy; the diminishing zeal for the Crusades &c.; or they even descended to depict the life of the peasantry, and sang their adventures with shepherdesses, &c. in *pastoretas* and *vaqueyras*.

The most illustrious patrons of the troubadour poetry were the counts of Provence, particularly Raimund Berengar III. (1167—1181), Alphonse II. (1196—1209), and Raimund Berengar IV. (1209—1245); the counts of Toulouse, as Raimund de St. Gilles, who joined the ranks of the crusaders in 1096, Raimund V. (1148—1194), and Raimund VII. (1222—1249); Richard *Cœur de Lion* of England, himself a troubadour; Eleanor, wife, first of Louis VII. of France, and afterwards of Henry II. of England; Ermengarde, Viscountess of Narbonne; the kings of Aragon, as Alfonso II. (1162—1196), Pedro II. (1196—1213), and Pedro III. (1276—1285); the kings of Castile, as Alfonso IX. (1188—1229), and more especially Alfonso X. (q. v.), surnamed the Wise; several Italian princes, as Bonifacio, Count of Montferrat, and after 1204 king of Thessalonica, and Azzo VII. of Este (1215—1263). These names also indicate the extent of territory on which the troubadour poetry was cultivated—viz., Provence, Toulouse, Poitou, Dauphiné, or briefly France south of the Loire; Catalonia, Valencia, and Aragon in Spain; and part of Upper Italy. It lasted for about 200 years (1090—1290), and one can distinguish three periods in its history: (1) The period of its genesis or birth, or its development out of mere popular minstrelsy into artistic poetry (1090—1140); (2) its golden age (1140—1250); (3) the period of its decline (1250—1290). The first of these periods is marked by a conscious striving after something finer and more poetic than the rude simplicity of the earlier verse; the second, by the loftiest expression of ideal chivalry and gallantry, and the most perfect development of artistic form; the third, by an ever-increasing serio-didactic tendency, and a degeneracy in poetic art. Thus the poetry of the troubadours rose, and ruled, and fell with that courtly chivalry which was at once its inspiration and its soul.

The long list of troubadours begins with GUILLEM IX. Count of Poitiers (1087—1127), the earliest of whom we have any knowledge, and whose verses exhibit partly the popular ballad style, and partly a more elaborate mode of poetic conception. His life and works appear to have been equally immoral.—After him comes BERNARD DE VENTADOUR (1140—1195), one of the first poets of the golden age of troubadour-minstrelsy. He was the son of a poor serf of the Vicomte Ebles II. of Ventadour. Recognizing the talent of young Bernard, his master encouraged and assisted him; but his poetic enthusiasm was more excited by his passion for Ebles's wife, Agnes de Montluçon, than by Ebles's own commendations, and by the favor shown him by later patronesses, Queen Eleanor, Joanna of Este, &c., all of whom he celebrated in fiery and delicate strains.—MARCABRUN (1140—1185), a foundling, was much feared for his power of satire, and was, in fact, murdered by the Castellan of Guian for an exercise of his fatal gift. He is reckoned the inventor of the art-song (*Cansós*).—JAUFRE RUDEL, Prince of Blaya (1140—1170), is equally famous for his languishing love-songs, and his romantic passion for the Countess of Tripoli, whom he never saw till he was at the point of death.—PEIRE D'AUVERGNE (1152—1215), son of a citizen of Clermont, called himself 'Master of the Troubadours;' yet his songs are more remarkable for their artistic finish than for their poetic inspiration.—GUILLEM DE CABESTAING (1181—1196), son of a poor knight, has become famous through his tragic love for the wife of his lord, Raimon de Roussillon.—RICHARD THE LION-HEART'S song composed during his captivity in Austria, is widely known; and the songs of GUIRANT DE BORNEIL (1175—1220) have a manly and earnest ring about them; but perhaps the most celebrated of the whole fraternity was PEIRE VIDAL (1175—1215), a man wondrously endowed with poetic gifts, but who led so mad, wasteful, immoral a life, and committed such extravagant follies, that one doubts whether he was altogether sane. He was the terror of husbands.—BERTRAND DE BORN (1180—1195), equally celebrated as warrior and poet, played an important part in the wars of Henry II. of England with his rebellious sons, and was a zealous French patriot. His songs are for the most part of a political cast, full of martial ardor and the love of fatherland. In his lifetime, men dreaded his sharp tongue no less than his keen sword.—FOLQUET DE MARSEILLE (1180—1231) was the son of a Genoese merchant established at Marseille. After wasting his youth in amorous gaieties, in a fit of grief for the death of one of his many mistresses, he entered the church, rose to the dignity of Bishop of Toulouse, and signalized himself by the fanatical zeal with which he persecuted the Albigenses. Folquet's songs, 25 in number, are of an impassioned nature.—RAMBAUT DE VAQUEIRAS (1180—1207), a native of the county of Orange, in the south of France, was the son of a knight, and so great a favorite with Bonifacio II., Marquis of Montferrat, that the latter positively tolerated his sister's intimacy with the poet. He accompanied his patron to the East, and probably fell with him fighting against the Bulgarians. Some of his songs have found their way into different Romanic tongues.—PEIROT (1180—1225), in his condition and fortunes, curiously resembled his contemporary just mentioned. His pieces rank among the finest love-songs of the troubadours.—The MONK OF MONTAUDON (1180—1200) is a poet whose proper name is not known. He was sprung from a noble family belonging to Auverge, and became Prior of Montaudon, but, notwithstanding, led the free life of a wandering poet. Finally, he betook himself to the court of Aragon; Alfonso II. made him Prior of Villafranca, where he died. He was more renowned for his satire than for his sentiment, and his songs are full of personalities directed against his brother troubadours—very cynical and very caustic.—ARNAULT DANIEL (1180—1200), a nobleman of Riberac, in Périgord, whom love made a troubadour. His powers of invention have been highly praised. Petrarch calls him *il grande maestro d'Amore*. Dante also celebrates his genius.—GAUCELM FAIDIT (1190—1240), son of a burgher of Uzerche, in Limousin, led at first, with his wife Guillelma Monja, the free and pleasant life of a jongleur; but subsequently left her, and became enamoured of the Countess Marie of Ventadour, who made him her troubadour. He would fain have been her paramour also, but she was too prudent; and so, to revenge himself, he carried on intrigues with other women; but his sweetest songs were those he sang in his lady's praise.—RAIMON DE MIRAVOL (1190—1220), one of the most lovable of the troubadours, although the women—his spouse not excepted, who was herself a poetess—abused him so bitterly, that for two years he was out of his mind.—SAVARIE DE MAULEON (1200—1230), a French baron, became Grand Seneschal of Aquitania, and took part with Raimund of Toulouse against Simon de Montfort. His political career was marked by great vacillation. As a poet, he is noted for his *Tenzone*.—PEIRE CARDINAL (1210—1230), son of a night, was intended for the church, but preferred the life of a troubadour, and traveled with his jongleur from court to court. Jago I. of Aragon was his great patron. He was a master of the moralistic *Sirventes*, and assailed—but only with a sort of generalized satire—the nobles and clergy.—The last representative of the troubadours was GUIRAUT RIQUIER (1250—1294), a native of Narbonne. Although he had in his time many patrons, of whom the most distinguished was Alfonso X. of Castile, he was often in sore need; and his poems, full of complaints of the disrepute into which his order had fallen, may be regarded as the swan-song of troubadour poetry.—See Diez, *Leben und Werke der Troubadours* (Zwickau, 1829); Fauriel, *Histoire de la Littérature Provençale* (3 vols., Par. 1846); Galvani, *Osservazioni sulla Poesia de' Trovadori* (Modena, 1829), and *Fiore di Storia letteraria e cavalleresca della Occitania* (Milan, 1845); De Laveleye, *Histoire de la Langue et de la Littérature Provençale* (Brüss. 1845); Mahn, *Die Werke der Troubadours* (Berl. 1846); and *Die Biographien der Troubadours* (Berl. 1853); Brinckmeier, *Blumenlese aus den Werken der Troubadours* (Halle, 1849), and *Rügelieder der Troubadours* (Halle, 1846), Kannegiesser, *Gedichte der Troubadours* (Tüb. 1852), and *Ungedruckte Provenzal. Lieder* (1853); Bartsch, *Grundries zur Geschichte der Provenzalischen Literatur* (1872); Bayle, *La Poesie Provençale au Moyen Age* (1876).

TROUS-DE-LOUP, or WOLF-HOLES, are hidden holes about 6 feet deep, and 4½ in diameter at the top. They are funnel-shaped, and have one or more pointed stakes at the bottom. They are placed often thickly about the glacis and approaches to a fortress; the object being to break the ranks and otherwise disorganize an attacking force.

TROUT (Fr. *truite*, from M. Lat. *tructa*, which, according to Diez, may be from Gr. *troktes*, the name of a voracious sea-fish, derived from *trogo*, to eat), the popular name of many species of the genus *Salmo*, as characterized by Cuvier, some of which are referred by Valenciennes to his restricted genus *Salmo*, some to *Fario*, and some to *Salar*. See SALMON. The name is given to some of the silvery species migrating to the sea, and to all the yellow species, which constantly inhabit fresh waters. The former are noticed in the article SALMON, the present article is devoted to the latter.

Trouts are found in almost all the lakes and rivers of the temperate and colder parts of the northern hemisphere. The COMMON T. (*Salmo fario* or *Salar Ausonii*) is widely diffused in the eastern hemisphere, abounding in almost all the lakes and rivers of the British Islands and the north of Europe. It is found even in very small streams, and almost to their mountain sources, but attains its largest size where there is considerable depth of water and abundance of food. An instance is on record of a T.,

caught in England, in a branch of the Avon at Salisbury, weighing 25 lbs.; but such a size is very rare, and even in ponds where the T. are regularly fed, they seldom exceed 10 lb. A trout of 1 lb or 1½ lb. is reckoned by the angler a very fine fish; and many a stream swarming with T. produces none nearly so large. The head of the Common T. is large; the eye large; the general form symmetrical, stouter than that of the salmon, the convexity of

Common River Trout (*Salmo fario*).

the outline of the back nearly similar to that of the belly; the tail is slightly forked, except in old fish, in which it becomes almost square, and sometimes even slightly convex.

The teeth are numerous, strong, and curved; two rows of them extending along the whole length of the *vomer*, with no marked group at its front. The color is more or less yellow, but the tint varies much in the T. of different waters, sometimes passing into greenish black or violet. The color is brightest in the T. of clear streams. On the back and upper part of the sides there are numerous spots of black and red; the belly is silvery white. The spots on the sides vary much. The fins are light brown; the dorsal fin and tail with numerous darker brown spots. The varieties which the common T. exhibits in tints and spots, has led to the supposition that several distinct species have perhaps been confounded as one, and attempts have been made to point out their characters; but these have not proved satisfactory to the greater number of naturalists. It is certain that the appearance of the T. is much affected by the character of the water in which it lives, and the food with which it is supplied. The T. of a river with a muddy bottom are very different from those of a clear stream, and those of a stream darkly colored by moss are easily distinguished. The tint of the flesh varies as well as the external colors, being pink in some—the finest for the table—and white in others. It has been found that T. transferred from one locality to another soon change their tints.

The T. is very voracious, and readily devours almost any kind of animal food. Worms and slugs washed into rivers by rains are very acceptable to it. Small crustaceans are supposed to be the chief food of T. in some lakes and streams which are noted for the excellence of their produce. Small fresh-water shell-fish are also a favorite food of trout. Small fish of any kind which they can capture are their prey, and multitudes of salmon-fry thus perish. A gentleman well known to the writer of this article caught a large trout which had a very young viper in its mouth, bitten into three pieces; not yet swallowed, probably, because there was not room for it in the over-gorged stomach. The leaping of T. for flies in a summer day or evening adds to the charm of many a rural scene. Small T. often throw themselves quite out of the water; the larger ones in general merely rise to take struggling flies from its surface. The angler adapts his lures to the season and the weather. In spring and summer, when the weather is fine, the artificial fly is very successful; bait, generally the worm, is used in wet weather, or when the streams are much swollen by rains. The minnow is a good bait for large trout. No bait is more deadly than salmon roe, but the use of it is prohibited by law in Britain, for the sake of the salmon-fisheries.

The T. generally spawns in the end of October, when the lower jaw of the male becomes elongated, but not so much as in the salmon. The spawn is deposited in the same manner as that of the salmon, in gravelly beds, in running streams; and the T. of lakes ascend streams for this purpose. Where T. have no access to proper spawning-ground, recourse must be had to artificial means to increase the stock (see PISCICULTURE); but in many small streams their numbers seem incapable of being diminished by any amount of angling. The best feeding-grounds are often where there is no good spawning-ground within reach of the fish. The T. grows rapidly when it has abundant food. From instances of individuals kept in wells and ponds, it is known to attain an age of 30 or even 50 years.

Among the varieties of the Common T., one called the GILLAROO T. is found in Lough Neagh and other lakes of the north of Ireland. It attains a large size, is very thick in proportion to its length, and has much smaller teeth than the ordinary trout.

The LOCHLEVEN T. (*Salmo Levenensis* or *S. cæcifer*) is found in Loch Leven in Scotland, where the Common T. is also found and is distinguished from it by the more pointed pectoral fins; the much longer rays of the tail-fin, which is also more pointed at its extremities; and particularly by the number of the cæcal append-

Lochleven Trout (*Salmo Levenensis*)

ages, which are from 60 to 80 in the Lochleven T., whilst they do not exceed 46 in the Common Trout. The flesh of the Lochleven T. is not white or pink, but red. It attains a large size.

The GREAT LAKE T. (*Salmo ferox*) is the only other British species. It is found in some of the larger British and Irish lakes, and in the lakes of Scandinavia, seldom, if ever, ascending rivers,

Great Lake Trout (*Salmo ferox*).

except for a short distance at the spawning season. It attains a size of almost 30 lbs., is a very powerful, active fish, and tries the skill of the angler in no small degree. It differs from the Common T. in the longer muzzle, in the position of the fins, in having the tail square in all stages of growth, and in other characters. Its color is generally deep purplish brown, passing into greenish or grayish yellow on the belly. The spots are large, and not numerous. The Great Lake T. feeds much on small fishes, and is as greedy as a pike. It is taken by night-lines, or by trolling with strong tackle and a small trout or other small fish for bait. Young fish are taken with the artificial fly. The flesh of this species is very inferior in quality to that of the Common Trout.—Very different from it is the LAKE T. of the Lake of Geneva (*Salmo* or *Fario Lemanus*), which is a fish of excellent quality, and nearly allied to the Salmon Trout. See SALMON. It ascends the rivers which fall into the lake, as the Salmon T. ascends rivers from the sea.

North America has numerous species of trout. One of them, the COMMON BROOK T., or SPECKLED T. (*Salmo fontinalis*), is so similar to the Common T. of Britain, that it may almost be regarded as a variety rather than as a distinct species. It abounds in the streams of Canada and the more eastern British provinces, and in the northern and middle parts of the United States.—The NORTH AMERICAN LAKE T. (*Salmo confinis*) inhabits the deepest waters of the great lakes, and sometimes attains a weight of more than 60 lbs. It is dark-colored, mottled with grayish spots. Its flesh is dirty yellow, and of very poor quality. It never takes the fly, but may be caught with the minnow, or a bait of fat pork. It is more sluggish than its congeners, and affords poor sport to the angler. There are several species of Lake T. in North America. The finest in quality, as well as largest in size, is the MACKINAW T. or NAMAYCUSH (*Salmo amethystus* or *namaycush*). It is not found in Lake Erie, nor in Lake Ontario, but in Lake Huron, Lake Superior, and the more northern lakes, even in those of the arctic regions. It inhabits the deepest parts of them, except in autumn, when it resorts to shallow water for spawning.—The SISKIWIT T. (*Salmo* or *Salar siscowet*) of Lake Superior is of large size, stout, thick, and of rich flavor, but so fat as to be almost unfit for food.—The RED-BELLIED T. (*Salmo* or *Fario erythrogaster*) of the lakes of New York and Pennsylvania, sometimes 2½ feet in length, is deep greenish on the back, lighter on the sides, which are spotted with red, the belly orange red.

The north-west of America has its own peculiar species of T., one of which, the OREGON T. (*Salmo Oregonensis*), is found in almost every stream from the snowy peaks of the Rocky Mountains to the sea, and is very similar to the Common T. of Europe.

TROUVÈRE, the name given in Northern France to the same kind of courtly or polished poet who, in Southern France, &c., was called Troubadour (q. v.). Like the latter, he was usually attended by a jongleur, whose business it was to furnish an instrumental accompaniment to the songs which his master composed and sung. Sometimes but rarely, the trouvère himself played on a harp. On the other hand, if minstrels and jongleurs were ambitious enough to aspire to original composition—as was

the case, for example, with Adenez le Rois, Raymbert de Paris, &c.—they were nicknamed 'Bastard Trouvères' (*Troveor bastart*), or 'interloping rhymers' (*Contrerimoieurs*). This disdainful feeling of superiority was none the less likely to be strong that the poetry of the trouvères was high in favor at the northern courts, and that even kings and nobles were proud of the 'accomplishment of verse.'

Among these princely and patrician amateurs were Thibaud of Champagne, king of Navarre, Jean de Brienne, Charles d'Anjou, Henri III. of Brabant, Pierre de Dreux, Count of Brittany, &c. The great patrons of the trouvères were the kings of France and England, the Dukes of Brabant, the Counts of Champagne, Flanders, &c.; while by the Anjou dynasty of the kings of Naples, their art was carried into Southern Italy, and by Henry of Burgundy into Portugal. The number of trouvères, in consequence, grew to be considerable; and one can still reckon the names and works of more than 150, of whom perhaps the most celebrated is the Castellan de Coucy.—See De la Rue, *Essais Historiques sur les Bardes, les Jongleurs et les Trouvères Normands et Anglo-Normands* (3 vols., Caen, 1834); Dinaux, *Trouvères, Jongleurs et Menestrels du Nord de la France et du Midi de la Belgique* (3 vols., Par. 1837—1843); Paris, *Le Romancero Français* (Par. 1833); Wackernagel, *Altfranz. Lieder* (1846); Mätzner, *Altfranz. Lieder* (1853); Bartsch, *Altfranz. Romanzen* (1870); Scheler, *Trouvères Belges* (1876).

TRO'VER, in the Law of England, is an action brought to recover goods from a person to whom they do not belong, but who has in some way obtained possession of them. It was founded on the old fiction, that the rightful owner had accidentally lost the goods, and the party in possession had found them, and would not give them up to such owner. It is practically an action to try the title to the goods, and therefore is of extensive application in the law of contracts, as well as other branches of law. The plaintiff, if successful, recovers the value of the goods as a satisfaction. The defendant is said to have illegally converted or appropriated the goods, and it is by the conversion of the goods that the damage is done, and for which the remedy is given.

TROW'BRIDGE, a market-town of Wiltshire, stands on a rocky eminence in the valley of the river Biss, 10 miles south-east of Bath. In the church of St. James, which dates from the 14th c., Crabbe the poet officiated as clergyman from the year 1814 to 1832, and his remains repose under a monument in the chancel. The town has long been the seat of woollen manufactures, and these, within recent years, have been carried on with much spirit and success. Cassimeres, kerseys, tweeds, and woollen cloths of the best qualities are manufactured. Many handsome villas have been erected outside the town by the wealthy manufacturers. Pop. (1871) 11,508; (1881) 11,041.

TROY. The earliest traditions of the Greek people, as contained in their oldest poetry and history, represent the country on both sides of the Ægean as peopled by various races, either of genuine Hellenic, or of closely affiliated tribes. Among those who peopled the eastern or Asiatic coast are specially named the Pelasgi, the Leleges, the Caucones, the Carians, the Lycians, and the Trojans. These last, to whom Homer's poem has given a celebrity that throws all the rest into the shade, occupied the small country in the northwest corner of Asia Minor, best defined, perhaps, as the region of Mount Ida, with its topographical dependencies. That the Trojans were either a Greek race, or some non-Hellenic people under a Greek dynasty, seems probable, from the absence in Homer of any such decided national contrast between Greeks and Trojans, as we find in medieval poetry between Christians and Saracens. Local legends represented them as closely connected with Crete; and Homer in the *Iliad*, xx., makes Priam the sixth in descent from Dardanus, the first of the dynasty, who was supposed to have come from Crete.

The story of the Trojan war, which forms the subject of Homer's great poem the *Iliad*, is extremely simple. The Trojans, in the person of Paris, or Alexander, the son of the reigning monarch, Priam, are represented as having had certain dealings with the Achæans, or Greeks of the Peloponnesus, in the course of which the gay young prince carries off from the palace of Menelaus, king of Sparta, his spouse Helen, the greatest beauty of her age. To revenge this insult, the Greeks banded themselves together, and sailed against Troy with a large fleet. All the Greek tribes afterwards famous in history took part in this expedition; but the most notable were the Argives or Achæans—Greeks of the east and north part of the Peloponnesus, and adjacent isles; the Spartans—Greeks of the south-east district of the Peloponnesus; the Neleids—Greeks of the west coast of the Peloponnesus; the Bœotians, and the Thessalians. Of the Thessalians, the most prominent captain was Achilles; and the general command of the whole expedition was committed to Agamemnon, king of Mycenæ, as the head of the most numerous contingent, and at the same time the brother of the royal person whose hospitality had been so grossly violated. This well-appointed European army is represented as having spent nine years in besieging the god-built walls of the city of Priam without making any impression on its strength.

A violent quarrel between Achilles and Agamemnon, breaking out in the tenth year, so weakened the invading force, that the Trojans, under Hector, pushed the Greeks back to the very verge of the sea, and almost set their ships on fire. This quarrel forms the subject of the *Iliad*. At the critical moment, however, the Thessalian captain is reconciled to the head of the expedition; and with his return to the field, the fortune of war changes; Hector, the champion of Troy, falls, and the impending doom of the city is darkly foreshadowed. The siege and sack of Troy did not fall within the plan of Homer's poem, but are narrated at length in the *Post Homerica*, a Greek poem by Quintus Smyrnæus, a poet of the decadence. The Greeks possessed a long series of popular poems called the Cyclic poems, in which the whole sequence of the Trojan story was narrated, giving completeness to the brilliant fragment, which has been adorned by the genius of Homer. From these poems—of which the abstracts are still preserved—Virgil derived those materials which he has used with such effect in the second and third books of his great poem. The Cyclic poems, besides the events in the Trojan war after the death of Achilles, contained an account of the various colonies in Italy and elsewhere believed to have been founded by the scattered chiefs of the expedition after their return home. Of these, the settlements of Diomede, Philoctetes, and Idomeneus, on the south-east coast of Italy, and that of Æneas on the banks of the Tiber, are the most famous.

The chronology of the Trojan war, depending as it does mainly on artificial construction from genealogical data, is not, of course, trustworthy; but there are good reasons for believing that the generally received date of 1184 B.C. is not far wide of the mark. After the fall of the kingdom of Priam, the future story of Troy is short and uneventful. Under the Lydian kings, whose dynasty culminated in Crœsus, a New Troy—*Ilium Novum*—began to creep into notice, which, from the glory that belonged to its name, and the favor of Alexander the Great, Julius Cæsar, and other influential visitors, grew into some significance. The interest which attached to it, however, in its most flourishing estate was more antiquarian than political.

How far the events of the Trojan war, as found in Homer and the Cyclic poets, are to be taken as historical, depends upon the view which is taken of the general character of the materials of popular ballad poetry in all countries. That there is in the general case an under stratum of historical reality, out of which the earliest popular poetry grows, may be assumed as certain. But how strong the tendency is, in early uncritical ages, to erect on this foundation a purely imaginary superstructure, need scarcely be mentioned. At the same time, there is a very great difference to be observed in the popular poetry of different nations, in respect of the greater or less amount of trustworthy historical matter which lies embedded in the imaginative conglomerate. The excess of the imaginative, fanciful, and altogether improbable element, is found in our own Arthurian and Carlovingian romances. In Homer, on the other hand, there is a sobriety of tone, a geographical clearness, and a general air of veri-similitude, which incline the reader to accept the historical reality of the main facts. In the first chapter of Heredotus, we find the Phœnicians practising the very same act of abduction, though in a more violent form, which the poet represents as having kindled the famous ten years' warfare between Greece and Troy; and even in the most general view, the war of Troy between rivil peoples on the opposite sides of the Ægean, may be looked on as the natural overture of those great struggles, by which, on the same theater afterwards, the fate of the world, indicated by the preponderance of the European over the Asiatic element, was more than once decided.

The PLAIN OF TROY is formed by the débris of the great chain of mountains which terminates the peninsula of Asia Minor on the north-west, where it is separated from Europe by the Sea of Marmora and the narrow strait of the Dardanelles. This chain of mountains is called Ida by Homer (*ide*, wood); and its highest peak towards the south side of the Troad, overhanging the Bay of Adramyttium, is celebrated by the same poet as Gargarus. Westward from this chain, the land slopes gradually down by a series of undulating ridges to the south coast of the Dardanelles. The plain included between these ridges and the sea is the plain of Troy. It is surrounded on all sides by elevated ground, by hills and mountains towards the east and south-east, and by rocky ridges or cliffs along the coast. At one place only does it open to the sea, and this is at the extreme north-west corner, where it meets the south end of the Dardanelles. Here there is a stretch of sandy shore about two miles in length, beginning behind the Turkish fort of Koumkale, and trending eastward. This is the only place where a fleet such as that described in the *Iliad* could effect a permanent landing; and here, accordingly, by general consent, the encampment of the Greeks is placed.

The promontory which bounds this bay to the east is universally acknowledged as the Rhæteau promontory of the ancients, while that on the west is the Sigean. Here, also, as the natural mouth of the plain, the principal river, by whose action mainly it was formed, finds its way into the sea. This river is the Mendereh, obviously a corruption of the Homeric Scamander, called also by the poet Xanthus, from *xanthos*, that is, the *yellow* river, from the color of its waters; a quality which has been noticed by most modern travelers. Looking up the plain from any of the heights about the mouth of the river in a south-easterly direction towards Gargarus, its course can be easily traced to a distance of about nine miles, where it emerges into the plain through a defile in the mountains. This distance of nine miles, therefore, is the extreme length of the plain of Troy. Its breadth is about three miles. It presents the appearance of 'a long tract of meadow-land, enclosed within a girdle of low, round-backed hills, and prettily garnished by many lines of trees, which skirt the water-courses.' These waters, with the single exception of the Scamander, are not large enough, according to our usage, to deserve the name of rivers, but are mere mountain-torrents or brooks, generally dry in summer, some of them nothing better than a sort of natural drains or ditches.

Those deserving of mention are three: the first flowing from the chain of Ida westward into the plain, about three miles from the sea, called the *Dombrek;* the other in the same direction, about five miles further up, called the *Kimair*. The third streamlet rises at the head of the plain, near the Turkish village of Bunarbashi, and creeping along the bottom of the slope towards the Archipelago, forms the boundary of the plain on the west, and empties itself into the Mendereh, about two miles above its mouth. One of these streams must be the Homeric Simois.

The topography of a plain so famous in the history of human civilization has, of course, occupied the attention of the learned both in ancient and modern times; and a considerable library could be formed of volumes in which this region has been described, and its most famous localities discussed. The topographical result of these voluminous discussions can, however, now be given in a very few sentences. In the first place, after seventy years of confusion and hallucination, it may be regarded as certainly established, that the Mendereh is the Scamander. It is also universally allowed that *Novum Ilium*, or New Troy, occupied the site of Hissarlik, on an eminence about four miles from the mouth of the river, on its right bank, near the bend of the Dombrek. It is also a matter of general consent, that the great tumulus or barrow, near the Sigean promontory, where the Dardanelles broaden up into the wide Ægean, is the veritable monument of Achilles, described by Homer in a famous passage of the *Odyssey*; but beyond these three points, it cannot be said that any part of the classical topography of the plain has been ascertained with certainty. The great point to determine, of course, is the site of the Homeric Troy, the capital of the empire of Priam; but this is a matter which, in default of inscriptions, can be ascertained only by previously deciding which of the three streamlets above mentioned is the true heir to the legendary glories of the Homeric Simois; for between the Scamander and the Simois the tide of battle rolled to and fro, as Homer expressly tells us; and at the head of the plain between these two rivers the town of Troy must certainly stand.

Those who hold with Strabo among the ancients, and Maclaren among the moderns, that the Dombrek is the Simois, have strong ground for maintaining that New Troy was built upon the site of Old Troy, and that no further search is necessary; while they who look on this point as suspicious, must recognize the Simois in the river of Bunarbashi, and the site of the Pergamus of Priam on the plateau at the great bend of the Scamander, about a mile to the eastward of the village of Bunarbashi, where the substructions of an ancient city have been lately excavated. Those who wish to see this nice topographical question discussed in the most masterly style, will read *The Plain af Troy Described*, by Charles Maclaren (Edin. 1863), on the one side; and *Ueber das Homerische Ilion*, by Professor Welcker, in his collected tracts (Bonn, 1845), on the other. A succinct exposition of the arguments on both sides will be found in Professor Blackie's notes to the *Iliad*, Book xxi. The literary history of this topographical question, commencing with the work of Le Chevalier, a Frenchman, translated into English by Professor Dalzel in 1791, is extremely curious; but the most distinguished scholars and topographers being now agreed that the Mendereh and the Scamander are identical, it is not necessary to make any allusion to the wonderful discovery of 'the wells of the Scamander,' by which Le Chevalier imagined he had made himself immortal. Dr. Schliemann, who lately carried on a systematic investigation of the supposed neighborhood of ancient Troy, believes he has found, at Hissarlik, its veritable site. In July 1872, he discovered a very large collection of gold, silver, and copper implements and weapons, undoubtedly of great antiquity. Further researches in 1878, revealed various architectural details, gold and silver ornaments, with cockle and mussel shells. See Schliemann's *Troy and its Remains* (1875), and *Ilios* (1880).

TROY, a city of New York, U. S., on the east bank of the Hudson River, at the head of steamboat navigation and tide-water, 151 miles north of New York City, and 6 miles north of Albany, built upon the alluvial flats of the river and hills, called Mount Ida, on the east side. Winants Kill and Poesten Kill, two small streams, having each a series of falls, furnish water-power to mills and factories, besides that given by a dam across the Hudson. At T. is the principal outlet of the canals connecting the Hudson with Lakes Champlain, Ontario, and Erie; and it has railways diverging in all directions, connecting it with New York, Boston, &c. The Union Dépôt, in the center of the city, is one of the largest in America, 60 trains arriving and departing daily. The iron furnaces and manufactories are the largest east of the Alleghanies, being furnished with the magnetic ores of Lake Champlain, and the hematitic ores of Western Massachusetts. The coal is brought from Pennsylvania and Maryland. The chief iron-works are those for bar-iron, railway-spikes, nails, locomotives, stoves, hot-air furnaces, hollow ware, machinery, agricultural implements, &c. Other important manufactures are those of railway cars, coaches, omnibuses, cotton and woollen goods, breweries, distilleries, flour, boots and shoes, shirts and collars—the latter employing 6000 persons, with extensive machinery. There is also the largest manufactory of mathematical instruments in the country. The property which reaches tide-water by the canals centering at T., including lumber, is valued at 17,000,000 dollars annually. A fine iron bridge connects T. with the suburb of West T. The city contains 50 churches, public schools with an annual enrolment of 8000 pupils; the Rensselaer Polytechnic Institution, with 14 teachers and 170 students; a Roman Catholic seminary; asylums, academies, &c. T. was settled by the Dutch in 1752. Three times it has been nearly destroyed by fire; in 1862, the loss was 3,000,000 dollars. Pop. (1840) 19,334; (1850) 28,785; (1870) 46,465; (1880) 56,747.

TROYES, a town of France, formerly capital of the province of Champagne, and now of the dep. of Aube, on the left bank of the river Seine, 103 miles east-south-east of Paris by railway. It is a very old-fashioned place, and most of the houses are of wood. The principal buildings are the cathedral, dedicated to St. Peter, a splendid specimen of *flamboyant* Gothic, founded in 872, and rebuilt between the 13th and 16th centuries; the churches of St. Urban, the Madeleine, St. Pantaleon, and St. Remi, the Hôtel de Ville, a public library, containing 100,000 vols. and 5000 MSS.; a Museum, the Palace of Justice, the Exchange, Merchants' Hall, and various educational institutions. T. is not so populous or important as it was in the middle ages. Even as late as Henry IV.'s time, it had more than 60,000 inhabitants; in 1881, the pop. was 45,824. It carries on numerous cotton and woollen manufactures, and, as the center of a rich agricultural region, it has a large transit-trade.

T., anciently the capital of the Celtic Tricassii, was called by the Romans *Augustobona;* later, *Civitas Tricassium;* and then *Trecæ* (a corruption of Tricassii), whence the modern Troyes.

TROY-WEIGHT. The origin of the term 'Troy' is unknown; some consider it to be a corruption of *le roy*, as the troy pound was, till recently, the standard pound (*pondus regis*); some derive it from *Troy novant*, the monkish name for London; while the majority of philologists and lexicographers profess to see the origin of the name in the town of *Troyes*, in France, an important center of commerce during the middle ages, which hence *may*, like the towns of Cologne, Toulouse, and others, have had its own special system of weights; though why the term should have migrated to Britain, and been exclusively employed there for so long, is not at all evident. A Troy pound (of what value is unknown), is first mentioned in Britain in 1414, long before which period the standard pound of 12 oz., as well as another pound (the Tower pound) of 12 oz., was in use. The term 'Troy' was first applied to the standard pound in 1495, but at the same time no change seems to have been made in its value, and it continued, as before, to be exclusively employed by the dealers in the precious metals, gems, and drugs. See POUND. The troy pound contains 12 oz., each ounce 20 penny-weights, and each penny-weight 24 grains; thus the pound contains 5760 grains, and is to the avoird. pound as 144 to 175; while the troy ounce is to the avoird. ounce as 192 to 175. For medicines, other subdivisions of the Troy pound were formerly employed; but now, medicines are weighed by the Avoirdupois standard (q. v.). The old English pound, to which the term Troy was afterwards applied, was doubtless the pound of silver; and the Tower pound of 12 oz. differed from it only by $\frac{1}{4}$ths of an ounce.

TRUCE, a suspension of hostilities between two armies or states for a period specially agreed upon. During a truce, it is dishon-

orable to occupy more advanced ground, or to resort to any act which would confer advantage. A truce requires ordinarily to be confirmed by the commander-in-chief to become binding. It is lawful to break it before the prescribed period, on notice previously agreed on being given to the opposite party. This is called denouncing a truce.

TRUCE OF GOD. See GOD'S TRUCE.

TRUCK-SYSTEM (French *troquer*, Scotch *trock*, to barter or exchange) is applied to the practice of paying workmen in goods instead of current money. There is no question about the bad social influence of such an arrangement in the ordinary staple and steady systems of productive industry, though there are cases where it is beneficial—as where new works bringing together large bodies of men are started in districts where there is little or no traffic. In such cases, an arrangement to supply the workmen from temporary stores established by their employers, or by persons in communication with them, will be better than leaving the families so collected at the mercy of miscellaneous speculators, probably insufficiently supplied with capital. The Truck Act of 1831 (1 and 2 Will. IV. c. 37) imposes penalties on the employer who pays in goods in certain producing trades. The feature which was supposed to be the supreme triumph of the act, however, and was to make it self-working, was, that all wages so paid were to be a blank. The workman so remunerated had still an action for his wages, and in various shapes it was provided that the goods should be no 'set off' against the money value of the labor. The Report of a Select Committee appointed in 1842 to inqure into the extent and operation of the truck-system, found that, notwithstanding the act, it flourished extensively in several productive trades—as in coal and other mines, iron-works, quarries, and various kinds of manufactories; and they reported that its prevalence had a very pernicious effect on the families of the workingmen. In the year 1853, Mr. J. H. Burton was employed by government to investigate the system as it operated in Scotland; and his Report of the results was presented to parliament. He found that, however pernicious it might be, it was a thing beyond legislative control, and that the attempts to suppress it, in many cases only strengthened its hold, by the completeness of the organization for carrying it out. One, and a perfectly simple, form is this. At a large iron-work, say, the stated payment of the men is monthly. From their improvident habits, however, they are ever requiring advances. These are at once paid in cash. There is at the same time a neighboring store; it may be owned by the same proprietors as the iron-work, or it may be let to some other person at a rent estimated, not at the value of the premises in the market, but at that of the trade which is guaranteed to the tenant. At this store, all purchases are made in cash, and all comers may purchase as at any other shop. The books of the two establishments, however, show how much of his advances each workman has expended at this store. A man says he wants a pound in advance of his monthly wages. He gets the money, and no questions are asked. By comparison of books, however, it comes out how much of this is spent in the store. When he asks another advance, it may be refused, for reasons known to both parties, but not told. In some instances, the registers are so complete that when the workman pockets his advance, he knows, though he has never been told, what proportion of it he must spend at the store to keep in the advanced pay-list. It was found not unusual to limit the free expenditure to 5 per cent., or a shilling in the pound. Thus the system has its foundation in the improvidence of the class it affects. Until that disease is cured, and the workman can wait for the periodical pay-day, he must take his advances on the employer's conditions. As a general economy, the truck-system does not pay. If it is supposed to be profitable, it is from the fallacy, that two profits may be made on one capital. The capital which the iron-master devotes to dealing in beef, tea, and beer, must be subtracted from the capital embarked in his iron-work. This is the business to which he professes to devote himself, and for which he believes himself to have peculiar faculties. His truck-shop either diverts his attention from his main business, or he must hand it over to a hireling, who certainly will not work the capital so embarked, as profitably as that portion employed in the iron-work, and superintended by the owner himself. But in great trades where truck is the established rule, the individual employer cannot help himself. The rate of wages is adjusted on the scale of a portion coming back in the shape of the profit on purchases at the shop. The employer must therefore keep a shop, unless he can get his men to be so reasonable as to work for him on less wages than their neighbors nominally get; but he would be a person of miraculous reasoning powers who would persuade working-men to do that.

TRUFFLE (*Tuber*), a genus of fungi of the section *Gasteromycetes;* globose, or nearly so; of a fleshy substance, with a distinct skin, the whole substance pervaded by a network of serpentine veins, which are the *hymenium*, and bear the spore-cases in minute cavities. The species are not numerous; they are very generally diffused in temperate parts of the world; they are subterranean, often found at the depth of a foot or more in the soil. Some of them are amongst the most highly valued of esculent fungi. The COMMON T. (*T. cibarium*) is of a black color, and has a warty surface. It varies in size from that of a large plum to that of a large potato. On account of its agreeable flavor, it is used in the preparation of many dishes. It is common in the central and southern parts of Europe, chiefly in loose soils, in woods and pastures, as in the chestnut woods of France and Italy. In England, it occurs, pretty abundantly, in the downs of Wiltshire, Hampshire, and Kent. Other species, as *T. æstivum*, *T. rufum*, and *T. moschatum*, are found in some parts of France, Italy, and other countries of Europe, and are sought after and used in the same manner as the Common Truffle. It has recently been discovered that the English species are more numerous than was formerly supposed; truffles have also been discovered in localities in the south of England where their existence was formerly unknown. The gathering of truffles is the occupation of many persons in the places where they abound. They are dug up with a kind of hoe or pick. Dogs are trained to seek them, and readily discover by the scent the spot where they grow underground. The stirring of the soil in the gathering of truffles seems to increase its productiveness.

Truffle (*Tuber cibarium*).

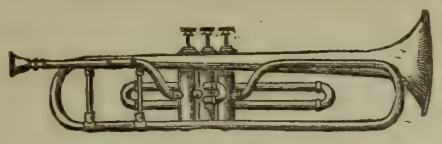
No particular kind of dog is specially employed for truffle-seeking; but one of which the parents are truffle-dogs is preferred, as it is said to be more easily trained. In some parts of France, pigs are also trained to seek truffles. In Germany, the name BLACK T. is given to the Common T., and that of WHITE T. to *Rhizophagon album*, a species of a nearly allied genus, which has also been found in England. It grows half above ground, is of a whitish-red color, and is generally of the size of a large walnut. It is less aromatic than the Common T., but is used in the same way.

TRU'LLAN, the name (derived from the hall—Gr. *troullos*—of the palace in which the Fathers assembled) given to the council also called *Quinisext* (q. v.).

TRUMBULL, JOHN, American painter, son of Governor Jonathan Trumbull (said to have been the original 'Brother Jonathan') of Connecticut, and brother of General Jonathan Trumbull, aide-de-camp to General Washington, was born in Lebanon, Connecticut, 6th June 1756, was educated at Harvard College, and devoted himself to painting. He had completed two pictures, the 'Battle of Cannæ,' and the 'Judgment of Brutus,' at 19, when the war of the Revolution broke out, and he joined the provincial army before Boston as adjutant of the 1st Connecticut Regiment. The execution of drawings of the British works procured his appointment as aid to Washington, and soon after, that of brigade-major. In 1776—1777, he served under Gates and Arnold as adjutant-general; but, offended with the action of Congress respecting the date of his commission, he resigned, and resumed the palette. In 1780, he came to London, *viâ* France, where he was making rapid progress under the instructions of Sir Benjamin West, when, during the excitement occasioned by the execution of Major André, he was thrown into prison.

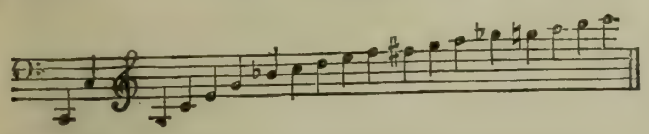
The king, George III., promised West that his life should be spared, but he was kept eight months in prison, and then released on condition of leaving the kingdom. After the war, he returned, and resumed his studies. His 'Priam receiving the Body of Hector,' painted at this period, is in the gallery of the Boston Athenæum. In 1786, he produced the first of a series of modern historical and military works, the 'Battle of Bunker Hill,' followed by the 'Death of Montgomery,' 'Sortie of the Garrison from Gibraltar,' exhibited in London in 1789, and engraved by Sharp. He, this year, returned to America, painted several portraits of Washington, and secured likenesses of many of the prominent actors in the Revolution; and in 1796, returned to England as secretary of legation to Mr. Jay. He was in England again from 1808 to 1815, painting industriously but with little success. Returning then to America, he was employed by Congress to paint four large national pictures for the Rotunda of the Capitol at Washington—the 'Declaration of Independence,' 'Surrender of Burgoyne,' the 'Surrender of Cornwallis,' and the 'Resignation of General Washington, at Annapolis, December 23, 1783.' These pictures are chiefly valuable as collections of portraits. He afterwards completed a gallery of all his historical pictures, 57 in number, on a smaller scale, which became the property of Yale College, and has great historical value. He was the President of the American Academy of Fine Arts from its foundation in 1816, until the formation of the National Academy in 1825; and died in New York, November 10, 1843.

TRUMPET, a musical instrument of great antiquity, which, in its present form, consists of a tube eight feet long, less in diame-



Trumpet.

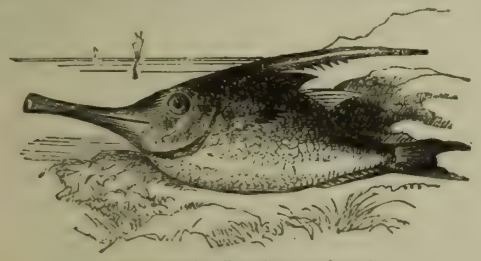
ter than the horn, doubled up in the form of a parabola, and sounded by a mouth-piece. It produces the following progression of sounds:



Music for the trumpet, as for the Horn (q. v.), is written in the key of C, the key to which the instrument is to be adapted being pointed out by the composer. The pitch is an octave higher than that of the horn. Trumpets in the keys of C, D, and E♭ are most used; but there are also trumpets in A, B♭, E, F, and G. To enable the trumpet to give a complete series of semitones, finger-keys and sliding tubes have been introduced by some makers, rather to the detriment of the freshness and fulness of tone of the instrument.

TRU'MPETER, a soldier in a cavalry regiment, whose duty it is to re-pronounce or pass on the orders of the commanding officer; for which purpose certain recognized simple tunes have arbitrary meanings attached to them.

TRUMPET-FISH, or SNIPE-FISH (*Centriscus*), a genus of fishes of the family *Fistularidæ*, remarkable for the elongated and tubular snout. The only British species (*C. scolopax*), rare on the



Trumpet-fish (*Centriscus scolopax*).

British coasts, but abundant in the Mediterranean, attains a length of about five inches, the snout projecting about an inch and a half in front of the eyes. The mouth is destitute of teeth. This little fish is esteemed a delicacy, and is often to be seen in the markets of Italy.

TRUMPET FLOWER, the popular name of certain flowering shrubs of the genera *Bignonia* and *Tecoma*, both of the natural order *Bignoniaceæ* (q. v.) *Bignonia capreolata* is a native of the southern states of America, but often planted in shrubberies and gardens in the middle states. It is a climbing shrub with conjugate leaves and heart-shaped oblong leaflets. The flowers are reddish-yellow, with a long tubular corolla, from the form of which the English name is derived.—*Tecoma radicans* (formerly *Bignonia radicans*) is also a climbing shrub, and a native of the southern states of America, reaching to a more northern latitude than the last. It has much larger flowers, of a scarlet color. The leaves are pinnate, the leaflets ovate and toothed.—*T. grandiflora* is a native of Japan, with pinnate leaves and flowers much larger than *T. radicans*. Both are cultivated with success in the open air in England.

TRU'NNION. See GUN.

TRU'RO, a municipal and parliamentary borough and seaport of Cornwall, of which county it is considered the metropolis, though Bodmin (q. v.) is the county town, 8 miles north-north-east of Falmouth. It stands at the junction of two rivers, the Allen and the Kenwyn, which are here met by an inlet of the sea called the Truro river, the banks of which present some beautiful scenery, and which admits of vessels of 100 tons burden passing upward to the quays of the town. T. is the center of a mining district, and largely exports tin and copper ore. St. Mary's Church, a Perpendicular edifice of the 16th c., is interesting. The bishopric of T. was constituted in 1876; the new cathedral church of the diocese was founded in 1880. Pop. (1881) 10,663.

TRUSS, an instrument employed in the palliative treatment of Hernia (q. v.), with the view of preventing its descent, and, in some cases, of effecting a permanent cure. It consists essentially of a pad or cushion attached to a metallic spring, with straps so arranged that its position may be retained during the varied postures of the body. The necessity of having recourse to a suitable truss the moment that the slightest protrusion shows itself in any of the parts liable to hernia, cannot be too strongly urged as a matter of necessary general knowledge. At whatever period of life a hernia occurs, if properly attended to, and judiciously supported, it usually gives little trouble, and if it occurs in early life, it may often be cured; whereas, if it be neglected, increase of bulk, and subsequently, diseased states of the parts, often terminating in death, will almost certainly occur. A surgeon should always be consulted in the choice of the instrument.

'The practice,' says Mr. Birkett, 'of leaving cases of rupture in the hands of mere tradesmen cannot be too strongly censured. Amongst the poor, we constantly observe the lamentable effects of this proceeding. Many varieties of trusses have been invented. Mr. Kingdon, surgeon to the City of London Truss Society, considers that the 'circular spring truss' is the most suitable form in the majority of cases. There are occasional cases in which the common truss fails to support a rupture comfortably, and in these cases various instruments, for the most part the property of special instrument-makers, are often serviceable; and the surgeon should be acquainted with the peculiarities of the pieces of apparatus known as the Mocmain Lever Truss, Coles's Truss (with a spiral spring acting on the pad), Salmon and Ody's Self-adjusting Truss, Eggs's Truss, &c. The patient must expect to find the truss somewhat uncomfortable for a week or two, but will soon get used to it. The skin of the part upon which it presses should be regularly washed and bathed with Eau de Cologne or spirit, as, without this precaution, boils are apt to form on it.

TRUSS. See CONSOLE. Also the framework, composed of tie-beam, rafters, struts, &c., forming one of the principal supports of a roof.

TRUSSING, in Ship-building, diagonal timbers or iron plates crossing the ribs internally, and consolidating the whole together. Iron is preferred to wood, as being less heavy and less bulky.

TRUST, in the Law of England, is a confidence reposed in some other person touching land or goods for which the *cestui que trust*, or beneficiary, has no remedy except in the Chancery Division of the High Court of Justice. It means a species of divided proprietorship, whereby the trustee acts as a custodier or strong-box; and yet the benefit of the property is not his, but belongs to the *cestui que trust*. The person who creates the trust is sometimes called the *celui que trust*. As a general rule, all property, whether real or personal, may be made the subject of a trust, provided some policy of the law or statute does not prevent it. Trusts are most frequently created by a will; but they may be declared by word of mouth as regards personality; while as to land, some writing is necessary. No particular words are necessary, but the intention of the party making the trust must be clear. Thus, in wills, a testator sometimes uses words which do not amount to an express trust, but speaks of his 'wish and desire,' or his 'confidence,' that the executor or trustee shall do certain things. These words are called in the law precatory trusts, but are enforced in the same way as more direct language, if no uncertainty exists as to the purposes or mode of carrying out the trust. But if a testator merely recommends an executor to 'consider certain persons,' 'to be kind to them,' or 'to do justice to them,' or 'to make ample provision for them,' &c.—such expressions are treated as too vague to be binding, and therefore the executor may disregard them, or use his own discretion. A trustee's is not a compulsory office, but gratuitous, and therefore he need not accept the office unless he pleases. But if he once accept, he is not at liberty afterwards to renounce, unless the trust-deed contain a provision enabling him to do so, or the Court of Chancery for good reasons discharges him. A trustee cannot delegate the office to a third person, but continues personally bound to do his duty. Where there are several trustees appointed, the office is considered joint, so that if one dies, the survivors continue to exercise the office. As a general rule, all must join in doing any act; but if the trust is of a public nature, a majority may bind the minority.

Each trustee is liable only for his own acts or defaults, and this is so even though, for form's sake, he join his co-trustees in signing a receipt, if he can show that he never received the money in point of fact. Nevertheless, when money lies in the hands of one trustee, the others ought not to be satisfied with his mere statement that the money has been invested by him, but should see that it is actually done. Another rule is, that a trustee is not allowed to make a gain of his office; and so jealous is an English court of this rule, that the trustees of a large estate are not even allowed to sport over the estate—at least so as thereby to keep any valuable right of that kind for their own pleasure. Hence, a trustee is personally liable if he trade with the trust funds, or buy shares in a joint-stock bank; for even though the trust-deed authorize this to be done, he will be liable to pay the debts of the trading con-

cern, though far exceeding the amount of the trust funds. So, if a trustee is a solicitor, and does legal business for the estate, he will not be allowed to charge for his professional labors, but at most will be allowed only the costs out of pocket. It is seldom, therefore, that a trustee can get any benefit to himself from the trust estate, except in the rare case where the *cestui que trust* is dead without heirs, in which case the property will become the trustee's. This is, however, only so as to real estate; for if the trust estate consist of chattels, then, on the death of the *cestui que trust* without heirs or executors, the property goes to the crown, and not to the trustee. It is the duty of a trustee to keep the trust funds safe; and if they consist of moneys, then he ought to invest them in government stock, and not let the money lie unproductive. He is not entitled to lend the money on personal security, or in the shares of any private company; but he may invest in mortgages, unless he is forbidden by the deed or will. If there is, therefore, no power to invest in mortgages, the trustee must invest in three per cent. consols, and a few other government securities.

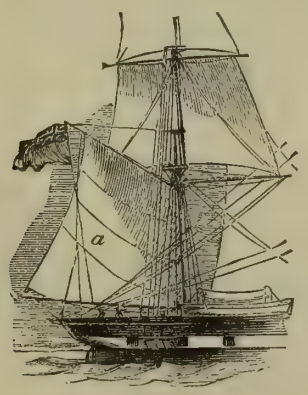
The trustees, as a general rule, must pay interest whether they invest the funds or not (if they have had time to invest) to the *cestui que trust;* and they must account for all the profits they make with the trust funds, whether rightly or wrongfully. If a trustee has grossly misconducted himself as to the trust funds, he will be charged five per cent. interest, and sometimes compound interest. A trustee is entitled to be indemnified for all the reasonable expenses or outlay attending the execution of the trust, but he must in general bear the loss of any mistake as to the law; but if there is any peculiar difficulty in carrying out the trust, he is entitled to take the opinion of, or even to throw the chief management upon, the Court of Chancery, as the only safe protection. When trustees are guilty of gross negligence, mismanagement, or misconduct, the Court of Chancery will remove them, and appoint others.—In Scotland, there are several technical points of difference from the above in the law of trusts.—Paterson's *Comp. of English and Scottish Law*, s. 201. The chief practical difference is, that the investment of the trust funds in heritable securities or mortgages, is considered equivalent or superior to government security, and hence it is the duty of the trustees to prefer such securities, as, owing to the practice of registration of deeds affecting real property, heritable security is always a safe investment there. In Scotland, as in England, trustees holding shares of a joint-stock bank as part of the trust funds, are liable personally to pay the debts of the bank.

TRUXI'LLO, or TRUJILLO, a town of Spain, province of Cáceres, on the great highway from Madrid to Badajoz, and 80 miles north-east of the latter place. There are several churches and convents here. Pop. 9800, who are engaged chiefly in agricultural work. T. is the birthplace of Pizarro, who was also buried here in the church of Santa Maria de la Concepcion.

TRUXILLO, a town of Peru, province of Libertad, near the sea-coast, about 300 miles north-north-west of Callao. The port of T. is Huanchaco, about eight or nine miles to the north-west, from which considerable quantities of rice and spices are exported. Pop. 10,000. T. was founded in 1535 by Pizarro, who named it after his birthplace in Spain.

TRYGON. See STING RAY.

TRYSAIL, a small fore-and-aft sail, mounted by a cutter or



Trysail (*a*).

schooner in a storm, when the wind is too violent for her to carry her ordinary canvas.

TSA'RSKOÉ SE'LO (i. e., Imperial Town), a town of Russia, in the province of St. Petersburg, and 13 miles south of the city of that name. It is the royal residence and favorite resort of the imperial family. The carriage-road from the capital to this town was constructed by the Empress Catharine II. at a cost of 1,000,000 rubles; but the *route* now preferred is that of the railroad—the first laid down in Russia. The façade of the great palace of T. S. is 780 feet long. Originally, every statue, pedestal, and capital of the columns, vases, &c., was covered with gold leaf; only the dome and cupolas of the church are now gilded. The interior of the chapel is lavishly gilded, the ceiling being one sheet of gold. There are several elegant rooms, though most of them are more remarkable for barbaric splendor than for taste. In the palace grounds, which are 18 miles in circumference, is an arsenal, containing a magnificent collection of armor, weapons, and accoutrements of all kinds. The grounds also contain several curious ornamental buildings, statues, artificial ruins, grottoes, lakes, waterfalls, &c. The population in 1880 amounted to 14,603.

TSCHUDI, an ancient and noble family in the Swiss canton of Glarus, several members of which have distinguished themselves as authors, statesmen, and warriors. The two following are the most notable of the Tschudi. GILLES, or AEGIDIUS (born 1505, died 1572), who was active on the Catholic side during the struggles of the Reformation in Switzerland, and in consequence was forced for a time to leave his native canton (1562), but was permitted to return two years afterwards. He was a prolific writer, not less than 166 works of his, in print or in MS., being known. The most valuable is a *History of Switzerland* (Basel, 2 vols. 1734). See Fuch's *Aegid. Tschudi's Leben und Schriften* (2 vols., St. Gall, 1805). To the same family belongs JOHANN JAKOB VON T., the eminent traveler and naturalist, born at Glarus, 25th July 1818. After completing his studies at Leyden and Paris, he undertook (1838) a voyage round the world; but circumstances restricted his design to an investigation into the natural history and ethnography of Peru, where he remained for five years. On his return to Europe (1843), he wished to join the Arctic expedition of Sir John Franklin, but was again prevented by circumstances from doing so, and finally settled in Austria. In 1868 he was made Swiss ambassador at Vienna. T.'s principal works are—*Peru: Reiseskizzen aus den Jahren* 1838—1842 (2 vols., St. Gall, 1846); *Untersuchungen über die Fauna Peruana* (St. Gall, 1844—1847, with 76 plates); the splendid work, *Antiguedades Peruanas* (Vien. 1851), executed in conjunction with Don Mariano Eduardo de Rivera (Eng. trans. 1854); *Die Kechuasprache* (2 vols., Vien. 1853), containing a grammar and dictionary of the Peruvian language, and his *Reisen durch Südamerika* (5 vols. 1868).

TSE'TSÉ (*Glossinia morsitans*), a dipterous insect, which is a terrible pest of some parts of South Africa. It is not much larger than the common house-fly, of a brown color, with four yellow bars across the abdomen. The wings project considerably beyond the abdomen. It is remarkably alert, at least during the heat of the day, and dexterously avoids any attempt to catch it with the hand. 'Its peculiar buzz,' Livingstone says, 'can never be forgotten by the traveler whose means of locomotion are domestic animals.' Its bite is almost certain death to the ox, horse, and dog. Livingstone, in one of his journeys, lost forty-three fine oxen by it. Yet the bite is harmless to man, to the mule, the ass, and apparently to antelopes and the other wild animals of the country. The proboscis is adapted for piercing the skin, and the fly lives by sucking blood. At first, no effect is perceived; but in a few days after an ox has been bitten by the T., the eyes and nose begin to run, 'the coat stares as if the animal were cold,' a swelling appears under the jaw, and sometimes at the navel, emaciation and flaccidity of the muscles ensue, purging, sometimes staggering and madness, and finally death. On dissection, the cellular tissue under the skin is found to be injected with air, as if a quantity of soap-bubbles were scattered over it.—Livingstone's *Travels*.

TSONG-KHA-PA (orthographically, *b*Tsong kha pa*) is the great reformer of Lamaism (q. v.), who, by his co-religionists, was considered to be an incarnation of the Bodhisattwa Amitâbha, or, according to others, of Manjus'ri or Vajrapân'i, and after his death, was canonized by the Lamaist Church. He was born in the middle of the 14th c. after Christ, in the country Amdo, in the place where now the celebrated convent *ss*Ku'bum is situated. According to the legends of Tibet, he was conceived by his mother in a supernatural, immaculate manner: he was born with a white beard, and from the day of his birth expressed himself clearly and fluently, and discoursed profoundly on religious matters. In his third year, he resolved to renounce the world. His mother accordingly cut off his long beautiful hair; but when it fell to the ground, a tree grew up—which is still in a court-yard of the convent of *ss*Ku'bum, and was seen and described by the missionaries Huc and Gabet, in the year 1845. The leaves of this tree are covered with one or more letters of the sacred Tibetan alphabet. He now lived retired from the world, entirely devoting himself to prayer and contemplation. A learned Lama from the West, 'with a long nose and bright eyes,' came to settle about this time in Amdo, and seems to have become his teacher. After

* The small letters prefixed to the initials of the Tibetan words in this article are not pronounced.

his death, T. set out to Tibet, and traveled until he came near Lhassa, where a god bade him halt. Here he studied assiduously the Buddhistic law, and soon became convinced of the necessity of reforming the actual worship and discipline of the Lamaist Church. When his teaching attracted a great number of pupils, and when these, in order to distinguish themselves from the followers of the old system, who wore a red cap, assumed as their mark a yellow cap, the head of the Lamaist Church resolved to stop the innovator in his dangerous course, and accordingly summoned him to his presence. But T. did not deign to obey his command. Thereupon, the great Lama repaired in person to the bold monk; but when he entered the cell of T., his red cap fell off—and when he began to descant on the superiority of the old system, T.—seated and turning the beads of his rosary—without raising his eyes, cried out: 'Miserable! I hear the groans of a creature whom thou murderest!' And, in fact, unmindful of the first commandment of the Buddhist law, the great Lama was busy crushing a louse which he had caught. Confused, he fell at the feet of T.; and from this moment no further resistance could be made to his reforms. Such is the legend; but independently of it, history tells us that the influence which T. exercised on the reform of Lamaism, though not miraculous, was very powerful, such as to reduce the wearers of the red cap to a small minority.

His reputation having widely spread, thousands of pupils thronged round him to hear and to adopt his doctrine. In consequence, in 1407 or 1409, he founded the convent *d*Ga' *l*Dan; and when this could no longer contain the number of his adherents, two other convents, which, together, it is said, are now peopled with 30,000 monks of the yellow cap. His works are numerous and voluminous; the most celebrated of them is the *Lam nim chhen po*, or 'The great Step-road towards Perfection,' consisting of three parts, namely, 'the road of the little, middle, and great man.' The sect which he founded, and which adopted the yellow cap, is called *d*Ge lugss pa, or the sect of virtue; and the principal reforms which he introduced into the Lama religion as it then existed, were compulsory celibacy for the monks—the Lamas of the old doctrine being conditionally permitted to marry—prohibition of scorcery and necromancy—which were extensively practised by the wearers of the red cap—and the institution, at fixed periods, of religious exercises and of common prayers, and, consequently, of regular meetings of the whole community. His greatest achievement, however, was the organization of the Lamaist hierarchy as it still exists. See LAMAISM. He died in 1419. His body is preserved in the convent *d*Ga' *l*Dan: it is free from decay; and, like the tomb of Mohammed at Medina, suspended in the air without any support. His portrait is seen in all the temples of the yellow religion, often between those of the two Lamaist popes, of whom the *Dalai Lama* is at his right, and the *Pan chhen Rin po chhe* at his left. He is recognizable by two lotus flowers which he holds in his hands, folded for prayer, and one of which usually carries in its calix a candle, while the other supports a book. His canonical name is *b*Lo *b*Sang graggs pa, or 'the Celebrated Sage.' —See for further detail, C. F. Koeppen, *Die Lamaische Hierarchie und Kirche* (Berlin, 1859), and the works quoted there.

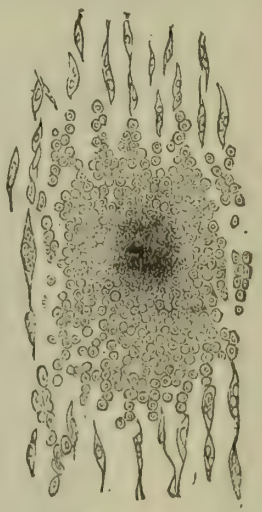
TU'AM, an inland market-town and episcopal seat, as well as center of a poor-law union, of Galway, Ireland, is situated on the Harrow, a branch of the Clare, 125 miles west from Dublin, with which it is connected by a branch from the Midland Great Western Railway. The pop. in 1881 was 3567, of whom more than 3000 were Roman Catholics. At the preceding census of 1871, the population, which is decreasing, was 4423. It has been an archi-episcopal see since the 12th c., and continues to have this rank in the Roman Catholic Church; but in 1839, the province was united, in the Established Church, with the archbishopric of Armagh, of which T. is now a suffragan see. The town possesses little trade, except in agricultural produce; but there are some tanneries, a flour-mill, and a brewery. The Roman Catholic church, which is a modern structure, is of great size, and of very striking architecture. Both the Roman Catholic archbishop and the Protestant bishop have residences in T.; and under the direction of the former is the college of St. Jarlath, numerously attended, but designed chiefly for clerical students. The municipal affairs are under the direction of commissioners. The schools, which are under the care of the brethren of the Franciscan Order, are numerously attended.

TUARIKS. See BERBERS.

TUBER, in Botany, a subterranean stem, thickened by the approximation of the nodes and swelling of the internodes, with latent buds along its sides ready to produce new plants in the succeeding year. The cellular tissue is unusually developed, and in general a large quantity of amylaceous matter is accumulated, whence the economical value of tubers, as in the potato, the Jerusalem artichoke, and the arrow-root. Tubers are capable of being employed for the propagation of the plant, by division into portions, each containing an *eye* or bud, according to the usual mode of planting potatoes. Like bulbs and corms, they may be regarded as a store laid up for the plant itself, that it may spring with new vigor in a new year. Like them, also, and even in a greater degree, they are in many cases a provision for the use of man. The most valuable tubers are those already named, but many others are used in different parts of the world. See OXALIDEÆ, TROPÆOLUM, &c.

TU'BERCLE is a word that has been employed by pathologists of different epochs in very different senses. The older writers employed the term merely to express an external form; and everything was called a tubercle which manifested itself in the form of a small knot. Without entering into any discussion of the views of Laennec (who asserted that tubercle presented itself in the lungs under two different aspects—namely, as *tubercular infiltration* and *tubercular granulation*, and thus opposed the old knot-theory), of Lebert (who was the first accurately to describe the so-called 'turbercle-corpuscles'), of Reinhardt (who, with many others, holds that tubercle is nothing more than one of the forms presented by inflammatory products when undergoing transformation, and that all tubercular matter is really inspissated pus), or of Rokitansky, Van der Kolk, Williams, Walsh, Paget, and other eminent pathologists, we shall briefly give the theory of tubercle which Virchow adopts in his *Cellular Pathology*, and which is perhaps more generally adopted than any other. Virchow holds that tubercle is a granule or a knot, and that this knot constitutes a new formation, which, from the time of its earliest development, is necessarily of a cellular nature, and like all other new formations, has its origin in connective tissue. When this new formation has reached a certain degree of development, it constitutes a minute knot; and if it is near the surface, it forms a little protuberance, its mass consisting of small nucleated cells. The great characteristic of this formation, is its extreme richness in nuclei, of which, at a first glance, it seems entirely to consist. But upon isolating the constituents of the mass, either very small cells with a single nucleus are seen, or larger cells with twelve, twenty-four, or even more divided nuclei are observed, these nuclei being always small, and having a homogenous and somewhat shining appearance.

In the accompanying figure (magnified 300 diameters), the whole succession of transitions is seen from the simple connective-tissue corpuscle, the division of the nuclei and cells, up to the production



Tubercle.

of the tubercle-granule, the cells of which, in the middle, are disintegrating into fatty granular *débris*. In its minute nuclei and very small cells, it contrasts strongly with the large and comparatively gigantic corpuscles of some of the more highly organized forms of cancer. To use the expressive language of Virchow: 'Tubercle is always a pitiful production, from its very outset, miserable.' For an account of the *Cheesy Metamorphosis* which subsequently characterizes the tubercle, and which is the regular but not the invariable termination of this formation (since tubercle *may* undergo a complete fatty metamorphosis, and become capable of absorption, or may undergo calcareous degeneration), see works by Virchow, Rokitansky, Paget. Koch is held by some to have proved that T. is caused by a specific germ (see GERM THEORY), or bacillus, found in all T., and in the spittings of the invalids; and that T. is therefore highly communicable.

Turbercle is usually described as occurring in two principal forms, the first being distinguished as the yellow, and the latter as the gray; the latter is also known from its ordinary size as the miliary turbucle. The latter is the turbucle to which the above description of Virchow applies, the yellow being the same in a state of fatty degeneration or cheesy metamorphosis. In con-

sumption, we often find large masses of softening tubercular matter in the lungs and elsewhere. These large masses are formed by the aggregation of smaller masses, which have coalesced as the deposit continued to increase. The intervening tissues at length suppurate, and thus soften and break down the tubercular matter, and lead to its expulsion; for a process of ulceration having been established into the surrounding tissues, the softened tubercle is brought up by coughing, and a cavity or *vomica* is formed at the spot previously occupied by the morbid deposit. It is a remarkable fact, and one of the greatest importance in the diagnosis of consumption, that tubercles, when they effect the lungs, are almost invariably deposited in the upper lobes. When it is stated that consumption is only one manifestation of Scrofula (q. v.), and that tubercle is the essential element of scrofula, it will be seen that the importance of this subject cannot be overrated. The reader may consult Mr. Ancell's elaborate volume *On Tuberculosis;* or a clever essay, with a similar title, by Dr. Dobell.

TU'BEROSE (*Polianthes*), a genus of plants of the natural order *Liliaceæ*, having a funnel shaped perianth, with 6-parted limb, stamens inserted in the tube of the corolla, a superior capsule, and flat seeds. The COMMON T. (*P. tuberosa*) has rounded bulbous roots; a cylindrical, upright, unbranched stem, three or four feet high; both root-leaves and stem-leaves sword-shaped, and very acute; flowers spiked and somewhat aggregated, large, pure white, the tube a little curved. The plant grows well in the south of Europe, but only bears the open air in more northern climates during summer. The roots are a considerable article of export from the south to the north of Europe; the plant being in high esteem for the beauty and fragrance of its flowers, the odor of which is most powerful after sunset, and has been known to cause headache and asphyxia in a room. The fading flowers emit, in certain states of the atmosphere, an electric light and sparks. The flowers yield an essential oil, which is used by perfumers. The native country of the T. is not quite certain. Another species, *P. gracilis*, is found in Brazil, and has been supposed to be the original of the cultivated plant. The T. has been known in Europe for about three centuries.

TUBE-WELL is an American contrivance, introduced into England in 1867, having for its object the obtaining of a small supply of water in a very short space of time by the application of a limited amount of manual power.

The apparatus comprises three parts—a tube or well, a rammer or monkey, and a pump. Fig. 1 shows the several parts, and fig. 2 the state when driven into the ground. The tube, AA, consists of an iron pipe about 1¼ inch diameter, made in pieces of convenient length, which can be screwed together end to end. The

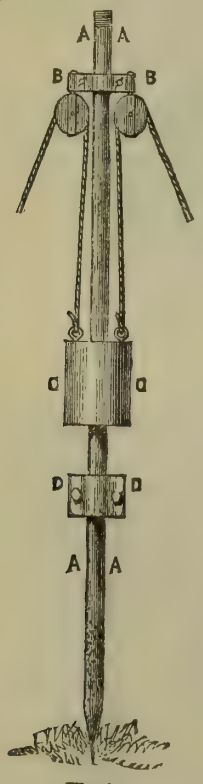


Fig. 1.

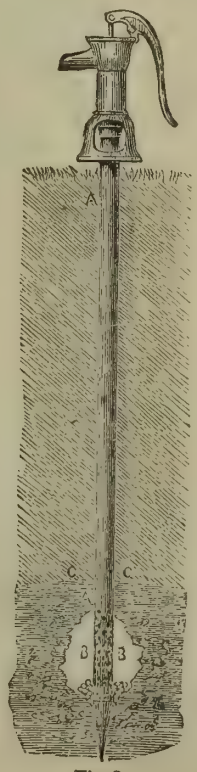


Fig. 2.

pipe terminates at the lower end with a solid tempered steel point, and is perforated for about 16 inches from the end with small lateral apertures. The pipe is driven a short way into the ground, just sufficient to keep it upright without falling, and is temporarily kept in that position by hand. A strong iron clamp, DD, is fixed to the tube by clamping-screws at a short distance above the ground; and another clamp, BB, is similarly fixed higher up. Two pulleys are supported by the upper clamp. The rammer or monkey, CC, consists of a 56-lb. iron weight, which slides up and down the tube, encircling it like a ring or belt. The rammer being raised by two men, is allowed to fall with its full weight on the lower clamp; thus giving a series of blows which drive the tube into the ground. When the lower clamp becomes level with the surface of the ground, it is raised up the tube; as is likewise the other clamp, which supports the two pulleys. Successive lengths of tube and successive shiftings of the clamps afford the means of enabling the perforated end of the tube to reach soil whence water can be obtained. When the symptoms appear of water having been reached, at CC, a small suction pump, shown at the top of fig. 2, is applied, and the water pumped. It is only when water is expected to be reached at a moderate distance below the surface that this apparatus is available, as it is not powerful enough for great depths, nor is the bore of the tube sufficient for a large influx of water; but the required conditions being found to exist, the apparatus saves a large amount of ordinary boring. As the water is pumped up, the loose sand and gravel disappear from the point of the tube, allowing the formation of a small pool or well (BB, fig. 2); while small pebbles which collect around the perforations act as a sort of filter. The tube can be extracted from the ground by forcing the rammer upwards against the upper clamp.

During a trial of this apparatus in the cricket-ground at Old Trafford, Manchester, the tube was sunk to a depth of 10 feet in 22 minutes, and water had been reached in even less than that time. Such a form of well, it is considered, will be free from the liability of receiving dirty surface-water; and no accident is possible from foul air or from the falling in of the sides. A well 15 feet deep was sunk in one hour in the Botanical Gardens at Manchester, and excellent water reached. Another was sunk in the grounds of St. Cloud in half an hour, and pumped up water at the rate of 20 litres (18 quarts) per minute. The inventor accompanied the American Federal army, and enabled the troops frequently to obtain water by the aid of these pumps. On one occasion, to try the capabilities of the tube, he sank one to a depth of 150 feet, at Ithaca, in New York state. Tube-wells were sent out with the British military force to Abyssinia.

TUBI'COLÆ, an order of *Annelida* (q. v.), having a tubular shelly covering, into which the animal can entirely retreat, but from which, when undisturbed, and disposed to activity, it projects its head and gill-tufts. The genus *Serpula* (q. v.) is a good example.

TUBICO'LIDÆ, or GASTROCHÆ'NIDÆ, a family of lamellibranchiate molluscs, remarkable for the calcareous tube into which the proper shell is cemented. Examples are noticed in the articles ASPERGILLUM, CLAVAGELLA, and GASTROCHÆNA. The *Pholadidæ*, including Pholas (q. v.) and Teredo (q. v.), are included by some in this family. *Teredo* has the characteristic tube, but *Pholas* has not.

TÜ'BINGEN, an important town of Würtemberg, in the Circle of the Black Forest, 20 miles south-south-west of Stuttgart, is situated on the Neckar, at the influx of the Steinlach, in one of the most beautiful and fertile districts of the Oberland. T. is an old place, irregularly built, with steep and narrow streets in the main; but the suburbs, especially round about the new university, are very pleasant. Westward from T. is the Schloss, built by Duke Ulrich in 1535. Book-printing, bookselling, working in copper, weaving, bleaching, trading in field-produce, wine, and fruits, form the principal sources of employment.

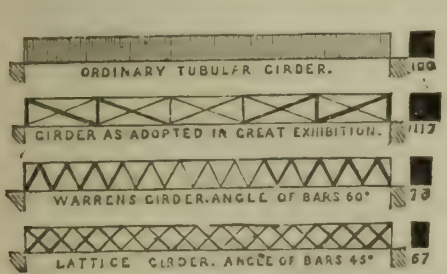
T. has three Protestant churches and one Catholic church, a Bible Society, a Chamber of Manufactures, and various educational and benevolent institutions. But it owes its celebrity wholly to its university. Founded in 1477 by Eberhard im Bart, afterwards first Duke of Würtemberg, the university of T. soon became a distinguished seat of learning, enjoyed for a time the presence of Reuchlin (q. v.), and Melanchthon (q. v.), and continued to flourish long after the Reformation had firmly established itself. The Thirty Years' War, however, fatally checked its prosperity; and it was not till the early part of the present c. that it began to reacquire a reputation. Under Baur (q. v.), it has recently become celebrated as a school of historico-philosophical theology, known as the 'Tübingen School,' the influence of which on the development of religious thought has been very great, and is likely to prove permanent. The university has 6 faculties, above 80 professors and teachers, a library of 200,000 vols. (located in Duke Ulrich's *Schloss*), and is attended annually by from 700 to 850 students, of whom between 200 and 300 are foreigners. Connected with it are an anatomical and physical institute, a botanical garden, a chemical laboratory, a collection of zoology, and comparative anatomy, one of minerals, one of coins

and antiquities, fencing, gymnastic, and swimming schools, &c. Pop. of T. (1880) 11,708.

TU'BULAR BRIDGE. The advantages of the tube for carrying a level roadway across a large span were brought into general notice by Robert Stephenson, engineer of the Chester and Holyhead Railway, in the construction of the bridges to carry that railway across the Menai Strait. It was required by the Admiralty, that these bridges, called the Britannia and Conway, should be constructed, so as not to interfere with the navigation, with clear spans of upwards of 400 feet. The largest arched spans that had been previously constructed did not exceed 240 feet; and suspension-bridges not being suitable for heavy and rapid railway traffic, the engineer was obliged to devise some new form, which should conform to the stipulated conditions.

Mr. Stephenson having decided upon the tubular form, proceeded, in conjunction with Mr. Fairbairn, to make an elaborate series of experiments on tubes, to determine the most suitable arrangement of the wrought iron of which they were to be composed. They found that a rectangular tube, of which the top and bottom were cellular (as in fig. 7, article STRENGTH OF MATERIALS), gave the greatest strength with the least material. The span of the Conway tube was 400 feet; while the tubular part of the Britannia Bridge consisted of two spans of 460 feet, and two of 230 feet each in the clear. The foundation-stones of these bridges were laid in 1846 and 1847 respectively. Since that time, many important bridges have been constructed on this principle. One of the largest and most important is the Victoria Bridge, over the St. Lawrence, near Montreal, in Canada. The total length of this bridge is 9144 feet, or nearly 1¾ mile. It is built in 24 spans, of from 242 to 247 feet each, and one of 330 feet. The greatest depth of the river is 22 feet, and the average rate of the current 7 miles per hour. The bottom of the center tube is 60 feet, and at the abutments the bottom is 36 feet above the water, so that there is a rise of 1 in 130 in the roadway towards the center of the bridge. An idea of the stupendous nature of this structure may be formed from the facts, that 9000 tons of iron were used in the tubes, and 1¼ million of rivets; also that the total surface of iron was 32 acres; and as it received 4 coats of paint, the total painting was 128 acres. There were 2,713,095 cubic feet of masonry, and 2,280,000 cubic feet of timber in the temporary works, dams, &c., and upwards of 3000 men were employed. The first stone was laid on July 20, 1854, and the first train passed over on December 17, 1859. The total cost was £1,400,000, or about £57 per lineal foot.

Notwithstanding the success of these structures, the tubular form has been to a great extent superseded in recent structures by the lattice or trellis. This has arisen from the great saving in the material of which the sides are composed, effected by the open lattice-work, as compared with the solid plated side of the tube. By the lattice arrangement, the material is more capable of arrangement in the direct line of the strains; and the section of the lattice-bars can be accommodated to the strain, so that there shall be no material which is not carrying its due share of the load. The first large structure of this nature was the Boyne Viaduct, on the Dublin and Belfast Junction Railway. Mr. Barton, the designer of this structure, in a notice of this bridge, gives the relative weight in the sides of different forms of girders, neglecting the weights of the top and bottom, which are the same in every case, as follows:



Besides this considerable saving in material, the facilities this form gives for repairs and painting, and the exposure of a smaller surface to the wind, are additional reasons for its preference.

TUBULIBRANCHIA'TA, an order of gasteropodous molluscs, having two branchiæ behind the heart, the whole animal enclosed in a long shelly tube, which is sometimes straight, sometimes twisted in an irregularly spiral manner.

TUCKER, ABRAHAM, an English author whose reputation falls far short of his merits, was born in London, September 2, 1705, studied at Merton College, Oxford, and in 1726 became a member of the Inner Temple. T., who was of good family, inherited a large fortune from his father; and in 1727 purchased Betchworth Castle and estate, near Dorking, in Surrey. During his life he enjoyed all the ease, comfort, and quiet happiness of an English gentleman of the 18th century. It is but fair to state that his frank, generous, virtuous nature, and his sincere love of intellectual pursuits, prevented him from misusing the advantages of his position. In 1736 he married Dorothy, daughter of Edward Barker, Esq.—afterwards Cursitor Baron of the Exchequer, and Receiver of the Tenths—by whom he had three daughters, the youngest of whom, Dorothy Maria, became, in 1763, the wife of Sir Henry Paulet St. John, Bart. T.'s affectionate regard for his family is a beautiful feature of his character. He was, too, all his life, an industrious student, a man of keen observation, of much innocent and cheerful humor, and withal, of methodical business habits. His death occurred November 20, 1774. T.'s great work is entitled *The Light of Nature Pursued*. It was begun in 1756, and formed the chief literary occupation of the rest of his life. It extended to seven volumes, only three of which were published in the author's lifetime, under the pseudonym of Edward Search, Esq. It is not a regular systematic treatise, but consists of a series of disquisitions on metaphysics, theology, morals, &c., all of which exhibit a remarkable originality, simplicity of humor, ingenuity of illustration, and solidity of understanding. Scarcely any English book of the 18th c. is more deserving of study, and scarcely any has been more neglected. A critic in the *Saturday Review* (November 12, 1864) has given an intelligent appreciation of its peculiar merits. The best edition of *The Light of Nature* is that published by the author's grandson, Sir Henry Mildmay, reprinted in 1837. A later edition is that by the Rev. Dr. Cairns.

TUCU'M AND TUCUMA' PALMS. See ASTROCARYUM.

TUCUMA'N, SAN MIGUEL DE, a town of the Argentine Confederation, capital of the province of the same name, about 120 m. N.W. of Santiago, is embosomed in splendid plantations of fruit-trees. T. has a cathedral, convents, a Jesuits' college, and many handsome houses. It carries on manufactures of sugar, leather, and brandy, has an active trade in oxen and mules; and the females are noted throughout the Confederation for their skill in making saddle-cloths. Pop. 17,000. Here, in 1816, a congress of deputies from the various Argentine provinces met, and proclaimed their independence of Spain.

TUDE'LA (the *Tutela* of the Romans), a city of Spain, province of Navarra, on the left bank of the Ebro, which is here crossed by a bridge of 17 arches, 46 miles by railway north-west of Saragossa. It is a dull, gloomy-looking place, with narrow streets and lofty houses; but the promenades along the river are very fine, as also are the *plazas*, or public squares. T. is the seat of a bishop, has a Gothic cathedral, a medical college, and manufactures of coarse woollen cloths, soap, earthenware, &c., and carries on an active trade in the products of the district. Pop. (1877) 10,086.

TUDOR, the surname of a family of Welsh extraction, which occupied the throne of England from 1485 to 1603. In the Welsh language, Tudor is the equivalent of Theodore. Owen Tudor, the first of the race known in history, has had a pedigree assigned him from the ancient Welsh princes, which rests on no very solid evidence. In fact, little is known of his origin, except that his father had to quit Wales on a charge of murder, and was outlawed. He seems himself to have been at one time a brewer at Beaumaris, in Anglesey; and he was afterwards a retainer in the suite of the Bishop of Bangor, and fought at Agincourt. His dancing at some court pageant is said to have first ingratiated him with Catharine of Valois, widow of Henry V., who appointed him to the office of Clerk of the Household, and before long entered either into an illicit connection or a private marriage with him.

The indignation of the public at this step obliged the queen to take refuge in a convent at Bermondsey, where she died; and Tudor was sent to Newgate, but succeeded in escaping, and obtaining two audiences of the young king, Henry VI., who afforded him protection, and conferred on him the lieutenancy of Denbigh. Two sons had been born to him by the queen. On the elder, Edmond, the king bestowed the earldom of Richmond; and on the younger, Jasper, the earldom of Pembroke. The Earl of Richmond married Margaret, daughter and heiress of John Beaufort, Earl of Somerset, whose father was an illegitimate son of John of Gaunt by Katherine Swynford. The sole issue of Richmond and the heiress of Somerset, Henry, Duke of Richmond, invited from abroad to deliver England from Richard III., ascended the throne after Richard's death at Bosworth as Henry VII. The partisans of the House of Lancaster supported him on the extinction of the lawful descendants of John of Gaunt; and by his marriage with Elizabeth, eldest daughter of Edward IV., and representative of the House of York, he was considered to have united the factions of the White and Red Rose. Five sovereigns of the House of T. successively occupied the throne—viz., Henry VII., Henry VIII., Edward VI., Mary, and Elizabeth—for an account of whom see separate articles. From Elizabeth, the last of the line, the crown passed to James VI. of Scotland, of the House of Stuart, in virtue of his descent from Margaret Tudor, daughter of Henry VII., and queen of the Scottish James IV. Strength of will was the prominent characteristic of the sovereigns of the

House of T.; their rule, generally prosperous, was far more arbitrary and despotic than that of the Plantagenets. Parliament was in many cases but the exponent of the royal will, and taxes were frequently exacted, and penal statutes dispensed with, by the prerogative alone. The condition of England under the Tudors differed from despotic monarchies chiefly in the important respect that the sovereign had no standing army. The T. monarchs exercised a remarkable influence on ecclesiastical affairs; it was under their rule that the Reformation took place, and the Anglican Church was developed.

TUDOR STYLE, in Architecture, a rather indefinite term applied to the late Perpendicular, and the transition from that to Elizabethan.

TUESDAY, the third day of the week, is so called from *Tiwesdæg*, the day of Tiw or Tiu, the old Saxon name for the god of war. See TYR. The day bears a corresponding name in the other Germanic dialects.

TUFF, or TUFA, a rock formed from the ash or powder ejected from a volcano, mixed with the lapilli, or small fragments of lava. It may be arranged under the air, and remain quite loose, or be cemented by the percolation of water charged with mineral matter, by pressure or other cause. Sometimes the materials are arranged under water, and then the tuff contains organic remains, like other aqueous rocks.

TUILERIES, PALACE AND GARDENS OF THE, were situated in the middle of Paris, on the right bank of the Seine, with Rue de Rivoli running along their north side, and Quai des Tuileries to the south. Here, in 1342, a certain Pierre des Essarts possessed a pleasure house, called the *Hôtel des Tuileries*, on account of its being built in a locality outside the city where there were several tile-works (*tuileries*). Francis I. bought this property from the Sieur de Villeroy, as a present to his mother, the Duchess of Angoulême. It was afterwards chosen by Catharine de' Medici as the site of a new palace instead of that of Tournelles, and the building was begun in 1566. Originally, the palace consisted of only the square structure in the middle; but was greatly enlarged by Henry IV., Louis XIII. and XIV., Napoleon I.; and received still further improvements at the hands of the emperor, Napoleon III. Louis XIII. was the first sovereign who resided at the Tuileries. Louis XIV. only stayed there for a short time, and then established himself at St. Germain; Louis XV. and XVI. lived at Versailles. In 1793, the National Convention held its sittings in the Tuileries; and Bonaparte chose it for his official residence. It was occupied by Louis Philippe, was the imperial residence of Napoleon III., and was burned by the Commune in 1871. The side wings have been restored.

TULA. See TOULA.

TULA-METAL, a peculiar alloy, made of silver, with small proportions of copper and lead. It is manufactured at the imperial metal-works at Tula, or Toula, in Russia, and is used for making the celebrated Russian snuff-boxes, erroneously said to be made of platinum.

TU'LIP (*Tulipa*), a genus of plants of the natural order *Liliaceæ*, having an inferior bell-shaped perianth, of six distinct segments, without nectaries; a sessile three-lobed stigma, a three-cornered capsule, and flat seeds. The bulb is fleshy, and covered with a brown skin. About thirty species are known, mostly natives of the warmer parts of Asia. The name T. is supposed to be derived from the Persian name *Thouleban*, which also signifies a turban. The most famous of all Florists' Flowers is the GARDEN T. (*T. Gesneriana*), which is from 18 inches to 3 feet high, with a smooth stem, bearing one erect, large flower; the leaves ovate-lanceolate, glaucous, and smooth. The T. is a native of the Levant; it was brought from Constantinople to Augsburg by Conrad Gesner, in 1559, and was rapidly diffused throughout all parts of Europe. The varieties in cultivation are innumerable. The tulip mania of the 17th c. in Holland is noticed in the article FLORISTS' FLOWERS. The T. is still most sedulously cultivated in Holland, especially at Haarlem, from which bulbs are largely exported. It is prized merely for the size and beauty of its flowers; its smell being rather unpleasant. Great attention is paid to the cultivation of tulips, not only in the gardens of the wealthy, but often in those of the humbler inhabitants of small towns and villages, in which beautiful beds of tulips may often be seen. Tulips succeed best in a light, dry, and somewhat sandy soil. Bulbs are planted in the end of October, or beginning of November, and the flowers are produced early in summer. Beds of choice tulips are protected in spring by hoops and mats; and in the flowering season an awning of thin canvas is spread over them, which greatly prolongs the duration of their beauty, as they are soon spoiled by exposure to strong sunshine. Tulips are propagated by offset bulbs, and new varieties are raised from seed.

Another species of T. cultivated in gardens is the SWEET-SCENTED T., or VAN THOL T. (*T. suaveolens*), which has a short, hairy stem, and yellow or red flowers, inferior to those of the common Garden T. in beauty, but prized for their fragrance, and for appearing more early in the season. It is often cultivated in pots in windows. It is a native of the south of Europe. The WILD T. (*T. Sylvestris*), a native of many parts of Europe and Asia, is admitted into the British flora, but is a very doubtful native of Britain. It is common in the woods and vineyards of Germany and the south of Europe. It has a slender stem, narrow lanceolate leaves, and a somewhat drooping, fragrant, yellow flower. It develops offset bulbs at the end of fibres thrown out from the root, at some distance from the parent plant. Its bulbs are eaten in Siberia, although bitterness and acridity characterize the bulbs of this genus.

TULIP TREE (*Liriodendron tulipifera*), a beautiful tree of the natural order *Magnoliaceæ*, a native of the United States of North America, having a stem sometimes 100—140 feet high, and 3 feet thick, with a grayish-brown cracked bark, and many gnarled and easily broken branches. The leaves are roundish, ovate, and

Tulip Tree (*Liriodendron tulipifera*).

3-lobed; the middle lobe obliquely truncated. The flowers are solitary at the extremities of the branchlets; they resemble tulips in size and appearance. The bark has a bitter, aromatic taste, and like that of all the *Magnoliaceæ*, contains a bitter principle, called *Liriodendrin*. It has been used as a substitute for Peruvian Bark in intermittent fevers, and is a good tonic. The T. T. is one of the most beautiful ornaments of pleasure-grounds, wherever it grows and flowers well, which, however, in Britain, it does only in the southern parts. It is now plentiful in many parts of the south of Europe. In some parts of the basin of the Mississippi, it forms considerable tracts of the forest. The heart-wood is yellow, the sap-wood white. The timber is easily wrought, takes a good polish, and is much used for many purposes.

TULLAMO'RE, one of the capitals, and now the assize town of King's County, Ireland, also the seat of a poor-law union, is situated on the Grand Canal, 59 miles west-south-west from Dublin, with which it is connected by a branch from the Great Southern and Western Railway. It stands upon what may be called a fertile island of the great Bog of Allen, and has within the last half-century risen into some importance. The population amounted in 1881 to 5098, mostly Roman Catholics. It is a place of considerable business, commanding, from its central position, the inland traffic of a very large and not unfertile district. A large trade in corn and agricultural produce is carried on with Dublin by the canal. There is a large distillery, as also extensive breweries and several tanneries; and T. is the center of a busy cattle-trade. The schools, both conventual and national, are excellent, and numerously attended. There are a jail and court-house, barracks, Roman Catholic and Protestant churches, &c. A newspaper is published here every week. Within a few miles is situated the extensive Jesuit college of Tullabeg, which receives above 150 pupils.

TULLE, a town of France, dep. of Corrèze, at the embouchure of the Solane into the Corrèze. It is for the most part badly built, but has some fine promenades, excellent quays and bridges, a Gothic cathedral, an episcopal palace, a theological seminary, a communal college, an industrial college, a public library, and a theater. One of the suburbs of T., called Souillac, is a national military manufactory, and the town is otherwise notable for its manufactures of leather, paper, cards, lace (known as *Point de Tulle*), liqueurs, and ironmongery. Some say that T. owed its origin to a Roman fort called *Tutela;* and in the vicinity are certain undoubted Roman remains; others, however, think it dates from the 4th c. A.D. The population in 1876 was 11,038.

TULLE, a kind of thin silk lace of a very open pattern and loose structure, usually in narrow widths, for dressing ladies' caps, &c.

TUMBLER. See LOCK.

TU'MBRIL, in an Army, a covered cart on two wheels, for the carriage of ammunition, tools, &c., belonging to the artillery. The name obtained a melancholy celebrity from being applied to the carts which served to carry the unfortunate victims of the French Revolution to the guillotine.

TU'MORS do not admit of a simple definition, but, in the words of Sir James Paget, who has specially investigated this department of surgical pathology, they all belong to the class of overgrowths or hypertrophies, and their most constant distinctive characters are—(1) that they are deviations both in respect to size and shape from the normal type of the body in which they are found; (2) that they have an apparently inherent power and method of growth; and (3) that their development and growth are independent of those of the rest of the body, continuing with no evident purpose when the rest of the body is only being maintained in its normal type.

Tumors are usually divided into two chief groups, known as innocent or benign, and malignant tumors. The characters of the latter are sufficiently discussed in the article CANCER, and we shall therefore restrict our remarks to innocent tumors. These may be divided into *cystic tumors*, or cysts, and *solid tumors;* while the latter are subdivided into the *discontinuous* and the *continuous;* the discontinuous being those which are completely invested with a layer of tissue, which at once isolates them and connects them with the surrounding parts, while the continuous ones appear as growths, not in, but of the surrounding parts, and appear as *outgrowths*, as, for example, many polypi, and pendulous or sessile tumors. In accordance with these ideas, Sir J. Paget classifies innocent tumors as follows: I. CYSTIC TUMORS: CYSTS; which may be (*A*) *Simple* or *Barren*, or (*B*) *Compound* or *Proliferous*. (*A*) *Simple Cystic Tumors* include the varieties known as (*a*) serous, constituting what are termed hydromata, (*b*) synovial, (*c*) mucous, (*d*) sanguineous, (*e*) oily, (*f*) colloid, (*g*) seminal. (*B*) *Compound* or *Proliferous Tumors*, including (*a*) complex cysts, (*b*) cysts with glandular or other vascular growths, (*c*) cutaneous cysts, (*d*) dentigerous cysts. II. SOLID TUMORS and OUTGROWTHS, including (*a*) fatty or adipose, (*b*) fibro-cellular, areolar, &c., (*c*) fibrous, fibro-muscular, (*d*) cartilaginous, (*e*) myeloid or marrow-like, (*f*) osseous, (*g*) glandular, and (*h*) vascular.

Of these various species we shall only notice a few of the most important. *Cutaneous cysts* may be congenital or acquired. They may be found under the skin of any part, but Sir J. Paget regards them as probably a hundred times more common in the scalp than in any other part. Their rate of growth is uncertain. When they grow rapidly, they are apt to ulcerate, and hence are derived most of the so-balled 'horns' of the scalp and face.

Cutaneous cysts are usually formed either by the morbid growth of natural ducts or follicles, or by the enormous growth of elementary structures, which increase from the form of cells and nuclei, and become closed sacs with organized walls capable of producing other growths. A hair follicle or a sebaceous gland of its duct become obstructed, is thus often the origin of a cyst. Cutaneous cysts may be treated in various ways. Those in which the skin over their chief prominence is marked with a small dark point, through which a fine probe may be passed into the cavity, may be gradually emptied by dilating their openings, and pressing out their contents; or they may be extirpated by caustic or the knife.

Fatty tumors are the most frequent of all innocent tumors, and are often described under the name of *lipoma* and *steatoma*. They do not differ materially in structure from the ordinary fat of the adjacent parts, and seldom cause much annoyance, except from their unseemly appearance. No good cause can be assigned for their formation, but they may sometimes be traced to a blow or friction, as of a strap. The age at which they most commonly show themselves is at about forty. They may occasionally be absorbed by the prolonged internal use of liquor potassæ; but this treatment is almost certain to disturb the general health, and as a general rule, excision is the proper treatment. *Fibro-cellular tumors* are remarkable for the rapidity of their growth (three or four pounds in the year, and in one case recorded by Sir J. Paget, a pound a month), and the weight which they may attain (sometimes forty pounds or more). The most common seat of these tumors are the uterus, the scrotum, the bones, the subcutaneous tissue, the lobules of the ear, &c. Polypi of the uterus, nose, &c., belong to this class. Except in the case of polypi, excision is the only available remedy; and in some parts of the body this is of course impossible.

We will conclude with a reference to a remarkable class of cases which often sadly puzzle the inexperienced surgeon. They are known as *Phantom Tumors*, and are apparently due to contraction of the muscles. 'The abdominal muscles of hysterical women are most often thus affected; sometimes with intentional fraud. The imitation of a tumor may be so close as to require great tact for its detection, but chloroform, by relaxing the muscles, dissipates the swelling. Occasionally, these apparent tumors move.' —Paget on 'Tumors,' in Holmes's *System of Surgery*, vol. i., an article containing an excellent abstract of the most recent knowledge on the general subject of tumors.

TUMU'LTUOUS assemblages are, in point of law, in the category of riots, and were carried to an enormous height in the reign of Charles I. It was afterwards enacted by a statute of 13 Ch. II. c. 5, that not more than twenty names should be signed to any petition to the Crown or either House of Parliament for any alteration of matters established by law in church or state, unless the contents be previously approved by three justices or a grand jury; and no petition should be delivered by a company of more than ten persons. A later statute of 57 Geo. III. c. 19, made it unlawful to convene a meeting of more than fifty persons, or for more than fifty to meet in any street within a mile of Westminster Hall for the purpose of considering any petition or complaint to either House of Parliament for alteration of matters in church or state on any day when parliament is sitting. But the act does not apply to meetings to elect members of parliament. Other enactments were passed as to assemblies of persons collected under pretext of public grievances, but these were temporary, and have now expired.

TU'MULUS. See SEPULCHRAL MOUND.

TUN, a word which, under various modifications, exists in the Celtic and Teutonic languages, seems connected with the Latin *teneo*, I hold, or the Greek *teino*, I stretch, and signifies primarily a large vessel or cask. In various countries, Britain included, it denotes also a liquid measure of capacity; in old ale and beer measure, the tun was equal to 216 gallons (each gallon = 282 cubic inches), in old wine measure it was equal to 252 gallons (each gallon = 231 cubic inches). The tun and all other liquid measures of higher denomination than the gallon are no longer legal; but the names are, for convenience, still retained. These denominations had their origin in the natural practice of giving names to casks in common use which preserved a uniform size. As a tun of water weighs a little more than 2000 lbs., it is probable that the ton weight (see TON) was taken from the tun measure.

TU'NBRIDGE, a market-town in the county of Kent, stands on the Medway, on ground rising from the banks of that river, 27 miles south-east of London. The castle, which stands on the Medway, near the entrance of the town, dates from the close of the 13th c., has a noble gate tower of great size, richly ornamented, and is at present occupied as a military training school. The parish church is a large and old, but sadly disfigured building; but the chief establishment of the town is the Grammar-School, of which the revenues are very considerable. Attached to it are 16 exhibitions of £100 a year, tenable at either university, besides 12 lesser exhibitions. The manufacture of toys and turned and inlaid articles of wood (see next article), is a specialty. Pop. (1871) 8209; (1881) 9340.

TUNBRIDGE-WARE, a kind of wood manufacture carried on at Tunbridge and Tunbridge Wells. It consists of such articles as ladies' work-boxes, ring-boxes, desks, &c., which are covered with a veneer characteristic of this industry, and formed from small pieces of wood of square and triangular shape in transverse sections, built up in geometric patterns; these are carefully glued together so as to form a solid mass, from which thin transverse veneers are cut, and are used to cover the articles made. This trade was formerly of much greater importance than at present.

TUNBRIDGE WELLS, a famous English inland watering-place, and after Bath, the oldest in the country, stands on the south border of Kent, 5 miles south of Tunbridge. The town, which is rapidly extending, occupies the head and slopes of one of the valleys of the Weald, and has in general a south-west aspect, commanding very fine views. The three centers of population are Mounts Ephraim, Sion, and Pleasant, separated by a large common and cricket ground. The waters are chalybeate. The Wells, discovered in 1606 by Lord North, are situated at the end of a promenade called the *Pantiles*. In the vicinity are charming rides and walks. The fashionable season is June, July, August and September. Tunbridge-ware is also largely manufactured here. Pop. (1871) 19,410; (1881) 24,309.

TU'NDRA (in Finnish, *Tunter*—that is, mossy flat) is the Russian name for the vast plains which border on the Arctic Ocean in Siberia, and also westwards from the Ural along the north of Europe. They are swampy tracts of land, partly covered over with a thick felt of bog-moss, and partly with a dry snow-white covering of reindeer-moss and different kinds of lichens. It is only the reindeer that renders this frightful waste habitable for the wandering hordes of Samoyedes, who hunt the furred animals as well as the swans and wild geese which in summer flock hither in vast numbers. These polar steppes, however, can be trodden only in winter, when the whole region is one sheet of frozen soil and ice. In summer, when the surface thaws, the greater part of the region becomes an inaccessible morass, except a portion along the north coast of Siberia, which retains its snow covering

throughout the year.—See Schrenk, *Reise nach dem Nordosten des Europ. Russland durch die Tundren der Samoyeden* 1837 (Dorpat, 1848).

TUNE, a short popular melody; also, that property of musical sounds by which they stand to each other in the relation of Pitch (q. v.).

TU'NGSTEN (symb. W, equiv. 92—in new system, 184—sp. gr. 17·6) is a rare metal, which derives its name from the Swedish words *tung*, heavy, and *sten*, a stone. It is chiefly derived from Wolfram (whence the symbol W), which is a tungstate of iron and manganese, and likewise occurs in Scheelite, which is a tungstate of lime. It is unnecessary to describe the means of separating the metal, which may be finally obtained either as a dark-gray powder or in heavy iron-gray bars, which are very hard, and difficult of fusion. Aqua regia and nitric acid convert it into tungstic acid. When 10 parts of this metal are alloyed with 90 of steel, a mass of extraordinary hardness is obtained.

T. forms two compounds with oxygen—viz., a binoxide (WO_2), which is obtained in the form of a brown powder by heating tungstic acid to low redness in a current of hydrogen, and which does not form salts with acids; and an acid teroxide, known as *Tungstic Acid* (WO_3). Independently of *tungstic anhydride*, there are two modifications of this acid, represented by the formulæ HO,WO_3, and HO,W_2O_6, which are known as *tungstic* and *metatungstic acids* respectively. Various tungstates have been formed and examined. Of these, the most singular is tungstate of tungsten ($WO_2.WO_3$), which is of a splendid blue color; and tungstate of soda, which answers admirably as a means of preventing muslin, &c., from bursting out in a flame, when brought in contact with fire. It is unnecessary to notice the metatungstates, or the sulphides, chlorides, &c., of tungsten.

TUNGUS, an ethnographic group of the Turanian family, are at the present time situated to the north and east of the Mongol group, inhabiting the vast plains stretching south from the icy sea of Siberia, between the Yenesei and the Lena, the northern slopes and valleys of the Great Altaï and the hilly uneven tract between the Upper Amur and the Lena. The chief peoples included under this group are the Niuju, the Dāurians, Tshapodshirs, Manchûs (in the south-east), and Lamûts (on the east coast). In the north, they have intermingled with the Samoyedes; in the west, with the Ostiaks, whose territory is on the other side of the Yenesei; and in the south, the Manchûs, though being gradually pushed northward by the Chinese, have for a long time exercised undisputed sway over their supplanters. Divided politically, between Russia and China, the southern portion of them are Buddhists, while the tribes farther north mostly practise Shamanism (q. v.), a few having, by the strenuous exertions of the Russian government, been induced to profess Christianity. The T. are partly nomad and wandering, and partly agriculturists and settled rearers of cattle. The first of these are commonly classed according to the districts they prefer to dwell in, as T. of the forests, or T. of the steppes: the former being shepherds, hunters or fishers; and the latter exclusively shepherds. The steppe T., again, are divided according to the animals of draught they employ, into the reindeer-T., the horse-T., and the dog-T. The T. are in general robust and lively, with flat visage and small eyes, the latter characteristics, however, being much less prominent in them than in the Kalmucks. A portion of the Chinese Tungûs constitute the Ssolon nation so celebrated as warriors in Chinese modern history. The Tshapodshirs tattoo their faces.

TUNICA'TA, a class of acephalous molluscs, having the body enclosed not in a shell, but a soft elastic tunic, which is perforated by two apertures, and is composed of a substance resembling Cellulose (q. v.). The T. are extremely numerous, and are found in all seas. The *Ascidiæ* (q. v.) belong to this class, and the *Salpidæ* (q. v.).

TUNING-FORK, a contrivance for regulating the pitch of the voice or of a musical instrument. It consists of two prongs of steel springing from a handle, and so adjusted as to produce a fixed note when struck. It is usually tuned in C in Britain, and in A in Germany. In consequence of the absence of any universally recognized standard, there is even in this country a considerable variety in the pitch of the tuning-fork. Messrs. Broadwood employ three forks of different pitch to tune their pianofortes: one corresponding to the Philharmonic standard of 30 years back for instruments used for the accompaniments at ordinary concerts; another somewhat higher for pianofortes meant to take part in orchestral compositions; and a fork of still higher pitch, adopted for the present opera and Philharmonic standard, which is about a semitone higher than the standard of 30 years ago. A fork has lately been invented in Germany capable of adjustment to different standards of pitch, by means of a movable brass slider, fitted with a screw, there being indications on the prongs of the positions of the slider which give the pitch adopted by the principal orchestras in Europe.

TU'NIS, a country of Africa, and one of the Barbary States, is bounded on the N. by the Mediterranean, on the W. by Algeria, on the S. by the Desert, and on the E. by Tripoli and the Mediterranean. Its greatest length from north to south is about 440 miles; its average breadth, 160; area, upwards of 45,000 sq. m.; pop., according to latest authorities, 2,000,000. T. is traversed by branches of the great Atlas range, which, in fact, has its proper termination here. The northern coast is rocky and steep, with numerous bays, of which the largest is the Gulf of Tunis; and two of its promontories, Capes Blanco (*Râs-el-Abîd*) and Bon, are the most northern in Africa. The eastern coast, on the other hand, is flat, sandy, and infertile, like that of Tripoli, but has two large gulfs, Hammamet and Cabes (the *Syrtis Minor* of antiquity). The southern part of T. belongs to the desert steppe known as Belud-el-Jerid. There is only one fresh-water lake of any consequence, that of Biserta or Bensart, near the north coast. The brooks and torrents of T. either lose themselves in the sand, or find their way to the sea after a short course. None are navigable. The longest is the Mejerdah (the *Bagradas* of the ancients), which flows in a generally north-eastern direction into the Gulf of Tunis. Other streams are the Ved-el-Milianah and the Ved-el-Kebîr. There are several mineral springs in the country. The climate of T. is fine, and the soil exceedingly fertile, so that, in spite of a very poor knowledge of agriculture, wheat, barley, maize, dhurra, pulse, olives, oranges, figs, grapes, pomegranates, almonds, and dates are abundantly produced. The culture of oil is more attended to, and is very lucrative. Great herds of cattle are fed on the plains; the sheep are famous for their wool; and the horses and dromedaries are no less celebrated. The chief mineral products are sea-salt, saltpetre, lead-ore, and quicksilver. In the vicinity of the sea-coasts considerable manufacturing and trading industry is manifested, more particularly in the cities of Tunis and Susa. Wool, olive-oil, wax, honey, soap, hides, coral, sponges, dates, wheat, and barley are the principal exports. Cloth, leather, silks, muslins, spices, cochineal, and arms are transported by caravans to the interior of Africa, whence are brought for export to Europe, &c., senna, gums, ostrich-feathers, gold, and ivory. Annual value of imports, £1,000,000; of exports, £1,300,000.

The predominant race is of Arabic descent, but there are many Berbers, especially in the interior. The territory of T. corresponds pretty nearly with that of ancient Carthage; and for a sketch of its pre-Christian history the reader is referred to the articles CARTHAGE, ROME, HANNIBAL, HAMILCAR, SCIPIO, JUGURTHA, &c. Its subsequent fortunes, down to 1575, are interwoven with the general fortunes of Barbary (q. v.); but in that year, Sinan Pasha conquered and incorporated it with the Ottoman Empire, and gave it a new constitution. The government was placed in the hands of a Turkish pasha, a divan or council, composed of the officers of the Turkish garrison and the commander of the Janizaries. After a few years, however, an insurrection of the soldiery broke out, and a new government was established, the head of which was a 'Dey,' possessing very limited authority; the chief power being at first exercised by the military divan. Gradually, however, an officer with the title of 'Bey,' whose original functions were confined to the collection of tribute and taxes, acquired a supremacy over the other authorities, and finally obtained a kind of sovereignty, which Murad Bey succeeded in making hereditary. The family of Murad Bey ruled in T. for 100 years, and gained considerable renown both by their conquests on the mainland, and their piratical enterprises against Christian powers at sea. During the 18th c., it became tributary to Algiers. About the beginning of the 19th c., Hamuda Pasha threw off the Algerian yoke, subdued the Turkish militia, and created a native Tunisian army; in consequence of which T. virtually attained independence. The recent rulers, Achmet Bey (1837), Mohammed Bey (1855), and Mohammed Sadyk Bey (1859), have proved liberal, enlightened, and reforming sovereigns. By a firman of October 25, 1871, the sultan renounced the tribute formerly exacted, and fixed the future relations of the Sublime Porte to Tunis. With the proclaimed purpose of chastising the Kroumir tribes, who had made incursions into Algerian territory, France sent an expedition to T. in the spring of 1881; but the outcome of the movement was that under compulsion the Bey signed a treaty giving France extensive power, and practically making T. a French dependency or protectorate. T. is still nominally under the authority of the Bey; but a French minister resident really controls affairs. The Porte protested in vain; but persistent insurrections against French authority necessitated tedious and

extensive military operations. See works on T. by Hesse-Wartegg, Reid, and Broadley (all in 1882).

TUNIS, capital of the state, lies on a small lagoon, near the south-west extremity of the Lake of Tunis, about 3 miles from the ruins of ancient Carthage. The streets are narrow, unpaved, and dirty, but the bazaars are well furnished, and many of the mosques are really splendid. The ceilings of the bey's palace glitter with gold, and carmine, and azure. The courtyard is paved with marble, and surrounded by arcades supported on marble columns. The citadel, begun by Charles V., and finished by Don John of Austria, is interesting from its collection of old arms, and was formerly the great slave-prison of Tunis. There are also Roman Catholic and Greek churches, Jews' synagogues, an Italian theater, and large barracks in Tunis. T. is the commercial center of the state. The imports in 1876 were £345,000, and exports £250,000. In the same year, 1024 vessels entered and cleared the port. T. has silk and woollen manufactures, as shawls, tapestries, mantles, burnuses, caps, turbans, colored cloths, also leather, soap, wax, and olive oil, all of which it exports, together with grain, fruits, cattle, fish, ivory, golddust, coral, &c. Pop. stated at 120,000.

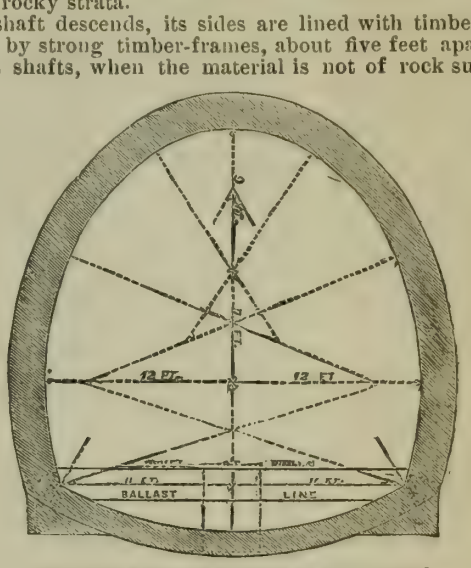
The lagoon or Lake of Tunis is shallow, and communicates with the *Gulf of Tunis*, an inlet of the Mediterranean, by a narrow strait called the Goletta. The gulf itself is 45 miles broad at the entrance—between Cape Bon and Cape Farina—and extends inland for 30 miles. The anchorage is good.

TUNKERS, a religious sect, occupying settlements in New England, New York, Pennsylvania, Ohio, Indiana, &c., and thus pretty widely scattered throughout the northern and middle parts of the United States. They are nowhere numerous, and are chiefly occupied in the cultivation of the soil. The name which they take for themselves is simply that of Brethren, and they profess that their association is founded on the principle of brotherly love. The name T. is of German origin, signifying Dippers, and is due to their dipping in baptism. It is very commonly, by corruption, pronounced and written *Dunkers*. In the vicinity of their settlements, they are generally known as the *Harmless People*. They derive their origin from a small village on the Eder in Germany, but have been an exclusively American sect since the beginning of last century, when they all emigrated to America. They were recently estimated to have over 500 churches, and some 50,000 members. They reject infant baptism, and have no ministers specially devoted to the ministry as a profession. Every brother is allowed to stand up in the congregation and exhort; and when one is found particularly apt to teach, he is ordained by laying on of hands with fasting and prayer, and is expected to devote himself in some measure to the ministry, although without any stipend or pecuniary reward, even if his own crops should suffer by his neglect of them. There are deaconesses as well as deacons among the Tunkers. Like the Quakers, they use great plainness of dress and language; they refuse to take oaths or to fight; and they will not go to law. They celebrate the Lord's Supper, and accompany it with love-feasts, washing of feet, the giving of the right hand of fellowship, and the kiss of charity. They anoint the sick with oil in order to their recovery, depending upon this unction and prayer, and rejecting the use of medicine. They generally believe in the doctrine of universal salvation; but it is not a tenet of the sect. They do not insist upon celibacy as an absolute rule; but they commend it as a virtue, and discourage marriage. They are industrious and honest, and universally held in good repute among their neighbors.

Sole dependence upon prayer for the cure of the sick is the characteristic also of a small religious sect, of which a few members are to be found in England, calling themselves the *Peculiar People*. In Switzerland, the name of Dorothea Trudel (d. 1862) was long famous for the cure of ailments by prayer. She did not, however, in all cases, refuse to call in medical advice. In Germany, a Protestant pastor, Blumhardt, pursues a similar system on a large scale, and it is said with great success.

TUNNEL. Tunnels are passages constructed under ground to carry roads, railways, canals, or streams of water. Tunneling, which has long been in use for roads and aqueducts, has of late received a great development in the construction of railways. At the present time, there are believed to be upwards of 80 miles of railway tunnels in Great Britain in constant use for the passage of trains; and as their cost averages from £45 to £50 per yard, a total of about seven millions sterling has been expended in their construction. The adjoining figure gives the ordinary section of a tunnel to carry a double line of railway. In tunnels of considerable length, as the progress made by working from the two ends would be very slow, it is considered advisable to commence the work from many points of its length; for this purpose, shafts or pits are made at these points down to the level of the tunnel. Of these shafts, some are temporary, and only kept open during the progress of the work; others are permanent, and for the purpose of ventilating the tunnel when in use. These shafts have to be large enough to allow the ascending and descending skips or buckets containing the excavated materials to pass one another. For the temporary shafts, an elliptical shape is found to give the greatest room for this purpose at the least expense. Square shafts are to be avoided, on account of the difficulty of excavating the corners in rocky strata.

As the shaft descends, its sides are lined with timber-planks, supported by strong timber-frames, about five feet apart. The permanent shafts, when the material is not of rock sufficiently



Transverse Section of a Tunnel on the Leeds and Bradford Railway.

solid, are lined with brick-work or masonry, built in lengths, as the shaft proceeds downwards. These permanent shafts are generally made circular in section, and it is found better to place them three or four yards from the side of the tunnel, communicating with it by a small passage. This is convenient in the construction, and also is a useful refuge for workmen subsequently during the passage of trains. These shafts are generally made about ten feet diameter. They are sunk a few feet below the floor of the tunnel, to form a pit for the collection of the water from the workings, which is hauled to the top in barrels or buckets. The raising of the excavations and the water, and the lowering of building materials, and of the workmen, is done by a windlass, a horse-gin, or steam-power, according to the extent of the work. On the completion of the shaft, the tunnel is commenced in both directions from its bottom; and in the case of ordinary rock, it is found convenient to commence by making a small adit, or passage, along from shaft to shaft, through the whole length of the tunnel; this is made six or seven feet high, and the top of it placed at the level of the top of the tunnel. When this is completed, the correct center line is marked out in it throughout the tunnel; the adit is then enlarged to the shape and size of the arch of the tunnel, which is built in, and then the excavation is completed, and side-walls built up to underpin the arch. In cases where the material is soft and full of water, the full section of the tunnel is generally carried forward at once, and in such cases an invert has to be built between the side-walls, to withstand the upward pressure, as the pressure of soft material has the character of a fluid pressure, and presses the tunnel on all sides. The excavation is then done in lengths of about 24 feet, which is firmly secured with poling-boards and larch bars, and securely shored; the centers are then set, and the brick-work built up. The timber bars are generally drawn out when the brick-work is carried up, and the holes they leave rammed tight with clay; but they have sometimes to be built in. When the quantity of water is very great, an adit is driven through the tunnel, at the level of its floor, before the work is begun, to allow the water to run off.

Tunnels are generally made straight, but sometimes they are curved; this is done that they may pass under the lowest part of the hill, in order that the shafts may be as short as possible. They are frequently constructed on steep gradients, but as the trains experience some resistance from the air in passing through them, it is advisable not to made them so steep as the gradients in the open air.

The Mont Cenis* tunnel greatly surpassed any earlier enterprise of the kind. This tunnel connects the railways of France and Italy, and is on the direct railway route from Paris to Turin. The length of this tunnel is 7 miles 4½ furlongs. It is 434 feet higher at Bardonnèche, on the Italian side, than at Modane, on the French side. On this account, it is on a gradient of 1 in 45½

* This is really a misnomer; the tunnel is at a considerable distance from Mont Cenis, and the chief summit under which it passes is the 'Grand Vallon' (11,000 feet high).

from Modane to the middle, and thence it falls 1 in 2000 to Bardonnèche, this latter fall being sufficient to run off the water. The dimensions at Modane are 25 feet 3½ inches wide at base, 26 feet 2¾ inches at widest part, and 24 feet 7 inches high, the arch being nearly semicircular. At Bardonnèche, it is 11¾ inches higher. It is all lined with stone-masonry, except at the Bardonnèche end, where the arch is of brick.

The work was begun in 1857, and was at first done in the usual way by hand; but in 1861, the perforating machines described below were introduced on the Italian side, and two years later (1863) on the French side. On the 30th June 1863, the tunnel had been driven 2800 yards, and the rate of advancement was 9½ feet per day. All the efforts of the engineers to accelerate the work were for several years unavailing; and in October 1866, just one-half the distance, or 6680 yards, had been pierced, showing the same constant rate of 9½ feet per day. At this rate, the tunnel would not have been completed till 1872. Owing, however, to improved modes of working, and to a favorable change in the nature of the rock, the rate of advancement became greater towards the end, and the two parties met on the 25th December 1870. The tunnel was formally opened in September 1871. A premium was to be paid by the French government to the Italian government, who did the work, for each year by which a term of 25 years, counting from 1862, was reduced. The French government were also to pay £1,287,000 for the construction of one-half the tunnel when completed.

This great work, which appeared almost impracticable to ordinary methods of tunneling by manual labor, was rendered practicable by machinery introduced by the engineers, Messrs. Sommeiller, Grandis, and Grattoni. The great difficulty lay in the fact that, from the great height of the mountain, shafts were impracticable, and progress could only be made from each end. The ventilation also presented serious difficulties. M. Sommeiller perfected a small machine, weighing 6 cwt., which bored a hole 1¼ inch diameter and 3 feet deep in twenty minutes; the time taken by two miners working by the ordinary method being two hours. Eleven of these machines were placed on a movable support, and were capable of working at almost any angle. Three or four large holes were bored in the center of the heading, and round these other holes of the ordinary size, in all 80 holes. The large holes were not fired, but were for the purpose of weakening the rock. The others were then fired in succession and in detachments, beginning with those nearest the center, and working outwards. The machines were worked by compressed air acting, like high-pressure steam, on a piston in a cylinder; this air being compressed outside the tunnel by water-power acting on the hydraulic-ram principle, and also by an air-pump; it was used at a pressure of five atmospheres above the atmospheric pressure, and was conveyed to the workings by a pipe 7⅜ inches diameter. After it had expended itself in working the borers, it escaped into the tunnel, and so ventilated the workings. The advanced heading was the only place where these machines were used. During the construction, a temporary locomotive railway was laid along the road over the pass.

The St. Gothard tunnel is a still more stupendous enterprise. It was begun in January 1871, and on 29th February 1880 the borings from the Swiss and Italian sides met, though much time and labor were still required to prepare the tunnel for railway traffic. The total length is 9½ miles, the width 21½ feet. The average rate of progress was 18 feet per day; the improved M'Kean drill, latterly used, cut its way at the rate of twelve inches per minute. The contract of the tunnel was near two millions sterling; but the actual cost, including approaches, is given at several millions more. The Hoosac tunnel in Massachusetts, U.S., is 4¾ miles long, was in progress, with intervals, from 1858 till 1876, and cost above £3,000,000. France proposes a tunnel through the Simplon. A tunnel connecting England and France beneath the English Channel, for which a company was formed in 1872, would eclipse all former undertakings; its length would be thirty-one miles.

TUNNY (*Thynnus vulgaris*), a fish of the family *Scomberidæ* (q. v.), found in the Mediterranean and in the Atlantic Ocean, but particularly abundant in the Mediterranean, where the T. fishery is of great importance. It occasionally, but rarely, occurs on the British coasts. The genus *Thynnus* is closely allied to *Scomber* (see MACKEREL), but has the dorsal fins close together, the detached finlets more numerous. The T. is a very large fish, sometimes nine feet in length, and weighing 1000 lbs., or even more. Its form is much thicker than that of the mackerel; its tail so widely forked as to be crescent-shaped. It is very plentiful near Constantinople, where it appears in shoals, sometimes so crowded that it may even be taken with the hand. The chief T. fisheries of the present day, however, are on the coasts of Spain, Italy, and Sardinia.

The Phœnicians established a T. fishery at a very early period on the coast of Spain, and the T. appears on Phœnician medals of Cadiz and Carteia. Salted T. was much esteemed by the Romans, and was called *Saltamentûm Sardicum*. The T. is generally captured by means of nets arranged in a funnel-like form, the fish entering the wide mouth of the funnel, and being gradually driven

Tunny (*Thynnus vulgaris*).

to the narrow end, where they are killed by lances and harpoons. The line of nets is often more than a quarter of a mile long, and costs about 6000 dollars.—The AMERICAN T. (*Thynnus secundodorsalis*) is found on the coasts of New York, and thence northwards to Nova Scotia. It sometimes attains a length of twelve feet. It is nearly black above, silvery on the sides, and white below. Its flesh is much esteemed. It also yields much oil, which is obtained by boiling the head and the belly. Twenty gallons of oil are often obtained from a single fish.

To the same genus with the T. belong the Bonito (q. v.) and the Albacore or Albicore (*T. albacorus*), which inhabits the West Indian seas, and is esteemed for the table. The name Albacore, however, seems to be often given to different species of this family, inhabiting tropical seas, and sometimes to the T. itself.

TU'NSTALL, a prosperous market-town in the county of Stafford. Pop. (1881) 14,244.

TUPAIA. See BANXRING.

TU'PELO (*Nyssa*), a genus of trees of the natural order *Alangiaceæ*, natives of North America, chiefly of the southern parts of the United States; having simple alternate leaves, mostly entire, greenish inconspicuous flowers at the extremity of long stalks, the fruit a drupe. *N. villosa* attains a height of 60—70 feet. It is often called BLACK GUM TREE. *N. tomentosa*, the LARGE T., is a lofty and beautiful tree, remarkable for the extraordinary enlargement of the base of the trunk, which is sometimes eight or nine feet in diameter, whilst at no great height the diameter diminishes to fifteen or twenty inches. The fruit resembles a small olive, and is preserved in the same way by the French settlers in America. *N. candicans* or *capitata*, the OGECHEE LIME or SOUR GUM TREE, is a small tree, of which the fruit is very acid, and is used like that of the lime. The wood of all the species is soft, that of the Large T. remarkably so.

TUPPER, MARTIN FARQUHAR, D.C.L., F.R.S., a poet rather popular than great, was born on 17th July 1810. His father, Martin Tupper, was a well-known London surgeon, of a family originally German, which had long been settled in Guernsey. Martin T. was educated at the Charter-house, and afterwards at Christchurch, Oxford. On leaving college, he entered himself as a student at Lincoln's Inn, and was called to the bar in 1835; but literature had more charms for him than the law, which he never seriously prosecuted. In 1832, he published anonymously a small volume of poems, which attracted little attention. For this lack of success, he was, however, amply repaid on the appearance, in 1839, of his *Proverbial Philosophy*. The popularity of this work in England, and still more in America, has ever since been immense, and almost unprecedented. The critics have indeed been less kind to it than the reading public; and the fame of Mr. T. has long been a topic of mirth to the wits of the literary guild; but from the serene height of his fortieth edition an author can perhaps afford to smile at the attacks of the envious generation below.

A fair criticism would probably adjudge that, while there is nothing in Mr. T.'s *Proverbial Philosophy* to justify its enormous success—so far as mere circulation is success—the book is yet something better than the mere conglomeration of stupid platitudes, which its detractors so confidently proclaim it to be. Besides this work, on which his reputation—such as it may be—rests, Mr. T. has published *The Crock of Gold*, a tale; *Geraldine*, a sufficiently ludicrous attempt to complete Coleridge's inimitable fragment *Christabel;* with various other works in prose and verse, which it is quite unnecessary to enumerate, inasmuch as no one of them has succeeded in making the least impression on the public.

TURA'NIAN LANGUAGES. In opposition to *Iran*, the name of their own country, the Persians from the earliest times called the countries lying to the north of it Turan, and this name

is still frequently used as synonymous with Turkestan. The term Turanian derived from it has been adopted by philologists, in contrast with Aryan (q. v.), to designate a family of languages comprising 'all languages spoken in Asia and Europe (including Oceania), and not included under the Aryan and Semitic families, with the exception of Chinese and its cognate dialects.' The languages of this family are of the agglutinate order (see PHILOLOGY). Max Müller classes them in two great divisions, the Northern and the Southern. The Northern division falls into five sections—the *Tungusic*, *Mongolic*, *Turkic*, *Finnic*, and *Samoyedic*. Of these, the Tungusic dialects, which extend north and west from China, are the lowest in organization, being, some of them, nearly as destitute of grammatical forms as the Chinese. The Mongolic dialects are superior to the Tungusic, although the different parts of speech are hardly distinguished; both branches, however, are believed to be manifesting symptoms of grammatical development. The Turkic dialects, of which the Osmanli or Turkish of Constantinople is the most prominent, occupy an immense area, extending from the Lena and the Polar Sea to the Adriatic. They are extremely rich in grammatical forms, especially in the conjugation of the verb. The most important members of the Finnic class are the Finnic of the Baltic coasts (see FINNS), and the Hungarian language, or Magyar (see HUNGARY). These dialects have also a fully developed grammatical structure, and in point of declension are even richer than the Turkic.

The Southern division comprises, among others, the *Tamulic* or Dravidian dialects of Southern India (see TAMIL); the *Gangetic* group, divided into two branches, the Trans-Himalayan (Tibetan, q. v.) and Sub-Himalayan (Bhotanese, &c.); the *Taic*, or the dialects of Siam; and the *Malaic*, or Malay and Polynesian dialects. The Turanian languages do not present the same unmistakable family likeness, the same clear evidences of genealogical relationship, as are presented by the Aryan and Semitic groups. The nature of their structure, and the nomadic character of the peoples speaking them, are sufficient to account for their exceeding diversity, even supposing them to have all sprung from the same original stock. 'The only characteristic Turanian feature which always remains is this: the root is never obscured. Besides this, the determining or modifying syllables are generally placed at the end, and the vowels do not become so absolutely fixed for each syllable as in Sanscrit and Hebrew. On the contrary, there is what is called the Law of Harmony, according to which the vowels of each word may be changed and modulated so as to harmonize with the key-note struck by its chief vowel. The vowels in Turkish, for instance, are divided into two classes, *sharp* and *flat*. If a verb contains a sharp vowel in its radical portion, the vowels of the terminations are all sharp; while the same terminations, if following a root with a flat vowel, modulate their own vowels into the flat key. Thus we have *sev-mek*, to love, but *bak-mak*, to regard, *mek* or *mak* being the termination of the infinitive. Thus, we say, *so-ler*, the houses, but *at-lar*, the horses, *ler* or *lar* being the termination of the plural.'—Max Müller's *Science of Language*, 1st series.

TU'RBARY, in the Law of England, is a right to go upon the soil of another and dig turf, and carry away the same. It is classed under the head of a *Profit à Prendre*, and is generally traced to some ancient custom of a manor, or is proved by prescription, or long use for thirty years and upwards.

TU'RBINE. See WATER-POWER.

TURBI'NIDÆ, a family of gasteropodous molluscs, having a spiral shell, with a narrow entire aperture. The species are numerous; some of them are found on the British coasts. They are numerous and widely distributed. Some are large, others small; some are very beautiful. The beautiful pheasant-shells (*Phasianella*) of the South Seas are referred to this family.

TU'RBOT (*Rhombus maximus*), a fish of the family *Pleuronectidæ*, or Flat-fishes, the most valuable of them all. The genus *Rhombus* has the body rhomboidal; the dorsal fin commencing immediately above the upper lip, and extending almost to the tail-fin; the eyes generally on the left side. The Brill (q. v.) belongs to it as well as the T., and some other less important fishes. The T. attains a large size, sometimes 70—90 lbs. weight. Its form is shorter, broader, and deeper than that of almost any other flat-fish. It is of a brown color on the upper surface, which is studded with hard roundish tubercles. Like the other flat-fishes, it generally keeps close to the bottom of the sea; and it is found chiefly on banks where there is a considerable depth of water. Some of the banks in the German Ocean abound in T.—as the Dogger Bank—and yield great quantities to the London market. The T., however, is also found, although more sparingly, in estuaries. In former times, it was chiefly caught by long lines; but of late, the greater part of the supply for the London market is obtained by beam-trawling (see TRAWLING). Few kinds of fish are more prized for the table than the turbot. —The AMERICAN or SPOTTED T. (*Rhombus maculatus*) is also highly esteemed for the table. It is common on the coasts of New England and New York. It attains a weight of 20 lbs. The breadth is about one-half of the length. The upper surface is smooth, reddish gray, with large circular or oblong darker blotches, and numerous white spots.

TURDI'DÆ. See MERULIDÆ.

TURENNE, HENRI DE LA TOUR D'AUVERGNE, VICOMTE DE, one of the most eminent of France's military heroes, was the second son of Henri, Duke of Bouillon, and Elizabeth of Nassau, the daughter of William I. of Nassau-Orange, the great assertor of the liberties of the Netherlands, and was born at Sedan, in the dep. of Ardennes, 11th September 1611. Brought up in the Reformed faith, he was sent, on the death of his father in 1623, to Holland, where, under his uncle, the celebrated Maurice (q. v.), he was initiated into the art of war. Returning to France in 1630, he was favorably received by Richelieu, who at once gave him a commission. In 1637, he was attached to the army of Bernard of Weimar, which at that time was engaged in Lorraine; and by bringing about the capture of Landrecies, Maubeuge, and other places, including the key of Western Germany, Brisach, gained such repute, that on his return to Paris (1638), he experienced quite a triumphal reception. The victories of Route and Casale in the Italian campaign of the following year, added to his laurels; and in 1641 he was for the first time intrusted with the supreme command. The rapid and thorough conquest of Roussillon from the Spaniards in 1642, was good proof of his masterly military genius, and was rewarded in 1643 with the baton of a marshal of France, and the chief command on the Rhine, where repeated reverses, a defective commissariat, and want of pay, had completely demoralized the army. But through a liberal expenditure of his own funds, and of loans obtained by him on his own security, the troops were speedily re-equipped; and by a victory over the Bavarians at Rottweil (1644), their *morale* was restored. Condé's arrival transferred him to a subordinate position; and his restoration to supreme command was followed by the commission of a glaring strategic error for which he was severely punished by his able and watchful opponent, Mercy, who completely routed him at Marienthal, 5th May 1645; but on August 3 of the same year, this disgrace was amply avenged by Condé at Nordlingen, where Mercy was slain; and T. gloriously concluded the war on the part of France by the reconquest of the Treves electorate, by the conquest of Bavaria in conjunction with the Swedes, and by a successful campaign in Flanders.

In the civil wars of the Fronde (q. v.), which immediately followed, T. joined the party of the *frondeurs*, of whom his elder brother was one of the principal leaders; but after being defeated at Rethel (December 15, 1650), he withdrew to Flanders, returning on Mazarin's retirement. On the minister's return, T. joined his party, while Condé deserted to the *frondeurs*, and the two greatest generals of the period were for the first time pitted against each other. T. was uniformly victorious over his former chief, though his forces were inferior in number; and ultimately forced him to retire from France; after which he subdued the revolted cities, crossed the northern frontier, and conquered much of the Spanish Netherlands. In 1667, on the outbreak of war between France and Holland, Louis XIV. created T. Marshal-general of France, and would have made him Constable, had he not been a Protestant. Indeed, the unorthodoxy of T. had for some time been a matter of grave concern to the bigoted young monarch, at whose suggestion Bossuet attempted the veteran's conversion by composing his celebrated *Exposition de la Doctrine Chrétienne*, which, backed by the king's repeated solicitations and remonstrances, and doubtless, as Voltaire suggests, by the more efficacious promptings of ambition, had ultimately the desired effect. T.'s campaign in Holland, in which he was nominally under Louis's command, was a most triumphant one; and the Elector of Brandenburg, who had ventured to side with the Dutch, was pursued to Berlin (1672), and forced to beg for peace. The emperor next took up arms on behalf of Holland, whereupon T. was transferred to the Upper Rhine. This, his last campaign, is foully disfigured by the horrible devastation of the Palatinate, executed under express orders, doubtless, but with a willing thoroughness which is utterly unjustifiable. After routing the Germans at Mulhausen and Turckheim, and forcing them across the Rhine, he was at last opposed to a worthy antagonist in Montecuculi (q. v.); but, unfortunately, their famous passage of strategy of nearly half a year's duration was left unfinished, T. being killed while reconnoitring the ground at Salzbach, with a view to a grand engagement. His grateful sovereign, to show that he made no distinction *entre porter le sceptre, et le bien soutenir*, ordered him to be entombed at Saint Denis, and funeral orations were pronounced for him by Flechier and Mascaron. T.'s monument suffered at the Revolution, and was ultimately placed by Napoleon under the dome of the Invalides. T. left Memoirs of his campaigns.

TURF LAWS. The laws concerning the ancient pastime of horse-racing are subdivided into those affecting races, wagers, and betting-houses, for which last, see BETTING. 1. As to racing, it

has sometimes been popularly believed that the public have a right to trespass on lands to attend or to hold races; but no such right exists. Hence the stewards or persons intrusted with the management and possession of the land for the time have a right, which is seldom enforced, to turn off any person they please from the grounds. A sweepstakes is a stake or fund, for which at least three entrances must be made, and the whole stake becomes, under certain regulations, the property of the winner. Many of the great races are not run within a year from the time the horses are entered. The owner of a horse entered can withdraw or 'scratch' him before the race is run. When the race is run, the successful party may sue for the amount of the stakes; and if the race is not run, or cannot be run, each subscriber may sue for recovery of his contribution; but no one can obtain his contribution, or countermand it, till the event has happened, for a sweepstakes is a legal contract to abide the result. If the stakes are contributed for an illegal game, it is otherwise; and before the stakes have been paid away, any contributor may sue for and recover his deposit. The stewards are the proper parties to decide all disputes about the fairness of a race, and their award is binding: if they cannot agree, then it will fall to be decided by a jury. —2. As to wagers. By the act 8 and 9 Vict. c. 109, s. 15, all wagers were declared void, except as regards subscriptions of money or plate to be awarded to the winner of a lawful game, sport, pastime, or exercise. If one makes a wager on a race, he may retract it any time before the event comes off, and require the money, if deposited, to be repaid; and no wager can be tried in any court of law or equity, so that the winner cannot compel payment. It is merely a debt of honor.

TURFAN, an important city in the east of Eastern Turkestan (which is sometimes named after it), on the southern slope of the Thian Shan Mountains. It consists of about 6000 houses.

TURGENEF (or TOURGUÉNIEF), IVAN SERGEJEVITSCH, one of the best modern Russian novelists, was born at Orel, 9th Nov. 1818, educated at Moscow and Berlin, and obtained a post under the minister of the interior. He became known as a poet in 1843. He was banished in 1852 for his liberalism; and though afterwards pardoned, has lived mostly at Paris and Baden. T. is a very prolific author; of his novels, the chief that have been translated are *Russian Life*, *Fathers and Sons*, *Smoke*, *Liza*, *Spring Floods*, and *Virgin Soil* (1877).

TURGOT, ANNE ROBERT JACQUES, French statesman, born in Paris, May 10, 1727, was descended from one of the oldest families in Normandy. T. was destined for an ecclesiastical career, but adopted by preference the profession of law. In 1761, he was appointed Intendant of Limoges, and administered the affairs of the province for thirteen years. He introduced a more equitable administration of imposts, and succeeded in abolishing the old method of repairing roads and bridges by the compulsory labor of the poor inhabitants of the district, called *corvées*. He also exerted himself in providing for the subsistence of the people and the protection of commerce. He introduced into the Limoges the cultivation of potatoes. A wider field opened before him on the death of Louis XV. The finances were in a terrible state of disorder, the whole social and political system of France needed regeneration and reform; and T. appeared to be the man to meet the crisis. He was first made Minister of Marine, and afterwards Comptroller-general of France, when to fill that post was to be virtually the Prime Minister. In his letter to Louis XVI., he adopted, as the principle of his administration, that there should be 'no bankruptcy, no augmentation of imposts, no loans;' yet he foresaw that the strength of the privileged classes, and the corrupt influence of those who profited by abuses, would be too much for him, and that against such enemies he could hardly hope to retain the confidence of the king.

His first task was so far to reduce the expenditure as to leave a surplus of 20 millions of francs a year, to be applied to the liquidation of old debts. He augmented the public revenue without imposing new taxes, and he introduced exactness of payments and fidelity of engagements into all his financial operations. One of his first measures was the carrying out of free-trade in corn throughout the interior of the kingdom. He constantly occupied himself with the amelioration of the condition of the people. He proposed to enfranchise the rural districts from statute labor, provinces from their barriers, commerce from internal duties, trade from its shackles, and, lastly, to make the nobility and clergy contribute to the taxes in the same proportion as the third estate. This great minister and virtuous citizen, of whom his colleague, Malesherbes, said: 'He has the head of Bacon, and the heart of L'Hopital,' wished, by means of provincial assemblies, to accustom the nation to public life, and prepare it for the restoration of the States-general. If the nobility and privileged classes had possessed enough of foresight and patriotism to submit to his plans for reforming France, she might have been spared the horrors and excesses of the Revolution. But his projects for the public good were defeated by the confederacy formed against him by nobles, courtiers, farmers of the revenue, and financiers. The king forsook him, although, at the same time, observing that T. and himself were the only persons who desired the welfare of the people. He retired, having held office for only twenty months. It is alleged against his practical talent for statesmanship, that he labored under a want of address, and that he did not sufficiently dissemble his hatred and contempt for the cowardice and baseness of those who fattened upon the abuses that were eating like an ulcer into the heart of France. After his retirement, he resumed his early worship of the Muses. His Latin inscription for the portrait of Franklin is a line of which any author might be proud: 'Eripuit cœlo fulmen, sceptrumque tyrannis.' He also devoted himself to physics and mathematics. His works are a mine of sound and original thought. His *Mémoire* on the American war expresses views on the nature of colonies which have since been adopted by the best writers. His work on *Usury* contains almost all that is of value in Bentham's *Letters on the Usury Laws*. He held general objections to charitable institutions. He died of gout, March 20, 1781, leaving behind him a memory which France will ever cherish with veneration.

TURI'N (*Augusta Taurinorum*, *Bodincomagus*, *Colonia Julia*, *Taurasia*—in Italian, *Torino*), a city of Northern Italy, formerly capital of Piedmont, then of the kingdom of Italy, is situated near the confluence of the Po and the Dora Ripaira, 45° 5′ N. lat., 7° 42′ E. long. Its pop. at the beginning of this century was 42,000 —in 1863, it was 235,000; now that it is no longer the capital, it is reduced to (1881) 226,307. It began to acquire importance when Amadeus V. declared it the capital of Savoy in 1418, built a castle there, and made it his residence. In 1620, Charles Emanuel I. enlarged the city by royal decree: it was still more enlarged in 1673 and in 1702. At the beginning of this century, the French destroyed and levelled the ramparts of the town, converting them into public promenades. Of late years, the moats and fortifications have been demolished, to make way for new streets towards Porta-Susa. In consequence of these improvements, T. has become one of the handsomest cities in Europe. It is famed for its handsome squares. Some of the finest are—Piazza San Carlo, surrounded by wide porticoes, and adorned by a fine equestrian statue of Emanuel Philibert of Savoy, by Marochetti; Piazza Castello, also surrounded by porticoes, which are prolonged down Via Po to the end of Piazza Vittorio Emanuele, the finest square in Europe for size, regularity of architecture, and beauty of situation; Piazza Carlo Felice, with porticoes and a fine garden; Piazza Carlo Alberto, with an equestrian statue of the king of that name by Marochetti; Piazza d'Armi, a vast open space for military exercises, flanked by the old and new arsenals of the kingdom. Leading out of Piazza Vittorio Emanuele, there is a handsome five-arched bridge across the Po, begun by Napoleon I., with money got by the sale of the jewels and votive offerings of the cathedral, and finished by the kings of Sardinia. Another fine bridge is that across the Dora, of one single arch, nearly straight, the work of the engineer Mosca.

Among the numerous churches, the principal are the cathedral of San Giovanni, a Gothic structure, built in the 7th c., and reconstructed in 1498; San Filippo, the handsomest church in T.; La Consolata; La Gran Madre di Dio; and a Waldensian temple. On the summit of a hill near the town is La Superga, a splendid Basilica, raised by Victor Amadeus to fulfil a vow, and now the mausoleum of the House of Savoy. Among the 'palaces,' must be noticed the royal palace, designed by Castellamonte, which is poor in outward appearance; the Carignano Palace, an odd building, by Guarini; the town-hall designed by Lanfranchi; the university, with 71 professorships and about 900 students, a library of 120,000 vols., and 2000 MSS.; the Accademia delle Scienze, with an Egyptian museum, the finest in Europe; the Seminary; the Hospital of San Giovanni. The private palaces are numerous and vast, but in a bad style of architecture. There is the Theater Royal; the Carignano Theater, designed by Alfieri; the Vittorio Emanuele, and many other theaters.

The manufactures of T. consist of woollen and silk fabrics, velvet hats, paper, pottery, leather, arms, and liqueurs. The population is sober, industrious, and generally well off.

T. was originally inhabited by the Taurinians, a tribe of Ligurians. It is first mentioned in history in the time of Hannibal, by whom it was taken and sacked, on his descent into Italy after crossing the Alps. T. became a royal colony, 166 B.C., and was called by Augustus, *Augusta Taurinorum*. On the fall of the Empire, it went to the Lombards, and became the capital of one of the 30 Lombard duchies. Charlemagne made it the residence of the Duke of Susa, whose line ruled till 1032, when the House of Savoy succeeded it. It was taken by the French in 1506, and held by them for nearly 60 years. They again took it in 1640; and in 1796, it was dismantled, and united to the French Empire in 1800 with the name of the department of the Po. In 1815, it was restored to the House of Savoy.

TURKESTA'N, 'the country of the Turks,' called also *Jagatai*, and by the Persians *Turan*, is an extensive region of Central Asia, stretching from the Caspian Sea eastward to beyond Lob-nor (long. 110° E.), and from Siberia and Dzungaria southward to Persia, Afghanistan, and Tibet. Until quite recently, it was supposed that the Bolor Tagh (q. v.), a mountain chain of the first magnitude, running north and south, divided it into two parts. English explorers entering T. from the south, and Russians from the north, have shown that no such range exists. Its place is taken so far, however, by a lofty table-land, the Pamir Steppe, which, sloping gently toward the east and west, separates the rivers running eastward to the desert of Gobi from those which run to the Sea of Aral. It separates T. into a western and an eastern portion.

WESTERN TURKESTAN, *Great Bukharia*, or simply *Turkestan* or *Turan*, consists of the great hollow plain of the Caspian and Aral Seas, which occupies its west and center, and of the hilly and well-watered districts formed by the ramifications of the Thian-shan Mountains and Hindu Kush. The plain is composed of deserts of loose shifting sand, interspersed with oases where a subsoil of clay renders the formation of lakelets of rain possible; strips of fertile land along the banks of rivers, and occasional tracts clad with coarse thin grass; the eastern districts abound in valleys of remarkable fertility. The climate varies on the plains from extreme cold to burning heat, and though, in the eastern highlands, the cold is almost as intense in winter, the heat of summer is much less. The rivers of T. are the Sir-Daria (see JAXARTES) and Amu-Daria (see OXUS); the Zer-Afshan, which rises on the south of the Asfera-tag, and flows westward for 400 miles, terminating in a small salt lake or marsh near Bokhara; and the Murghab, which rises in the mountains of Ghur, and after a west-north-west course of 450 miles, loses itself in a marsh beyond Merv. The vegetable products of the country are fruits, grain, cotton, flax, hemp, and tobacco. Silk is also produced in considerable amount. Forests can hardly be said to be at all represented in this extensive region. Salt is abundant, large tracts of desert being strongly impregnated and even crusted over with it; and sal ammoniac is common. Agriculture, and the breeding of the domestic animals, are the occupations of the great mass of the population; but manufacturing industry is also considerable. The produce consists of cotton, silk, linen, and woollen goods, shagreen (superior to that manufactured in Europe) and other kinds of leather, paper made of raw silk, carpets, and a few sabres, knives, and rifles.

Western T. is divided into Russian T., including Khokan (q. v.), now Ferghana, in the north and north-east; Khiva (q. v.), under Russian influence, in the west; Bokhara and its dependencies in the east and center; the country of the independent Turkomans, including the town of Merv; and Afghan T., including Badakshan (q. v.) and Kunduz, Balkh (q. v.), Maimaneh, Andkhui, and Sir-i-pul. The population comprises Uzbeks (q. v.), the dominant race, Turkomans, Karakalpaks, Kirghis (q. v.), Sarts or Tajiks, Persians, Kiptchaks, and a few Arabs, Hindus, and Jews. Of these, the Sarts or Tajiks, the original inhabitants of the cities, are of ancient Persian stock, and along with the Uzbeks, Hindus, and Jews, form the settled population; the Persians are either slaves, or, being introduced into T. as such, have obtained their freedom, and settled in the country; the other races are mostly nomad and predatory. The prevalent religion is Mohammedanism, and most of the tribes are Sunnites. A few Sheeahs, Sufis, and Buddhists are also found.

T. has played an important part in Asiatic history from the very earliest times. The contests between the Iranian and Turanian races occupy a prominent place in Firdusi's sketch of the semi-mythical traditions of Persia; and the earliest light of history shows us Bactriana (Balkh) and Sogdiana (Bokhara) as well cultivated and populous countries, generally attached to the Persian empire, and inhabited by Persians, to whom most of the prominent cities of T. owe their origin. With Persia, T. passed into the hands of the Macedonians, who made Bactria an independent Greek kingdom, while the rest was in possession of the Parthians. Under the Sassanides, the Persian boundary was again advanced to the Jaxartes; but the gradual gathering of Turkish tribes from the north-east on the right bank of that river, led to a constant state of warfare on the frontier, which ultimately resulted in the occupation of *Mawer-ul-Neher* ('the country between the rivers' i e., the Oxus and Jaxartes) and of Khaurezm (Khiva) by the invaders.

In the 8th c. of the Christian era, the Arabs possessed themselves of T., and during the decline of the califate, it became the seat of various minor dynasties, as the Samani (q. v.) in Mawer-ul-neher, and the shahs of Khaurezm; and after a brief union with the Seljuk empire in Persia, was mostly united to Khaurezm, and along with it overrun by the Mongol hordes under Genghis Khan (q. v.), on whose death it became one of the four divisions of his vast empire, and was allotted to his son Jagatai. On the decline of Jagatai's dynasty, Timûr (q. v.) rose to supreme authority in T., and in the course of a 35 years' reign, made it the center of an immense empire, which stretched from the Hellespont to the frontiers of China, and from Moscow to the Ganges. This period was the golden age of T.; its powerful monarch was never weary of adorning its cities with the spoils of victory; colonies of learned men, skilled artisans, and all whose knowledge or abilities could be of service to his subjects, were either tranferred to T. from the countries he had conquered, or induced by the most munificent offers to settle there; till under him and his more immediate successors, Samarkand became a focus of enlightenment and learning. But after the death of Shah Rokh, Timûr's youngest son, the empire was split up into numerous fragments; and after a time a new dynasty snatched Persia from Timûr's family, while the Uzbeks, under Sheibanî Khan, drove them (1500) from the country north of the Amu-Daria; one of the expelled princes, Mirza Baber, who had ruled in Ferghana (the south half of Khokan), subsequently founding the 'Great Mogul' empire in Hindustan. The Uzbek empire generally included Badakshan, Herat, and Meshed; but these were lost on its division, in 1658, into various independent khanates. Khiva was conquered by Nadir Shah in 1740, and Bokhara limited to the north bank of the Amu-Daria; but the Kirghis of the Little Horde restored the independence of Khiva, which they ruled till 1792, when the present Uzbek dynasty obtained the throne; and Shah Murad (1806—1822), celebrated under the appellation of *Beggee Jan*, effectually re-established its former extensive sway to the Bokhariot sceptre.

Khokan, after emancipating itself from the authority of Sheibanî's successors was incorporated with Bokhara; but afterwards united with the states of Eastern T.; and on their conquest by China, resumed its independence. The recent history of T. records a series of wars between Bokhara and Khokan, and Bokhara and Khiva, in which the Bokhariots had generally the advantage, owing to the aid of the Turkomans of the southern desert, whom they subsidized; the raids of the Turkomans along the northern frontier of Persia; the advance of the Afghans from the south-east; and the progress of Russian conquest from the north and west. To explain the Turkoman raids, a few additional words on the geography of T. are necessary. Between the deserts of T. and those of Persia lies a long and fertile tract running from the south-east of the Caspian to Herat, the 'key to India;' over it pass the great routes from Western to Eastern Asia. North of it, chiefly in the deserts, dwell the Turkomans, a population of one million of savage brigands and man-stealers, constantly engaged in marauding expeditions against the Northern Persians. They have desolated the frontier, and the atrocities they commit far exceed anything recorded of the African slave-trade. In 1860, Hanza Mirza, an uncle of the present shah, marched against them, but was defeated in attempting to capture their intrenchments in a marsh. On that occasion, 15,000 Persians and 30 guns were taken by the Turkomans. In 1865, a more successful expedition proceeded against Saraks, and the guns were recovered. Still the northern routes are in the hands of the Turkomans, more especially that leading by the Daman-i-koh Hills; and so late as 1872, reports appeared of Turkoman raids in Northern Persia. The south-eastern part of T. has also been the scene of recent strife. The Afghans have invaded it for the recovery of possessions they claimed north of the Hindu-Kush. In 1850, they took Balkh and Khulm, and in 1859, Kunduz, Badakshan at the same time submitting to pay a large tribute. The English and Russian governments seem now to recognize the claim of the Afghans to fix their frontier at the Oxus (see debate in House of Commons, 22d April 1873).

The Russians bid fair soon to absorb all that remains of independent Turkestan. In 1864, they invaded Khokan, and took Tashkend and Khokan. A struggle followed with Bokhara. On the 20th May 1866 was fought the battle of Irjar, the most important event in the recent history of Turkestan. The emir had to flee for his life, leaving his camp in the hands of the enemy. In 1868, the Russians, 8000 men, again advanced and crossed the river of Samarkand. The troops of the emir, 40,000 men, took te flight when they saw the Russians approach with their dreaded artillery, and on 14th June a treaty was concluded, by which Bokhara transferred to Russia Samarkand and all the territory north and east of it. Khiva still remained independent in the midst of its deserts. But early in 1873 an expedition in four divisions set out from the Russian frontier posts against Khiva, which fell in June of that year, after no great resistance. A great part of Khivan territory north of the Amu-Daria was ceded to the conquerors; and after a fierce struggle in 1875 and 1876 with the warlike inhabitants of Khokan, which is now the Russian province of Ferghâna, Russia formally annexed the whole. The news of the fall of Khiva was welcomed in this country as a triumph of civilization over barbarism; but the further annexation of Khokan provoked the fear that Russia will go on to annex other territories now in the hands of the Turkomans, including the northern routes to Herat. In 1879, the Russians attacked the Akhal Tekke Turkomans, living on the southern edge of the Kara Kum desert be-

tween the Caspian and Merv, but were repulsed. An expedition in 1880–81, under Skobeleff, ended in the total defeat and subjection of the Tekkes. See Vambery's *Bokhara;* Schuyler's *Turkestan;* Marvin's *Merv, Queen of the World* (1881); *Geog. Mag.*, 1875–76; *Proc. Geog. Soc.*, 1881; O'Donovan's *Merv Oasis* (1882).

EASTERN TURKESTAN, known also as *Upper Tartary, Chinese Turkestan, Little Bukharia,* and *Túrfan,* is bounded on the north by the Thian-shan Mountains, on the west by the Pamir tableland, and on the south by the highlands of Tibet or Cashmere. Towards the east it sinks to the desert plain of the Gobi, round the western bay of which it forms a vast crescent-shaped oasis from 4000 to 5000 feet in elevation, drained by the tributaries of the Tarim. This river flows eastward into the desert, and empties itself in the Lob-nor, after a course of 1500 miles. The Lob-nor, a lake or rather series of lakes and marshes, was visited by Colonel Prejevalsky in 1877. The region around it is very desolate and unattractive. Mr. Shaw the first Englishman who visited Eastern Turkestan, gave a very enthusiastic account of its capabilities as a field for English commerce as it was when under the late Emir, Yakoob Beg (see his report, 1871). Mr. Shaw described the plains as covered with corn-fields and orchards, though their fertility is dependent on irrigation. Canals ramify the country, sometimes crossing one another at three levels. But large areas are very unproductive; and though there are numerous villages and towns, some of them large, the population of the country as a whole—probably some 600,000—is but thin. The country produces gold and abundance of silk; and the inhabitants are skilful in making gold and silver stuffs, carpets, and linen, cotton, and silk goods. The political capital is Kashgar; the commercial capital, Yarkand. In the latter are numerous colleges and schools; in both there used to be an active trade, with resident representatives of most of the nations of Asia. But since the re-conquest of the country by China, anarchy prevails, and trade is for the time being destroyed; all the more as Kuldja, taken by the Russians from the rebels against Chinese authority in 1871, has been retained by Russia, in spite of Chinese protestations. In 1879, however, it was understood that Kuldja was to be restored to China. The inhabitants speak Turkish, but are said to be of Persian descent.

Little is known of Eastern T. previous to its conquest by Genghis Khan; but after the decay of his empire into petty states, among which are Kashgar, Yarkand, Aksu, and Khoten, the chiefs of these were constantly quarreling with each other—a temporary peace being occasionally produced by their subjection to some powerful neighbor—till several of the leaders, with the Yarkand prince at their head, invited the Chinese to take possession of the country, and in 1758 it became a povince of China. In 1864, however, a mutiny among the Chinese troops induced the dispossessed native chiefs to stir up a Mohammedan insurrection. They invited a Khokan prince, Buzurg Khan, to assume the government. Through his lieutenant Yakoob Beg, he dispersed the Chinese garrison left to defend the fort of Kashgar. But the lieutenant soon superseded him, and became sole Emir under the title of Athalik Ghazi. He possessed civil as well as military capacity, and raised the country to a state of considerable prosperity. He sent an envoy to Calcutta in 1872, and in 1873 Sir T. D. Forsyth visited Kashgar from the Indian government. But the Emir's position did not secure more intimate relations. He had since 1869 successfully resisted the encroachments of Russia, but in 1876 the Chinese again advanced, defeated him, and retook their old province in 1877. The Emir died shortly after. See Forsyth's *Report* (1875); *From Kulja, across the Tian Shan to Lob-Nor,* by Colonel N. Prejevalsky (1879); Boulger's *Life of Yakoob Beg* (1878).

TU'RKEY, or the OTTOMAN EMPIRE (q. v.), includes large portions of the continents of Europe, Asia, and Africa, and consists of Turkey Proper, which is under the direct rule of the sultan, and of several dependent and tributary states. The arrangements sanctioned by the Berlin Congress in 1878 have largely changed the size and organization of the empire. Turkish affairs could not soon be expected to settle into equilibrium; and on most subjects reliable statistical results are at best approximate. In any case, it is necessary for an understanding of Turkey as it now is, to begin with Turkey as it was before the last momentous war with Russia.

The *Almanach de Gotha* of 1878 gave the following estimates of the area and population of the Turkish empire before the sweeping changes agreed to at Berlin:

	Sq. Miles.	Population.
I. Immediate Possessions—		
In Europe	139,824	9,400,364
In Asia and Africa	1,083,673	18,079,112
District of Constantinople	....	1,400,000
Nomadic races	....	2,000,000
Army and Police	....	560,262
Foreign residents in Turkey	....	500,000
	1,223,497	31,939,738
II. Protectorates—		
In Europe { Roumania	46,617	5,073,000
In Europe { Servia	14,549	1,367,000
In Africa { Egypt	866,012	17,000,000
In Africa { Tunis	45,538	2,000,000
III. Tributary Principality of Samos	212	35,878
	972,928	25,475,878
Turkish Empire	2,196,425	57,415,616

Montenegro, formerly a tributary state, had been virtually independent for many years.

The population of the various provinces, even of European Turkey, has always been difficult to ascertain. The most satisfactory estimate was probably one made before the vilayet of Herzegovina was separated from Bosnia, and published in 1876 in the Vienna journal, *Monatsschrift für den Orient.* This was based on the *Salnamés,* or official almanacs of the vilayets, and shows at the same time the distribution of the religions in the provinces, but it takes account only of the male population.

	Moslems.	Non-Moslems.
Vilayet of Bosnia	309,522	306,707
" Monastir	485,993	417,805
" Janina	250,749	467,601
" Salonica	124,828	124,157
" Adrianople	235,587	401,148
" Danube	455,767	715,938
	1,862,446	2,433,356

Constantinople, not included in any of the six vilayets, had a total population of 680,000. The total male population of European T., excluding the vassal provinces, was 4,976,000. The entire population of both sexes might, therefore, be assumed to exceed 10,000,000. The proportion of Non-Moslems to Moslems given above (57 to 43) probably understates the numerical predominance of the former.

Many of these estimates have of course become obsolete since the Berlin Congress of 1878 (see History of the OTTOMAN EMPIRE). This Congress, which met primarily to revise the 'preliminary' treaty of San Stefano, concluded between Russia and Turkey at the close of the war of 1877–78, has revolutionized the relation of the Porte to the subject Christian principalities and provinces, alienated large portions of hitherto Turkish territory, and inaugurated what must necessarily be a new era in the history of the Ottoman empire. The principal results of the Congress's work are treated under the several heads of the states they chiefly concern (see ROUMANIA, SERVIA, MONTENEGRO, BULGARIA, &c.), but must here be briefly summarized.

The vassal states Roumania and Servia, as well as Montenegro, were declared independent, and each obtained a change or extension of territory; Roumania, which had to yield up its portion of Bessarabia to Russia, received in compensation the Dobrudscha, cut off by a line from Silistria to Mangalia. Servia was considerably extended to the south. Montenegro received an important addition to its territory, chiefly on the Albanian side, including the port of Antivari. (Dulcigno with its district was added in 1880.) What was formerly the Turkish vilayet of the Danube, was, with the exception of the Dobrudscha, now Roumanian, made into the tributary but automatic principality of Bulgaria, its southern boundary being the Balkan range. A large territory to the south of the Balkans was organized as the separate province of Eastern Roumelia, and though remaining directly under the military and political authority of the Sultan, secured the right of having a Christian governor-general and administrative autonomy.

It was agreed that Herzegovina and Bosnia, excepting a small portion of the latter, should be occupied and administered by Austro-Hungary, and thus in large measure alienated from the Porte; Spizza and its sea-board, immediately north of Antivari, was incorporated with Dalmatia; Greece was to receive additional territory; the Congress recommending that the rectified frontier should run up the Salambria River from its mouth, cross the ridge dividing ancient Thessaly from Epirus, cut off the town of Janina so as to leave it to Greece, and descend the Kalamas River to the Ionian Sea. In Crete the reformed government promised in 1868 was to be immediately and scrupulously carried out. In Asia the changes were much less considerable; the port of Batum, henceforth to be essentially commercial, Kars and Ardahan, with a portion of Armenia, were ceded to Russia, and Khotour, east of Lake Van, to Persia; the Porte engaging to carry out at once much needed administrative reforms in Armenia and elsewhere. By the 'conditional convention' made in 1878 between Turkey and the United Kingdom, the English government undertook to defend the Porte's dominions in Asia, and received in return the right to occupy and administer Cyprus. The rectification of the Greek frontier was not arranged till 1881. After endless negotia-

TURKEY
IN EUROPE,
GREECE,
ROUMANIA, SERVIA,
MONTENEGRO AND BULGARIA.
Geographical Miles. 60 = One Degree
Turkish Leagues, 22 = One Degree
English Miles, 69 = One Degree
Longitude East from Greenwich
HUNGARY
AUSTRIA
SERVIA
BOSNIA
HERZEGOVINA
MONTENEGRO
ROUMANIA
EASTERN ROUMELIA
BULGARIA
TURKEY
GREECE
ADRIATIC SEA
IONIAN SEA
AEGEAN SEA
MEDITERRANEAN SEA
BLACK SEA
Buda or Ofen
Pesth
Szolnok
L. Balaton
Gross Wardein
Szegedin
Old Arad
New Arad
Temesvar
MARGITTA ISLAND
Eszek
Neusatz
Peterwardein
Belgrade
Semendria
Passarowitz
Hassan Palanka
Kopriwna
Toplitza
Kneschine
Sedlar
Negotin
Widin
Kalafat
Tchernetz
Tirgochit
Iron Gate
Orsova
Turnu Severin
Krajova
Slatina
Rimnik
Kosia
Nunajesti
Simpolung
Pitesti
Urzichoni
Plaiesti
Valeni
Targovist
Bucharest
Giurgevo
Rustchuk
Turtukai
Silistria
Tultscha
Matchin
Ismail
Kilia
Reni
Galatz
Braila
Ibrail
Foltsi
Vaslui
Jassy
Tekutsch
Fokchany
Gudi
Braila
Tchatalgi
Babadagh
Hirsova
Kustendjeh
Tchernavoda
Kara Kerman
Mangalia
Baltschik
Bazardjik
Karaluk
C. Galata
C. Kalagria
Varna
Aladyn
Pravadi
Shumla
Rasgrad
Osman Bazar
Tirnova
Gabrova
Tchatak
Beiram
Sonbachi
C. Eminch
Misivri
Aidos
Bourgas
G. of Bourgas
Sizeboli
Tirnova
Kirk Kilisse
Adrianople
Hermanli
Mustapha
Tchelebi
Ouronjova
Stanimak
Philippopolis
Batak
Tatar Bazardjik
Tchirpan
Samakov
Ichteman
Dragoman
Lomnitza
Trojan
Orchanie
Slivnitza
Sophia
Pirot
Vratza
Nova Berda
Kostendil
Bagna
Stulzaitza
Rudovitz
Istip
Kopad
Veles
Melenik
Seres
Demir Hissar
Neurokop
Razlotik
Tchelebi
Ardas R.
Demotika
Tchorlu
Constantinople
Scutari
Kadikoi
Prinkipo
Heybeli
Halki
Kalamaki
Ismid
Nicomedia
Derekos
Bosphorus
Kavala
Orphano
Makri
Ferejik
Lagos
Ipsala
Rodosto
Kechan
Ganos
Avracha
Gallipoli
Thasos
Samothrake
Imbro
Lemnos
Besika B.
Tenedos
Youkyeri B.
Adrianople
Kidonia or Haivali
Bergamo
Mytelene
Smyrna
Alashehr
Manisa
Chio
Kastro
Ipsera
Samos
Nicaria
Patmos
Lero
Calimnos
Kos
Rhodes
Scarpanto
Candia
Canea
Suda
Retimo
Standia I.
Cerigo
Cerigotto
Spada C.
Busa
Kisamo
Malea C.
Matapan C.
Malta C.
Monemvasia
Navarino
Modon
Coron
Arcadia
Mistra (Sparta)
Calamata
Leondari
Acaraia
Nauplia
Argos
Napoli
Athens
Piraeus
Corinth
Megara
Eleusis
Salamis
Thebes
Livadia
Lepanto
Patras
Gulf of Patras
Gulf of Corinth
Missolonghi
Salona
Lepanto
Arta
Prevesa
Janina
Philates
Delvino
Durazzo
Scutari
Lake Scutari
Antivari
Dulcigno
Cattaro
Gusinje
Plava
Mitrovitza
Ipek
Prisrend
Kalkandelen
Uskup
Kalkandelen
Kalkandelen
Ochrida
Monastir
Perlepe
Ghevgheli
Kastoria
Caimari
Karaveria
Verria
Vodena
Yenije Vardar
Salonika
Gulf of Salonika
Gulf of Kassandra
Gulf of Orfano
Gulf of Contessa
Gulf of Saros
Gulf of Xeros
Gulf of Volo
Gulf of Zeitun
Gulf of Arta
Gulf of Prevesa
Gulf of Taranto
Gulf of Venice
Strait of Otranto
Brindisi
Italy
Corfu
Paxo
Anti Paxo
Santa Maura
St. Maura
Ithaca
Cephalonia
Zante
Strivali Is.
C. Leuca
C. Nau
C. Malta
C. Matapan
C. Crio
C. Spada
C. Melech
C. Sidero
C. Salamone
Mt. Athos or Mt. Santo
Mt. Olympus
Mt. Ossa
Mt. Pelion
Mt. Othrys
Mt. Parnassus
Mt. Ida
Mt. Ida
Mt. Blanc
Pt. Panarmo
Chelidromia
Scopelo
Skiathos
Skyros
Andros
Zea
Syra
Hydra
Thermia
Serpho
Siphanto
Paros
Naxos
Amorgo
Levithi
Milo
Skino
Policandro
Santorin
Anaphi
Scropho
Piscopi
Karki
Stampalia
Cerigo
Cerigotto
Gozzo
Malala
(To Turkey)

tions and procrastination, which for a while seemed almost certain to lead to war, the Porte agreed to cede, and Greece to accept, a considerable portion of territory, though less than the Congress of Berlin had recommended. The new frontier gives to Greece all Thessaly south of the watershed forming the northern boundary of the valley of the Salambria (anc. *Peneus*), including the towns of Larissa and Trikhala; and in Epirus follows the line of the Arta River, leaving the town of Arta to Greece. The fortifications of Prevesa are to be destroyed by the Turks, and the Gulf of Arta is to be neutral.

The area and population of Turkey in Europe have now to be thus arranged:

	Sq. Miles.	Population.
I. Immediate Possessions	64,000	4,550,000
II. Autonomous Province of Eastern Roumelia	13,500	815,500
III. Bosnia and Herzegovina (with Novi-Bazar)	23,000	1,326,500
IV. Tributary Principality of Bulgaria	24,500	1,965,500
Total of Turkey in Europe	125,000	8,657,500

TURKEY IN EUROPE, generally hilly and undulating, is traversed by a mountain system which has its origin in the Alps, enters T. at the north-west corner, and runs nearly parallel to the coast, under the names of the Dinaric Alps and Mount Pindus, as far as the Greek frontier. This range sends numerous offshoots east and west; the great eastern offshot being the Balkans (q. v.) range, with its numerous branches to north and south. The rivers of Turkey are chiefly the tributaries of the Danube; the Maritza, Strumo, Vardar; the Narenta, Drin, and Voyutza.

On the high lands, the cold is excessive in winter, owing to the north-east winds, which blow from the bleak and icy steppes of Southern Russia; and the heat of summer is almost insupportable in the western valleys. Violent climatic change is, on the whole, the rule in European Turkey; but those districts which are sheltered from the cold winds, as the Albanian valleys, enjoy a comparatively equable temperature. The soil is for the most part very fertile; but owing to the positive discouragement of industry by the oppressive system of taxation which was long in force, little progress has been made in the art of agriculture, and the most primitive implements are in common use. The cultivated products include most of those usual in Central and Southern Europe—viz., maize, rice, cotton, rye, barley, and millet. The mineral products are, iron in abundance, argentiferous lead ore, copper, sulphur, salt, alum, and a little gold, but no coal. The wild animals are the wild boar, bear, wolf, wild dog, civet, chamois, wild ox, and those others which are generally distributed in Europe. The lion was formerly an inhabitant of the Thessalian Mountains.

TURKEY IN ASIA.—This portion of the Turkish empire is more hilly than the other. The two almost parallel ranges, Taurus and Anti-Taurus, which are the basis of its mountain-system, cover almost the whole of the peninsula of Asia Minor or Anatolia (q. v.), with their ramifications and offshoots, forming the surface into elevated plateaux, deep valleys, and enclosed plains. From the Taurus chain, the Lebanon range proceeds southwards parallel to the coast of Syria, and diminishing in elevation in Palestine, terminates on the Red Sea coast at Sinai. The Euphrates, Tigris, Orontes, and Kizil-Ermak are the chief rivers. On the whole, Turkey in Asia is ill supplied with water; and though the mountain slopes afford abundance of excellent pasture, the plains, and many of the valleys, especially those of the Euphrates, Tigris, and Jordan, are reduced by the parching droughts of summer to the condition of sandy deserts. In ancient times, these now desert districts were preserved in a state of fertility by artificial irrigation; but during the six centuries of almost constant war which convulsed this once fair region, the canals were neglected, and have, ever since the rise of the Osmanli power, remained in an unserviceable condition. Nevertheless, the fertile portions produce abundance of wheat, barley, rice, maize, tobacco, hemp, flax, and cotton; the cedar, cypress, and evergreen oak flourish on the mountain-slopes; the sycamore and mulberry on the lower hills; and the olive, fig, citron, orange, pomegranate, and vine on the low lands. The mineral products are iron, copper, lead, alum, silver, rock-salt, coal (in Syria), and limestone. The fauna includes the lion (east of the Euphrates), the hyena, lynx, panther, leopard, buffalo, wild boar, wild ass, bear, wolf, jackal, jerboa, and many others; and the camel and dromedary increase the ordinary list of domestic animals.

Possessions in Africa.—Tripoli is a vilayet of the Ottoman Empire. Egypt, under its hereditary khedive, is still tributary to the Porte, though of late years the relations of the tributary state to its suzerain have been gradually becoming looser. Tunis, till 1881 under Turkish suzerainty, is since that year practically a French protectorate. See the articles TRIPOLI, EGYPT, TUNIS.

Industry, Manufactures, and Trade.—Notwithstanding the primitive state of agriculture in T., the extreme fertility of the soil makes ample amends for this defect. The products are wax, raisins, dried figs, olive oil, silks, red cloth, dressed goat-skins, excellent morocco, saddlery, swords of superior quality, shawls, carpets, dye-stuffs, embroidery, essential oils, attar of roses, opium, corn, plum-brandy, &c. The exports include also wool, goats' hair, meerschaum clay, honey, sponges, drugs, madder, gall-nuts, various gums and resins, and excellent wines; the imports are manufactured goods of all kinds, glass, pottery, arms, paper, cutlery, steel, amber, &c. Previous to the recent Russian war the average annual value of the imports of Turkey in Europe was estimated at £18,500,000, and the exports at £10,000,000. Trade has dwindled to about one-third of its former dimensions since the war. The exports from the whole of the Turkish Empire to Great Britain amounted, in 1879, to £7,705,594; and the imports thence to £3,473,461. The countries which trade with T. are, in order of importance, Persia, Great Britain, France, Austria, Russia, Egypt, &c.; and the principal ports of the empire are Constantinople, Trebizond, and Smyrna. The mercantile marine of Turkey is small. In 1879 it comprised only some 230 sea-going ships (a dozen of them steamers), of a total tonnage of 34,800 tons. In 1878 there were over 780 miles of railway open for traffic in European Turkey; in the Asiatic part of the empire, about 175 miles.

Population.—A more heterogenous aggregation of races than that which constitutes the population of the Turkish empire can hardly be conceived. Turks, Greeks, Slavs, Roumanians, Albanians, are largely represented, besides Armenians, Jews, Circassians, &c., and Frank residents. In European Turkey, the Turks are estimated at 2,200,000; the Slavs, including the Bulgarians of the principality, at near 2,000,000; the Greeks at 1,030,000; the Albanians at 1,250,000; and the Roumanians at 1,000,000. Then in Asia there may be 4,450,000 Turks, not to speak of those in Africa; of Turkomans, 100,000; of Kurds, 1,000,000; of Syrians, 190,000—all in Asia: 1,000,000 Greeks; 2,400,000 Armenians (partly in Europe); as well as Jews, Arabs (in Asia and Africa), Druses, Franks or Western Christians, Gipsies, Tartars, Circassians and other kindred races, Copts, Nubians, Berbers, &c. Of these, the Greeks and Armenians are traders; the Slavic people and the Albanians are the chief agriculturists in Europe, and the Osmanlis, Armenians, Syrians, and Druses in Asia. Of the whole population about 25,000,000 are Mohammedans, and 15,300,000 Greek and Armenian Christians.

Administration, Religion, Education.—The government of T. has always been a pure despotism; the constitution granted in 1876 and revoked in 1878 was only nominal. The power of the Sultan (also called Padishah, Grand Seignior, Khan and Hunkiar) is much limited by the *sheikh-ul-islam*, the chief of the *Ulemas* (q. v.), who has the power of objecting to any of the sultan's decrees, and frequently possesses more authority over the people than his sovereign. The supreme head of the administration, and the next in rank to the sultan, is the grand vizier (*sadri-azam*), under whom are the members of the cabinet or divan (*menasybi-divaniié*), including the president of the council, the ministers of foreign affairs, of war, of the navy, of artillery, of the interior, of justice, of finances, and the other heads of departments of the administration. Governmental crises are frequent, especially of late; but palace intrigues are always a chief power in the state. The governors of the *vilayets*, or provinces, are styled *valis;* each vilayet is divided into *sanjaks*, or *livas*, ruled by inferior officers; each liva containing a number of *cazas*, or districts; and each caza a number of *nahiyehs*.

The provincial governors have no longer the power of life and death; and their power of practising extortion on those under their rule has been greatly diminished. The variable imposts are, however, farmed, but considerable restrictions are imposed on the farmers to prevent oppression. The established religion is Mohammedanism, but all other creeds are recognized and tolerated; and since 1856, a Mussulman has been free to change his religion at pleasure, without becoming liable to capital punishment, as was formerly the case. Education was long neglected, but in 1847 a new system was introduced; and since then, schools for elementary instruction have been established throughout T.; and middle schools for higher education, and colleges for the teaching of medicine, agriculture, naval and military science, &c. Many wealthy Turks, however, send their sons to France or Britain to be educated. The newspapers published in T. are not all printed in Turkish: several of them are printed in Greek, French, and other languages.

Revenue and Debt.—The Turkish government has never published an account of the actual revenue and expenditure of the empire. Estimates were given: but the budgets were so constructed as either to show a surplus, or to make the income and disbursements balance one another, while it was notorious that there were heavy deficits year by year. Years before the war of 1877, the Turkish exchequer was evidently on the brink of in

solvency, as was manifested by the violent expedients proposed for escaping from part of its liabilities. In 1875 a decree reduced the interest payable on the debt to one-half the proper amount; and another decree in 1876 announced that no further payments would be made till the internal affairs of the empire should allow of it. The enormous expenditure of the war, and the loss of valuable provinces, have only added to the utter disorganization of Turkish finances.

The first budget that admitted a deficit was that of 1874–75, where the revenue was given at £22,552,300, and the expenditure at £22,849,610. In 1875–76 the revenue was estimated at £19,106,352, and the expenditure at £23,143,276. In 1878–79, the revenue was guessed at £14,000,000; expenditure (with part of the war expenses), £50,000,000. At the end of 1880, the *Times* estimated the available annual revenue at £9,450,000, and the budget expenditure was nearly £12,000,000.

Between 1854 and 1874, when the borrowing power of T. came to an end, fourteen several loans had been contracted to meet deficiencies. At the end of that period, the foreign debt of T. amounted to £184,981,783. The internal and floating debt was stated in 1878 at £75,000,000; and the government had issued vast quantities of *caimés* or paper money, probably to the nominal value of £90,000,000.

Navy and Army.—The navy consisted in 1878 of 15 large armor-clad vessels, 18 smaller iron-clads, and 45 other steamers. During the war of 1877–78, five iron-clads and three other steamers were sunk or taken; and since, three iron-clads have been sold to England.

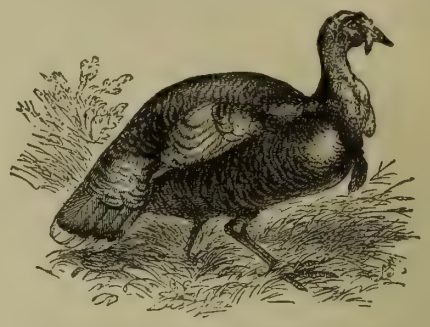
In the course of the war with Russia, T. contrived to put on a war footing no less than 752,000 men, including reserve and irregular troops. At the end of the war, the disorganized remnant amounted to about 120,000 men. Extraordinary efforts have been made to keep up the army: in 1880, when it had seemed necessary to call out the reserves, the empire actually had an army of 300,000 men, well armed and fairly equipped. According to the reorganization progressing in 1880, the military forces of the empire consist of active army (*nizam*), two 'bans' of landwehr (*redif*), and a landsturm (*mustafiz*). When the reorganization is complete, there should be, on the war footing, an available force of 468,000 infantry, 64,800 cavalry, 57,600 artillery, 10,800 pioneers, and 9000 of the military train; total, 610,200 men.

TURKEY (*Meleagris*), a genus of gallinaceous birds of the family *Pavonidæ*, or, according to some ornithologists, of a distinct family, *Meleagridæ*, both, however, being included by others in *Phasianidæ*. The head is bare, the neck wattled, and the bill of the male surmounted with a conical fleshy caruncle, sometimes erected, sometimes elongated and pendulous. A curious tuft of long hair springs from the base of the neck of the male, and hangs down on the breast. The bill is rather short, strong, and curved; the tail is broad and rounded, capable of being erected and spread out, as the male delights to do when he struts about in pride, with wings rubbing on the ground, uttering his loud peculiar *gobble*. The COMMON T. (*M. gallo-pavo*), the largest of gallinaceous birds, well known as an inmate of our poultry-yards, is a native of North America. It appears to have been introduced into Europe in the beginning of the 16th c., and is naturalized in some places; as it may be said to have been in the royal park of Richmond, near London, in the first half of the 18th c., when that park contained about two thousand turkeys; but in consequence of the frequent fights between poachers and keepers, it was thought proper to destroy them. Fewer attempts have been made than might have been expected to introduce the T. in parks and woods in Britain, where it might probably be expected to succeed as well as the pheasant. In a domesticated state, the T. varies much in plumage; in its wild state, this is not the case. The plumage of the wild T. is also richer, and its power of wing greater; but the wings even of the wild bird are short, scarcely extending beyond the base of the tail. The darkest-colored of domesticated turkeys most nearly resemble the wild T. in plumage. In its native woods, it seems to attain even a larger size than in the poultry-yard.

Turkeys were once plentiful in the forests of the Atlantic states of North America, and as far north as Lower Canada, but have disappeared as cultivation has advanced, and have become rare even in the eastern parts of the Valley of the Mississippi, where their numbers were once very great. The T. is found as far south as the Isthmus of Darien, but does not occur to the west of the Rocky Mountains. It inhabits the woods of the larger islands of the West Indies. In warm climates, it is said to produce two or three broods a year; but in colder countries it produces only one. The males associate in flocks of from ten to one hundred, and seek their food during great part of the year apart from the females, which go about singly with their young, or associate in flocks, avoiding the old males, which are apt to attack and destroy the young. At the pairing-time, desperate combats take place among the males. Wild turkeys roost on trees. They feed on all kinds of grain, seeds, fruits, grass, insects, and even on young frogs and lizards. They make their nests on the ground, merely gathering together a few dry leaves, and often in a thicket. The eggs are usually from nine to fifteen in number, sometimes twenty. They spread themselves in summer over the higher grounds; but in winter, congregate in the rich low valleys. The sexes mingle in winter, and form larger flocks than in summer.

On account of its size, and the excellence of its flesh and eggs, the T. is one of the most valued kinds of poultry. The management of it differs little from that of the common fowl. The young are tender for the first few weeks, and require care, particularly to keep them from getting wet by running among wet grass, or the like; but afterwards they are sufficiently hardy. Nettles are excellent food for turkeys, and are often chopped up for them, to be given in addition to grain, bran, boiled potatoes, and other such food.

The only other known species of T. is *Meleagris ocellata*, a native of the warmest parts of North America. It is not quite so



American Wild Turkey (*Meleagris ocellata*).

large as the Common T., and has a smaller tail. The neck is less wattled, but the head has a number of fleshy tubercles. The plumage is beautiful, rivaling that of the peacock in metallic brilliancy: blue, green, bronze, red, and golden hues being intimately and finely mingled, and forming *eyes* on the tail; whence the specific name.

TURKEY BUZZARD. See VULTURE.

TURKEY-RED. This celebrated color—the most durable, and perhaps one of the most beautiful which has yet been produced on cotton—is dyed by a process supposed to have been practised in India from immemorial time. It passed from thence through other parts of Asia to the countries of the Levant, and was introduced into France about the middle of last century. The first successful attempt to introduce it into Great Britain was made in Glasgow in 1783, by a Rouen dyer named Papillon, in conjunction with Mr. George Macintosh, the father of the inventor of waterproof cloth. They established the celebrated Turkey-red business now carried on by Messrs. Henry Monteith & Co. By an agreement with the Trustees for Manufactures in Scotland, Papillon allowed them to make his process public in 1803; and since then, Turkey-red dyeing has been extensively carried on in Glasgow and its neighborhood, and also in Lancashire.

There is a mode of dyeing cotton red with madder practised by calico-printers—the cloth being previously bleached with chloride of lime—where the whole process only occupies a day or two. But in the case of Turkey-red, which is also a madder-dye, the operations are long and tedious, and the bleaching with chloride of lime especially objectionable. The following is an outline of the steps in the Turkey-red process, as usually conducted: 1. Unbleached calico is thoroughly washed at a dash-wheel or other washing-machine, and then boiled for some time in a solution of carbonate of soda. 2. The cloth is soaked in a bath containing a soapy emulsion of olive oil, sheep's dung, carbonate of soda, and water; and allowed to remain for a week or more impregnated with the solution, after which it is aired in the field, and dried in stoves. This operation is repeated at least three times. 3. The next stage, sometimes called 'liquoring,' consists in passing the cloth through an emulsion of olive oil and carbonate of soda, but without sheep's dung; after which it is aired in the field, and dried in stoves, as in the last operation. The 'liquoring' is repeated at least four times. 4. The cloth now requires to be soaked in a weak alkaline lye of pearl-ash and soda, in order to remove any excess of oil. 5. The cloth is warmed in a bath containing a mixture of powdered oak-galls and sumach, or either of these substances alone, the operation being sometimes called 'galling,' and sometimes 'sumaching.' 6. The cloth is next steeped for twelve hours in a solution of alum, partially neutralized by carbonate of soda, but sometimes acetate of alumina is used instead of alum. Without this treatment, the dye could not be fixed upon the cotton. See DYEING. 7. When thoroughly washed, the cloth is ready to receive the red dye, which is produced by immersing it in a decoction of madder, to which some chalk and

TURKEY IN ASIA.
Geographical Miles, 60=One Degree
English Miles, 69 One Degree
TURKEY IN EUROPE
BLACK SEA
MEDITERRANEAN SEA
ASIA MINOR
ARMENIA
KURDISTAN
MESOPOTAMIA
ARABIA DESERTA
ARABIA PETRÆA
EL HEDJAZ
EGYPT
PERSIA
RUSSIA
CONSTANTINOPLE
SMYRNA
CYPRUS
CRETE
SCANDIA OR CRETE
PERSIAN GULF
BAGHDAD
BASRA
IRAK ARABI
DAMASCUS
ALEPPO
Sea of Marmora
Mouths of the Nile
Port Said
Suez
Cairo
Alexandria
Jerusalem
Beyrout
Tripoli
Latakia
Antioch
Mosul
Erzerum
Trebizond
Van
Lake Van
Euphrates R.
Tigris R.
Dead Sea
Lake Tiberias
Mt. Carmel
Mt. Hauran
Mt. Ararat
Mt. Olympus
Mt. Ida
Mt. Athos
Mt. Lebanon
Mt. Sinai
Gulf of Adalia
Gulf of Scanderoon
Gulf of Smyrna
Gulf of Khalidonia
Gulf of Volo
Gulf of Salonica
Sea of Galilee
Lake Tiberias
Lake Van
Lake Urumiyeh
Lake Bakhtegan
Lake Nedjef
Lake Habbaniyah
Lake Tharthar
Lake Hamrin
Lake Shahpuk
Lake Sabkha
Lake Derdere
Lake Tuz
Lake Beyshehr
Lake Eghridir
Lake Ak-Shehr
Lake Manyas
Lake Apollonia
Lake Koloe
Lake Marmora
Lake Mareotis
Lake Menzaleh
Lake Timsah
Lake Bitter
Lake Ismailia
Lake Kelbeh
Lake Belbeis
Lake Tenta
Lake Burdan
Lake Lamlum
Lake Samawah
Lake Sobeir
Lake Abadan
Lake Hamla
Lake Shabla
Lake Mohammerah
Lake Borak
Lake Hussein
Lake Ismatti
Lake Kornah
Lake Ghuheli
Lake Serut
Lake Tib
Lake Patak
Lake Suleimania
Lake Hillah
Lake Babylon
Lake Meshed Hussein
Lake Meshed Ali
Lake Divaniyen
Lake Kufa
Lake Nedjef
Lake Lemlum
Lake Samawah
Lake Rabatti
Lake Thammed
Lake Seleucia
Lake Musseyib
Lake Hillah
Lake Babylon
Lake Birs Nimrud
Lake Meshed Ali
Lake Divaniyen
Lake Kufa
Lake Nedjef
Lake Lemlum
Lake Samawah
Lake Rabatti
Lake Thammed
Lake Seleucia
Lake Musseyib
Lake Hillah
Lake Babylon
Lake Meshed Hussein

bullock's blood are sometimes added. It is put into the dye-beck when cold, and kept in it for two hours after it has been raised to the boiling-point. 8. It is next boiled in a weak solution of soap and soda, which removes a brown coloring matter present in the madder-dye, but more fugitive than the red portion. 9. Finally, the dyed cloth is cleared or brightened by boiling it in a solution of chloride of tin, and then washing and drying it. A more recent plan is to employ chloride of lime for the clearing.

The theory of Turkey-red dyeing is not well understood, which so far accounts for the fact, that it has been found impossible materially to shorten the process. The three most essential operations are the oiling, or rather the impregnation with an oleaginous soap, the mordanting with alumina, and the dyeing with madder; but it is found, that if any of the numerous dippings in the oily emulsions are left out, the color is inferior in proportion to the number of omissions. This is the least understood part of the process, and is no doubt the cause of the rich appearance of the dye, which approaches some of the fine reds produced on wool.

Besides being largely used in its plain state, Turkey-red cloth is extensively employed for handkerchiefs with white patterns produced produced upon them by discharging the color (see BANDANA); and of late years articles of various kinds, with patterns in several colors, have been produced by ordinary calico-printing machines, where, by proper arrangements, the different colors are obtained on parts where the red color is discharged by chloride of lime.

TURKEY-STONE. See HONES.

TURKISH LANGUAGE AND LITERATURE. The Turkish is one of the Turanian (q. v.) idioms, and is chiefly divided into Eastern and Western Turkish. The former is mainly represented by the Uigur (Jagatai), an idiom but recently recognized not only to belong to the Turkic stock, but to be its most ancient representative. Its forms are fuller and more pure, albeit, to a certain extent, harder and rougher. Its alphabet is formed from the Zabian, out of which have sprung also the Mongol and Mantshu. Besides this, the Kiptchak, spoken in Kasan and Astrakhan, forms a principal branch of the Eastern Turkish, for which, however, but little has hitherto been done from a philological point of view.

Of infinitely higher importance, however, is the Western Turkish, or language of the Osmanlis, which, through the conquests of that race, has spread far and wide over the whole of Western Asia, the Levant, and parts of Europe. The Osman or Western Turkish (emphatically Turkish) is more melodious and soft than the former, and so much mixed with foreign elements, chiefly Arabic and Persian, that, were it not for its grammar, which is purely Tatarian, it could hardly be called an original language, but rather a conglomeration of the three respective idioms. Besides, it has also received a large increase of words from other Asiatic and European languages, e. g., the Chinese, Greek, and Italian. It is one of the most widely spoken idioms; not only Western Asia, but even the east of Europe, use this tongue to a great extent for commercial and political transactions. The characters in which it is now written are no longer the original Uigur letters, but the Arabic, the 28 characters of which have been increased by the four additional Persian characters—produced by further diacritical points, and a new one of their own, amounting in all to 33, which are written from right to left, as is the case in all (save one) Semitic languages. But this alphabet is not well suited to a language composed, like this, of elements belonging to the three great families of speech, viz., Semitic, Indo-European, and Turanic.

Neither the vowels nor the consonants are adequately represented in all cases. Occasionally, however, it is also written in Armenian characters, which renders its sounds much more faithfully. There is no definite article or gender. The plural is indicated by a final *lar* or *ler*, and the cases are formed by the addition of *ung*, *eh*, *i*, *den*, and *le* for gen., dat., accus., abl., and instrumental respectively; which are, in plural, affixed to the *ler* or *lar*. The adjective has no flexion, but is placed unchanged after the noun. Diminutives are formed, somewhat like in Italian, by suffixes. The comparative and superlative are formed by circumlocution. The personal pronouns are without gender, and their declension is like that of the nouns. The possessive pronouns are made by suffixes. The Turkish verb is of a very complex nature. There are seven *genera* (Active, Passive, Negative, Impossible, Causal, Reciprocal, Reflexive), all of which are formed by certain monosyllables affixed or prefixed. The root of the verb is the second person singular imperative, to which the infinite affix *mak* or *mek* is joined. The moods and tenses are formed chiefly by the addition of the respective forms of the auxiliary verb *olmak*, to be. Apart from this, there are special particles to express the optative, conjunctive, &c. Conjunctions are either formed by gerundives or possessive forms, or they are borrowed from Persian and Arabic. Adverbs are formed by certain suffixes. The Turkish construction is most peculiar: the genitive always precedes the nominative, and the verb always stands at the end. All this gives the Turkish style a peculiarly artificial and inverted appearance, and often a sentence cannot be in the least comprehended until it is quite finished. Oriental flourishes, and allegorical figures of speech, with which Turkish is very lavish, do not tend to facilitate the study of the language.

The original literature of Turkey is to be found in the scanty remains of the Uigur period. That remote eastern branch of the Turkish family had, after their emigration from their homes, south of the Lake Baikal, to the Tangnu Tagh, played a foremost part in the contests and migrations of Central Asia, until they disappeared in the Mongol Empire about 1200 A.D. They were acquainted with Chinese literature, and had adopted the Buddhist doctrines to a certain extent, and their scanty literary relics bear traces of these influences. When, however, the Turks, in the 11th c., began their conquest of the countries of Mohammedan Asia, they learned to appreciate the literature of Persia, then beginning to grow up in its full glory; and ever since Turkish literature and Turkish language have retained a strong Persian impression. Two branches of Turkish literature are usually distinguished—first, the Eastern or Jagataian, which chiefly flourished between Timur's and Baber's time (1400—1530). Mir Ali Shir, the vizier of Sultan Hussein, is the most renowned poet of this period. He also collected the most ancient Jagatai poems. Sultan Baber, also belonging to this epoch, wrote Memoirs of his life and time (translated into English), which are of considerable importance. The other or Turkish literature, principally so called, is exceedingly rich, but hardly deserving the name of an original literature, it being, for the greatest part, a mere imitation of Persian and Arabic models. Of early writers, deserve special mention Sheikhi, a romantic poet and physician, and Soleyman Tchelebi. In the 16th c., the most flourishing period of Turkey, we find Meshihi, the poet; Kemal Pasha Zadeh, the historian and jurist. In history, we have, besides annalists like Saad-ed-Din, historians like Mohammed Effendi. Of the same epoch is Lamii, who excelled in many branches of literature, besides being an accomplished translator of Persian poets. Fasli (d. 1563) and Baki, the chief of Turkish poets (d. 1600), conclude this period, which is followed by another of great activity, but of inferior rank. It boasts of Nebi, the poet; Nefi, the satirist; but above all, Hadji Khalifah (q. v.), the eminent historian, geographer, and encyclopædist. Raghib Pasha stands out in the 18th c., together with Said Rufet Effendi, and a number of smaller writers.

Little is to be told of the present stage of Turkish literature; but there is a great activity now visible in the province of educational works, and the reproduction of ancient writings; a feature which augurs well for the future. Davids' (Lond. 1836), Redhouse's (Par. 1846), and Kasem-Beg's (Kasan, 1845; Ger. by Zenker, 1847) are the best known Turkish grammars; and Kieffer and Bianchi's (*Dictionnaire Turc-Française*, 2 vols., Par. 1835), as well as Redhouse's and Zenker's, among the best dictionaries of the Turkish language.

TURKMANSHAI, a village of Azerbijan, 65 miles east-south-east from Tabriz, is the place where, on February 22, 1828, was concluded the treaty between Persia and Russia, by which the former resigned to the latter the provinces of Erivan and Nakchevan.

TURKS, the name of a numerous, important, and widely-spread family of the human race, members of which are to be found as well on the banks of the Lena in Siberia, as on those of the Danube and the shores of the Adriatic in Europe. The T. belong to the second of Blumenbach's five great divisions of mankind—viz., *Mongolians;* and to the first, or *Mongolidæ*, in Dr. Latham's three-fold classification. In this latter classification, the T. form a branch of the Turanian stock of Altaic Mongolidæ. Their geographical distribution, according to Dr. Latham, is as follows: '1. As a continuous population. East and west; from the neighborhood of the Lake Baikal, 110° E. long., to the eastern boundaries of the Greek and Slavonic countries of Europe, about 21° E. long. North and south; from the northern frontiers of Tibet and Persia, about 34° N. lat., to the country north of Tobolsk, about 59° N. lat. 2. As an isolated population. Along the lower course of the Lena, and the shores of the White Sea, chiefly within the Arctic Circle. 3. As portions of a mixed population in China, Tibet, Mongolia, Persia, Armenia, the Caucasian countries, Syria, Egypt, Barbary, Greece, Albania, and the Slavonic portion of Turkey in Europe.' The names Tourkoi, Turkai, and Turcæ occur in some ancient authors as applied to a Scythian people dwelling in Asiatic Sarmatia, and it is very likely that the Scythians of antiquity were allied in blood with the numerous existing Turkish tribes, if not absolutely their ancestors.

The original seat of the T. was probably upon the northern slopes of the Altai range, from which, while a portion emigrated into Independent Turkestan, others, going south-south-east, established themselves upon the confines of the Chinese Empire. MM. Abel-Rémusat, Klaproth, Ritter, and other high authorities, concur in tracing all the now existing Turkish tribes to the Hiong-nu, a

powerful nation who, prior to the Christian era, threatened to overrun and subjugate China, and who then occupied the whole of the vast region now called Mongolia, from the north of China to Mount Altai. Dr. Prichard coincides in this opinion. The Hiong-nu (or *Vile Slaves*, so called by the Chinese), indeed, for some time succeeded in establishing a kind of rule in China, and even intermarried with the imperial family; but about the commencement of the Christian era, their power in China began to wane, and before the end of the 2d c. they were driven back as far as Independent Turkestan. 'After the fall of the empire of Hiong-no,' says Prichard, 'the T. are known in Chinese history by the name of Thu-k'iú, or Turks, and Whey-ou-eul, by Europeans written Huy-hurs, and more correctly, Uigours. The Uigours, or Eastern Turks, whose history has been elucidated by Abel-Rému-sat, are the link of connection between these more remote nations and the Seljuki and Osmanli Turks, who are known to European historians.'

After the fall of the Hiong-nu empire in China, the tribes who composed its strength separated, some maintaining themselves in their acquired settlements, and even conquering portions of China; but by far the greater number spread westward over Western Mongolia, East and West Turkestan, and Southern Siberia, and gradually lost their power and unity as a nation. Out of this débris of a fallen people arose, in the 5th c., the great empire (the empire of Kiptchak) of the Thu-k'iú, which contested the supremacy of Central Asia with the Chinese on the east, and the Sassanidæ (q. v.) on the west, ultimately falling in 744 before the Hoei-he, a confederation of Turkish Tribes which had hitherto been subject to it.

The Hoei-he, attacked in the west by the Hakas (the ancestors of the present Kirghis), yielded to their assailants in 848, but retained their power east of the Bolor-tagh, and for 150 years longer ruled supreme from that range to the Hoang-ho. During the eight centuries succeeding their expulsion from China, a regular though slow progress westward had been maintained by some of the Turkish tribes, a portion of whom appear (5th c. A.D.) in Southern Russia, and on the northern frontier of the Byzantine Empire, driving before them the kindred race of the Avars. They were found in Syria and Mesopotamia in the 7th c., and about the same time wandered into Northern and Eastern Khorassan. But the seat of power of the Turkish race still was in Central Asia, whence in the 10th c. the Seljuks (q. v.) emerged, conquering Persia, Syria, and Asia Minor, and establishing an empire which reached from Constantinople to the borders of Mongolia. The subdivision of the Seljuk empire in South-western Asia led to its gradual absorption by the Khaurezmians in the north, and the Kurds in the west, till the irresistible tide of Mongol invasion under Genghis Khan (q. v.), rolling over Central and Western Asia, and the east of Europe, completely overwhelmed Turkish dominancy. The great empire of Timur (q. v.) was Turk, with a strong infusion of the Mongol element, the residue of Genghis's irruption; and its destroyers, the Uzbeks (q. v.), and the various other tribes—Khirghis, Kiptchaks, Turkomans, &c.—which now possess its extensive domains, are also of Turkish race. The Osmanli-Turks are descended from a portion of the Turkish tribe of the Kayi, which fled from its settlements in Khorassan before the Mongols, and took refuge with the Seljuks of Iconium. See OTTOMAN EMPIRE, SELJUKS, &c.

The following is the enumeration of the principal Turkish tribes given by Dr. Latham: '1. *Uigurs*—On the Mongol frontier. Belonging to China. The Uigurs were the first Turks that used an alphabet. Little known. 2. *Turks of the Sandy Desert.*—Conterminous with Mongolia and Tibet. 3. *Turks of Khoten, Kashgar, and Yarkend.* 4. *Kirghis.*—Independent Tartary. The Kirghis (q. v.) form a portion of the population of the highest tableland in Asia—perhaps in the world—Pamir and the source of the Oxus. 5. *Uzbeks* (q. v.).—The Turks of Bokhara. 6. *Turkomans.*—The Persian frontier of Independent Tartary from Balkh to the Caspian. Pastoral robbers. 7. *Ottoman or Osmanli.*—The Turks of the Turkish Empire. 8. *Nogays.*—The Turks of the parts between the Black Sea and the Caspian, north of Caucasus. 9. *Turks of the Russian Empire.*—Bashkirs, Teptyars, Baraba, &c. With all these, although the language is Turk, there is good reason to believe that the original substratum is Finn. With the Bashkirs, this is generally considered to be the case. 10. *The isolated Yakuts of the Lena.*'

In physical appearance, all these tribes, with the exception of the Ottoman T. partake more or less of the Mongolian type. They have in general a broad, flat face, with prominent cheek-bones, the head from side to side nearly equal to its length from the forehead to the occiput, the nose flat, the eyes small, the color of the skin yellowish, straight hair, little or no beard, and stature undersized. It is among the nomad and agricultural T. that these characteristics are most prevalent, while among the more civilized they almost entirely disappear.

Dr. Prichard quotes Lieutenant Wood's account of the Kirghis as a good average description of the primitive Turkish tribes. 'In stature,' he says, 'the Kirghis are under the middle height; of a *kyl* numbering seven men, the tallest was 5 feet 5¼ inches in height. Their countenance is disagreeable; the upper part of the nose sinks into the face, leaving the space between their deeply-seated and elongated eyes without the usual dividing ridge; the brow immediately above the eye is protuberant, but starts back more abruptly than in Europeans; their cheeks, large and bloated, look as if pieces of flesh had been daubed upon them; a slender beard covers their chin, and in those individuals who have more luxuriant hair, the beard has a natural curl. Their persons are not muscular. Their complexions are darkened by exposure to all weathers rather than by the sun. The women are rather good-looking, and of delicate form, like the Hazaras, and make good wives.' The T. of the Turkish Empire, especially those of the upper classes, differ considerably from the type here described. The Ottoman T., in fact, both in feature, height, and general physical structure, bear a strong resemblance to other European nations. This is accounted for chiefly by the custom now prevalent among them for ages of intermarrying with Circassian females.

The various Turkish tribes speak very nearly the same language; 'so much so, that the Yakut of the Icy Sea is said to be intelligible to the Turks of Central Asia, and even of Constantinople.' In religion, the T. are for the most part Mohammedans; but the Yakuts are Shamanists; the T. bordering on the Chinese Empire are Buddhists; and those of Siberia, Christians of the Russo-Greek Church.

TU'RMERIC (*Curcúma longa;* see CURCUMA), a plant of the natural order *Scitamineæ*, a native of the East Indies, much cultivated both in India and in Cochin-China. The leaves are lanceolate, sheathing each other at the base, about a foot long; they spring from the crown of the root, and from their center rises a short leafy spike, with small cream-colored flowers. The root is divided into several fleshy fingers, oblong and as thick as a man's thumb, sometimes crooked when young, and the root then abounds in a kind of arrow-root; but in a more advanced stage, it contains in large quantity a peculiar, resinous, yellow substance, which is used as a dye-stuff, and for other purposes, and is called *Turmeric.* It appears in commerce in the form of dried roots, or as a powder. It depends for its value chiefly on a resinous principle called *Curcumin*, which is scarcely soluble in water, but easily soluble in alcohol and ether. The yellow color obtained from T. is not very durable, although it is employed as a dye both for silk and wool. Chemists make much use of T. as a test for alkalies, which change its yellow color to reddish brown, as do also their carbonates and phosphates, some of the alkaloids, and boracic acid. T. test-paper is made by immersing unsized paper in tincture of turmeric. It is much employed in the East in medicine, as a gentle laxative, diuretic, and stimulant. It is also much used as a condiment with many kinds of food, and is the principal ingredient in *Curry-powder.* For its cultivation, T. requires a rich friable soil, and a situation not liable to be flooded. It is propagated by cuttings of the root, which are planted at distances of eighteen inches or two feet. It is planted in April or May, and the crop is gathered in December. This kind of T. is sometimes distinguished by the name of LONG T.; and the name of ROUND T. is given to *Kæmpferia pandureta*, a plant of the same order, also a native of the East Indies, the roots of which are shorter and rounder, but otherwise of very similar quality. They are not nearly so much an article of commere as the other kind, but are particularly valued for the preparation of an artificial gold varnish, as they yield a better color than the long or true Turmeric. The Arabic name of T. is *Kurkum*, whence *Curcuma.*

TURN, in Music, an embellishment formed by the adjoining notes above and below combined with the principal note, and indicated by the sign ∽. Should another than the principal note follow the turn, the principal note is added before the next note is played, so as to give the turn four notes. In either of these cases, the turn must be played during the time of the principal note. But when the sign ∽ is placed above or below the principal note, the first note of the turn takes the place of the principal, which is played in combination with the others.

TU'RNAU (Boh. *Turnóv*), a walled town of Bohemia, circle of Jung-Bunzlau, on the east bank of the Iser, 50 miles north-east of Prague. It has a church, built in 1825, which is reckoned one of the most beautiful in Bohemia. T. has manufactures of cotton, woollens, and more particularly artificial gems, which are exported in great quantities to the United States. Pop. 4900. Here was fought (July 1866) a battle between the Prussians and Austrians, in which the former were victorious.

TURNER, JOSEPH MALLARD WILLIAM, the greatest of British landscape-painters, was born at 26 Maiden Lane, Covent Garden, London, in 1775. The precise day of his birth is unknown; but an approximation to it is furnished by his baptism, which is registered in the parish church as of date 14th May of

that year. He was the son of a barber, and received an exceedingly defective education. His turn for art showed itself very early, and drew attention to the boy. To a Dr. Monro, in particular, who gave him access to his excellent collection of water-color drawings, and otherwise kindly furtherance, he used afterwards to express his obligations. In 1789, he became a student at the Royal Academy, where, doubtless, he learned something; but throughout he seems to have been indebted less to any formal teaching than to the tentative efforts of his own singularly original genius. In 1787, when only twelve years old, he exhibited two drawings at the Royal Academy. Again, in 1790, he exhibited; and thence onwards till his death, with intermission of only one or two years, his pictures were regularly to be found on the walls. His success is sufficiently shown in the fact, that so early as 1799 he was elected an Associate of the Royal Academy, and only three years afterwards, attained the full dignity of Academician. The honor was worthily bestowed on one whose claim was already admitted as the first landscape-painter of his time; but his election in 1807 to the post of Professor of Perspective could scarcely be considered so judicious. A man so abnormally illiterate that his simplest note included a crop of solecisms, was not likely to succeed as a lecturer; and as a lecturer he failed utterly. The knowledge which he abundantly possessed, he could not in the least communicate; and after a very few years, he ceased to make the attempt. In the exercise of his art, T. traveled much; he was frequently in Scotland, France, Switzerland, and the Rhine countries; and in 1819, 1829, and 1840, he paid visits to Italy. His industry was almost as unexampled as his genius.

To the exhibitions of the Royal Academy, he contributed in all 259 pictures; but among these, many of his finest works were not included; and in another branch of art, the amount of his achievement was extraordinary. In 1808, he commenced the publication of his famous *Liber Studiorum*, a serious of engravings from original designs, which ranks as one of his most important undertakings; to this is to be added his *Scenery of the Southern Coast, England and Wales. Rivers of England. Rivers of France*, &c.; and besides, his services were continually in request as an illustrator. The illustrated edition of Rogers's *Poems* is his most celebrated work in this kind, and is quite unique in magnificence. At his death, which took place 19th December 1851, at Chelsea, where his few last years were passed in a small house by the river-side, it was found that he had bequeathed to the nation the noble collection of his works, which now occupies a room in the National Gallery, and remains a permanent monument of the power and splendor of his genius, if also of its occasional eccentricity and extravagance. The large fortune, amounting to something like £200,000, which he had amassed by his industry and thrift combined, he left to found an asylum for decayed artists; but owing to some technical defect in his will, this purpose could not be carried out.

Of the genius of T., and the various phases through which it was developed till it sunk in the decay and deliration obvious in the work of his few last years, we cannot here attempt to treat. In the eloquent pages of Mr. Ruskin's *Modern Painters*, the subject will be found thoroughly discussed. There are lives of Turner by Walter Thornbury (1861) and by P. G. Hamerton (1879). The picture presented, especially by the former, is a somewhat dark and painful one. This creator of the beautiful on canvas was in his character and way of life by no means so surprising a revelation of it. He was coarse, sensual, sordid, avaricious: of his inordinate passion for money, many odd anecdotes are extant; but it is only fair to say, that by the few friends who knew him intimately, he was held to be essentially a man of kindly and generous nature. He lies buried in the crypt of St. Paul's, beside Sir Joshua Reynolds.

TURNER, SHARON, the Anglo-Saxon historian, was born in London, September 24, 1768, articled to an attorney at the age of fifteen, and succeeded his master in the business before the period of his clerkship had expired. He continued, however, to gratify his literary tastes; and after years of hard reading and patient collection of materials, published, 1799—1805, a *History of the Anglo-Saxons*, in 3 vols., a work, with all its imperfections, that has given its author a permanent place in English literature. Other writings of T.'s are: *The History of England from the Norman Conquest to* 1509 (1814.); *History of Henry VIII.* (1826); and *Reigns of Edward VI., Mary, and Elizabeth* (1829); all of which were subsequently republished together under the title of *History of England from the Earliest Period to the Death of Elizabeth*; *Sacred History of the World as Displayed in the Creation and Subsequent Events to the Deluge* (1832, *et seq.*); a volume of essays and poems, &c. T. died February 13, 1847.

TURNHOU'T, a well-built town of Belgium, province of Antwerp, 34 miles east-north-east of the city of Antwerp, in the district known as the Campine (see BELGIUM), and the terminus of a branch-line of the Brussels and Antwerp Railway. The inhabitants manufacture ticking, and linen and lace goods, cutlery, playing-cards, paper, oil, &c. Pop. (1876) 15,743. T. is historically noteworthy as the scene of two battles, the first won 22d January 1597, by the Netherlanders, under Maurice, Prince of Orange, over the Spaniards; and the second, 27th October 1789, by the patriots under Van der Mersch, over the Austrians.

TURNING, the art of shaping wood, metal, ivory, or other hard substances into forms having a curved (generally circular or oval) transverse section; and also of engraving figures composed of curved lines upon a smooth surface, by means of a machine called a *turning-lathe*. This art is of great importance and extensive application in mechanics, the most delicate articles of luxury and ornament, equally with the most ponderous machinery, being produced by it. The art of turning dates from a very early period, and Theodorus of Samos (about 560 B.C.) is named by Pliny as its inventor; but long before this period, the *potter's wheel* (see POTTERY), the earliest and simplest form of turning-machine, was in general use, as is evidenced by numerous references in Holy Writ. The immense variety of work performed by turning-machines necessitates great variations in their construction; but their mode of operation is always the same, and consists in fixing the work in position by two pivots or otherwise, causing it to revolve freely round an axis of revolution, of which the two pivots are the poles, and holding a chisel or other cutting-tool so as to meet it during its revolution, taking care that the cutting-tool be held firmly and steadily, and moved about to different parts of the work till the required shape be obtained. Lathes are divided, with respect to the mode of setting them in motion, into *pole*-lathes, *foot*-lathes, *hand-wheel* lathes, and *power*-lathes; with respect to the species of work they have to perform, into *center*-lathes, which form the outside surface, and *spindle, mandrel*, or *chuck* lathes, which perform hollow or inside work, though this distinction is for the most part useless, as all lathes of good construction are now fitted for both kinds of work. *Bed*-lathes are those used by turners in wood, and *bar*-lathes for the best sort of metal-work; and the small metal center-lathe employed by watch-makers is known as a *turn-bench*.

The primitive and most simple form of lathe for wood-cutting is the pole-lathe. It consists of two planks or beams placed horizontally side by side with a narrow space between them, which, being firmly supported at a convenient height, constitute the *bed;* of two uprights or *puppets* rising from the bed, one of them stationary at the left end, and the other sliding along over the slit between the beams, and capable of being fastened at any required point by a projecting tenon and wedge beneath; of a *treadle* below and parallel to the bed; and of an elastic *pole* or *lath* (whence some derive the name lathe) fixed to the ceiling above. This form of lathe is well adapted for turning long thin cylinders of wood, the piece to be turned being held fast at each end by the conical iron or steel point projecting from the inner face of each puppet. Motion is communicated to the work by a cord which is fastened to the lath overhead, wound twice or thrice round the work, and then attached to the treadle below. When the workman presses his foot on the treadle, the work commences to revolve rapidly, unwinding the cord towards the treadle, and winding it up on the side next the pole, causing the latter to bend considerably. During this period, the workman has been holding his cutting-instrument to the work; but after the treadle has been quite pressed down, he removes his foot, and the reaction of the bent pole causes the work to revolve in an opposite direction, till the pole has straightened itself; and during this latter revolution no cutting is done. When the whole piece is to be turned, the cord must be moved from an unfinished to a finished part of the work. For the pole, an elastic steel bow and string are substituted when the work is light or fine, the cord being attached to the middle of the string, and the bow fastened to the ceiling by its center.

The advantage of the pole-lathe is, that it never acquires an impetus in the direction of the cutting motion, for whenever the pressure on the treadle is removed, the reaction of the pole takes effect; but the great waste of time during the straightening of the pole and rising of the treadle, has caused the abandonment of this machine for the foot-lathe. The foot-lathe, the most common and generally useful form of lathe, differs from the former in having a *head-stock* or *fast-head* in place of the left-hand stationary puppet. This head-stock, H, H (fig. 1), consists of two supports or puppets firmly connected at their base, and fastened at right angles to the bed by means of the screws, A, A; the outer puppet is pierced for the screw, S; and the inner is supplied with a steel collar, within which the mandrel, M, which carries the speed-pulleys, P, turns. The left end of the mandrel is concave, so as to allow the steel point of the screw, S, to fit closely. R is a *rest*, which slides along the slit between the two beams of the bed, and may be clamped at any point, and elevated or depressed as is found necessary. The rest is used by the workman for leaning his cutting tool upon, in order to afford it greater steadiness. G is the right-hand puppet *front-head*, or *tail-stock*, movable along the slit in the bed, and capable of being fastened like the rest; its point, I, can be advanced or re-

tired as required by means of the screw, J. C is the spindle, which, being connected with the treadle, W, by means of the rods

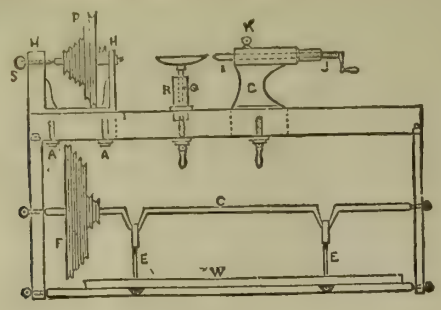


Fig. 1.

or chains, E, E, turns the fly or foot wheel, F, and by means of an endless band connecting the latter with the speed-pulleys, communicates motion to the mandrel.

The pulleys on the spindle and mandrel are of different sizes, and so arranged, that when the endless band is placed on the left-hand pulleys, an extremely rapid motion is communicated to the mandrel, the motion being reduced more and more as the band is transferred more to the right, till, at the extreme right, the rotatory motion is much slower than that of the spindle. When the foot-lathe is required for center-work, the inner end of the mandrel is furnished with a point similar to I; but when hollow or inside work is to be done, it must be armed with a screw, as in the figure. In this latter case, certain contrivances, known as *chucks*, for holding the work, are screwed on to the end of the mandrel. Some of these most commonly used are the *screw-chuck*, which shows on its right side a flat circular surface, from the center of which projects a large, coarse, conical screw for holding firmly any large piece of wooden work; the *hollow chuck*, a strong circular cup with perpendicular sides, into which one end of the work is firmly fastened by a mallet, or, if too small, by four screws working inwards through its sides; the *drill-chuck*, of a cylindrical form similar to the last, but with a square cavity for holding drills, the instrument, and not the work, being made to rotate in this instance; and the *concentric chuck*, a most ingenious piece of mechanism—a flat plate with two slits almost to the center, and in line of a diameter, within which slits works a spindle, with screw-ends carrying two steel studs, whose heads project through the slits above the surface on the right side; these heads carry two curved pieces, which serve as clamps to hold the work; and as the spindle-screws are of the same fineness, and with right and left threads, the revolution of the spindle either removes both further from the center, or brings both nearer to it; hence, when the studs are once set at equal distances from the center, they always remain so, and the work may be removed and replaced without danger of destroying the adjustment. All these chucks are of metal, and are mostly employed for heavy work; turners of wood or ivory preferring wood-chucks, which can be altered as required, and secured by an iron ring round the outside to prevent splitting.

The cutting-tools employed are very various: gouges are used to rough out the work—if soft-wood—after which chisels with a straight oblique edge are employed: the instruments for harder materials, such as ivory or bone, are smaller than the former, and have their sharp edges 'better backed;' for inside work, drills are first employed to make an opening, and then cutting-

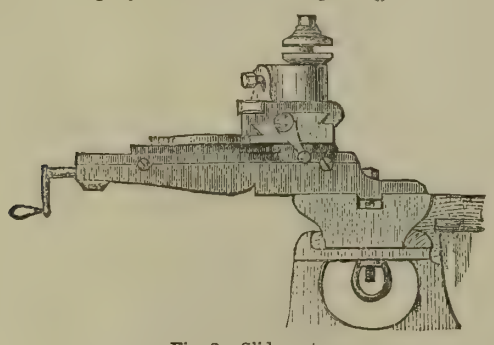


Fig. 2.—Slide-rest.

tools of various shapes are employed, according to the form which is wished to be given to the interior surface. To avoid the imperfections in the workmanship arising from unsteadiness of hand in the workman, the *slide-rest* (fig. 2) is employed. This valuable addition is furnished with two motions, one towards the work, and the other along, parallel, or at any inclination to it, according as cylindrical or conical figures are required; there is a socket for the chisel, which is firmly held in its place by a screw; and after the slide-rest has been adjusted, the operator has only to move the rest forwards or sideways, as may be required, the motions being effected by two screws and winches.

The *hand-wheel* lathe is similar to the former, but so much larger as to require two workmen, one of whom is employed in setting the instrument in motion by turning a wheel, which corresponds to the wheel F in fig. 1. The *power*-lathe is similarly set in motion by horse, water, or steam power, and is employed for heavy metal-work, as piston-rods, iron columns of various kinds, wheels, artillery, &c. This machine differs from the foot-lathe chiefly in the substitution of rack-work, and wheels and pinions, for the endless band, and for manual labor, in the various adjustments of the machine, such as in moving forward the tail-stock, &c.; and in the mandrel being supported by both puppets of the head-stock. In wood-turning, the wood is first prepared by a hatchet and rasp, must be lightly though firmly pressed against by the cutting tool; while metal-work must be cleaned from the sand of the mould or scales of the forge, and in turning, requires less care. Soft woods must be made to revolve with great rapidity; very hard woods and brass require much less velocity; wrought iron and copper, still less; steel, a further diminution of speed; and cast iron, the least velocity of all. After the work has been duly shaped, it requires to be polished; and this is effected while it is still in the lathe and rotating, by applying shark's skin to wood, pumice-stone and chalk to ivory and horn, and emery, tripoli, or putty powder to metals.

Hitherto, we have supposed that the axis of revolution of the work is fixed, and consequently that all work has been turned so as to present a transverse circular section; but many other forms of section may be easily obtained. The general mode of obtaining these non-circular figures is by screwing on to the mandrel an apparatus, by means of which the work can be thrown out of the center of rotation at regular intervals; but as each different class of form requires a separate kind of apparatus, it is impossible here to describe the operations in detail. One species, however, known as *rose-engine turning*, and employed for producing involved curvilineal figures, such as appear on bank-notes and on ornamented gold, silver, or gilt work, is so peculiar and ingenious, as to call for more special notice. In this species, the standards which support the mandrel are no longer fixed at right angles to the bed, but are capable of oscillating backwards or forwards in a plane parallel to the plane of rotation of the mandrel, and are so acted on by a spring, that when pushed to one side they are at once restored to their former position on the pressure being withdrawn. Suppose, then, a metal wheel with its rim waved or indented, fastened concentrically on the mandrel, and the mandrel, pushed aside by a fixed steel point or roller, applied to the rim of the wheel; the reaction of the spring against the pressure of the roller will keep the latter in close contact with the waved rim throughout, and will produce a definite oscillatory movement of the mandrel, of the chuck, and the work fastened on it, and consequently—the cutting or graving tool being firmly held by the slide-rest—definite deviations from a circle in the lines marked on the face of the work. The wave-rimmed wheel, called a *rosette*, may be replaced by another, and that by a third, and so on till a sufficient number of different waved lines are obtained. A number of rosettes are generally strung at once on the mandrel, and the fixed guide is brought into gearing by means of a steel band called a rubber, with one rosette after another. Similar concentric curves of greater or less perimeter are obtained by removing the slide-rest from, or bringing it nearer to, the axis of revolution.—For more complete information respecting this most interesting machine, and its many varieties of form and application, see article 'Turning' in the *English Cyclopædia*, Holtzapffel's *Turning and Mechanical Manipulations* (Lond. 1847—1852), and *Tourneur* (*Manuels-Roret*), by Valicourt (Paris, 1858).

TURNIP (*Brassica rapa*; see BRASSICA), a biennial plant, with lyrate hispid leaves; the upper part of the root becoming, especially in cultivation, swollen and fleshy. It is a native of Europe and the temperate parts of Asia, growing in borders of fields and waste places. It is commonly regarded as a native of Britain, although in most cases of its being found apparently wild, it may be doubted if it has not derived its origin from cultivated varieties. It has been long cultivated, and is to be found in every garden of the temperate and cold parts of the world as a culinary esculent; it is also extensively grown in fields for feeding cattle and sheep. It was cultivated in India long before it could have been introduced by Europeans, and is common there in gardens and about villages. The cultivated varieties are very numerous. In them, the upper part of the root assumes a globose, oblong, or roundish depressed form. Some are common to the garden and the farm, and some of the largest kinds attain such a size as to

weigh 20 or 25 lbs. Although the T. is of great value for feeding cattle, and the introduction of it into general field-culture was one of the greatest improvements ever effected in the husbandry of Britain, it is not very nutritious, no less than 90—96 parts of its weight actually consisting of water. Garden turnips are sown from the end of March to the end of August; field turnips generally in June, it being requisite that they should not be sown so soon as to incur a risk of their throwing up flower-stems in the first year, which, when it takes place, prevents in a great measure the swelling of the root, and renders it coarse and fibrous. In the garden cultivation of turnips, the root is generally intended for use in the first year. In dry weather, the plants are apt to throw up flower-stems, and so disappoint the hope of the gardener; which is also the case if the seed is sown too early in spring. Moist cloudy weather is most favorable. Garden turnips are sown, and allowed to grow, much closer than field-turnips; being gradually thinned out, and the thinnings used even when of small size. The varieties both of garden and field turnips are very numerous. The garden turnips are generally of comparatively small size, more rapid in growth and more delicate.—The SWEDISH T. or RUTA BAGA, which was introduced into cultivation in Britain, from the north of Europe, more recently than the common T., and has proved of very great value to the farmer, is regarded by some botanists as a variety of the same species, and by some as a variety of *Brassica napus*, but more generally as a variety of *B. campestris*, a species common in corn-fields and sides of ditches in Britain and the north of Europe.

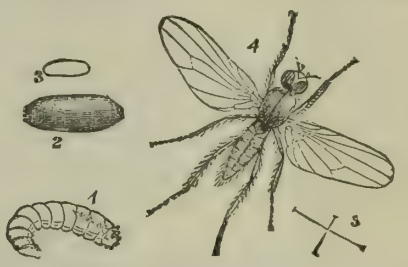
The cultivated T. grows best in a rich free soil. The mode of culture varies with the soil. Where the soil is light and dry, a smaller amount of plowing, harrowing, and drilling is necessary than on stiff soils. The T. is not well suited to clay soils, although it is often grown on them. A complete pulverization of the soil is requisite before the sowing of the seed. On light soils, a crop of turnips generally succeeds wheat or oats. T.-land is generally made up in raised drills, by the plow, and the seed is sown by the drilling-machine, on the top of the narrow ridges, which are about 27 inches apart. Small doses of guano, superphosphate of lime, crushed bones, or other such manures, produce great crops of turnips. They seem to act chiefly whilst the plant is young; and when it is further advanced, it derives nutriment from the soil, and even from the subsoil, by deeply penetrating roots, and from the atmosphere by its large leaves. See BONES AS MANURE. The young plants are thinned out by the hand-hoe, to a foot or upwards apart, and the ground is stirred and carefully kept clean by the plow or horse-hoe. The T.-crop is thus of great use in clearing the land of weeds. In many places, part of the crop is eaten on the ground by sheep, which are confined to a small part of the field by means of movable fences. It is common to leave one of each three rows of turnips for this purpose, the other two rows being carried to the farmyard for feeding cattle or stored. Turnips are stored either in a house, or in conical heaps, covered with their own leaves, or with straw and earth. They are sometimes protected from frost by being earthed up in rows by the plow. Some kinds are much more easily injured by frost than others; the Swedish turnips least of all.

The introduction of the T. as a field-crop is one of the most important events in the history of British agriculture. It has rendered possible a rotation of crops, which has been extremely advantageous, and has made the supply of butcher-meat more constant, by providing a supply of winter-food for cattle and sheep, whereas, formerly, all depended on the pasture. T.-husbandry was introduced into Scotland from Norfolk in the latter part of the 18th c., but soon attained a development, and was carried to a perfection in Scotland far beyond what it had previously reached anywhere. The climate of Scotland is particularly adapted to it, as is also that of Ireland; moist weather, both in summer and autumn, being suitable to the T.; whilst the climate of North America is so unfavorable to it, that it has not become an important crop there. Of late years, T.-crops in Britain have suffered very much from the disease called Anbury (q. v.), or *Fingers and Toes*. This is not the case in Norfolk, and the exemption is supposed to be due to the use of clay-marl as a manure; but the whole subject is involved in obscurity. The T. not unfrequently suffers from a fungus of the genus *Botrytis* (*B. parasitica*), allied to that which is supposed to cause the potato disease. It infests plants of rank growth, attacking their roots, which are weakened by the too great luxuriance of the leaves. Plants weakened by drought are liable to suffer from a white mould, a species of *Oidium*, which attacks the leaves, and renders the plant worthless. The leaves are devoured by the T.-fly, T.-flea, or T.-beetle (*Haltica nemorum*), and by other species of the same genus. The Nigger Caterpillar, the larva of *Athalia spinarum*, also devours the leaves, as well as the caterpillars of White Butterflies (*Pontia brassicæ*, *rapæ*, and *napi*), and of some moths. The leaves are also mined by the larvæ of several dipterous flies. Several species of aphis suck the juices of the leaves, and one (*A. floris rapæ*) devotes its attention to the young crops in seed-leaf, which are also attacked by a rose-chafer (*Cetonia aurita*), and a minute beetle (*Meligethes æneus*). Slugs, snails, and wire-worms are among the enemies of the turnip.

The young leaves of the T., are good as greens, and particularly those of the Swedish T., when it has begun to sprout in spring.

TURNIP-CUTTER, an implement used for cutting turnips for cattle. It is useful, not only as saving the teeth of sheep, which are apt to be much injured by eating turnips, but as preventing waste, for sheep feeding upon turnips scoop out a part, and leave the rest to rot. The oldest and simplest turnip-cutter acts by mere pressure, and is like a large nut-cracker on a stand. Many kinds are now in use, of which perhaps the best are those having knife-edges on the surface of a cylinder or cone, which are brought to act on the turnips by turning a handle.

TURNIP-FLY, a name given to several insects destructive to turnips. It is often given to *Altica* (or *Haltica*) *nemorum*, also called TURNIP-FLEA, from its skipping or leaping powers, but which is truly a very small beetle, with long and strong hind-legs,



Turnip-fly (*Anthomyia radicum*):
1, Maggot (magnified); 2, Pupa; 3, natural size: 4, insect; 5, natural size.

and ample wings, of a shining black color, with two yellowish stripes down the wing-cases, and ochreous legs. It swarms in meadows and hedge-rows in most parts of Britain from March to October, the larva feeding on many cruciferous plants. It often commits great ravages in turnips-fields, whilst the turnips are very young. The female lays her eggs on the under-side of the leaf, and the minute larva mines in the leaf, under the skin, making a tortuous gallery. Farmers sometimes steep the seed of turnips in order to prevent the ravages of this insect, but no good can be thus done, as the eggs are not in the seed.

The TURNIP-FLY, more properly so called, is *Anthomyia radicum*, a dipterous insect of the family *Muscidæ*, and of the same genus with the Cabbage-fly and Beet-fly. It attacks the root of the turnip, as the Cabbage-fly does that of the cabbage, the larva living in the root.

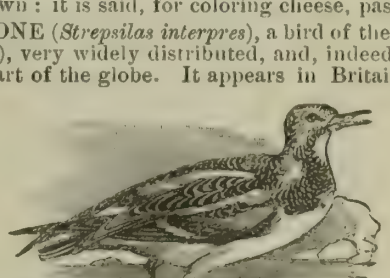
TURNIP SAW-FLY. See SAW-FLY.

TU'RNPIKE ROADS. See HIGHWAY, TOLL.

TURNPIKE STAIR, a turret stair revolving round a central newel.

TU'RNSOLE, a peculiar coloring material consisting of very coarse linen rags, usually pieces of sacking, prepared by cleaning and bleaching, and then dipped into the juice of the leguminous plant called *Crozophora tinctoria*, previously mixed with ammoniacal matter, and exposed to the air for some time. It is made in France, but is exclusively used in Holland, but for what is not certainly known: it is said, for coloring cheese, pastry, &c.

TU'RNSTONE (*Strepsilas interpres*), a bird of the plover family (*Charadriadæ*), very widely distributed, and, indeed, found in almost every part of the globe. It appears in Britain, chiefly as a



Turnstone (*Strepsilas interpres*), in summer plumage.

winter bird of passage, but breeds occasionally in the Shetlands. It frequents the sea-shore, and derives its English name from its habit of turning over small stones with its bill in search of food. It is the only known species of its genus. The eggs, which are four in number, are laid on lonely rocky coasts where there is sparse vegetation. They vary very much in color and markings, and are cunningly concealed. The whole length of the T. is rather more than eight inches. The plumage varies with the age

of the bird and the season. In August the plumage begins to get dull.

TU'RPENTINE is a semi-solid resin which is yielded by various species of pine, and by some other trees when incisions are made into them. The chief varieties of turpentine are *Common Turpentine*, yielded by *Pinus abies; Venice Turpentine*, yielded by the larch; *Bordeaux Turpentine*, yielded by *Pinus maritima;* and *Chian Turpentine*, yielded by *Pistacia lentiscus.* The Venice turpentine, which is regarded as the best variety, occurs as a clear, transparent, pale yellow, viscous mass, of a balsamic odor, and an acrid bitter taste, perfectly soluble in spirits of wine, and increasing in density on prolonged exposure to the air. On distilling it with water, it yields a considerable quantity of essential oil, vulgarly known as *spirits of turpentine.* This *oil of turpentine* (which, from its greater cheapness, is usually obtained from common turpentine) is, after rectification, represented by the formula $C_{20}H_{16}$, and has a spec. grav. of 0·864, and a boiling-point of 320°. It is colorless, transparent, has a strong refractive power, a strong peculiar odor, and a disagreeable acrid taste. It is readily soluble in alcohol, in ether, and in the fixed and essential oils, but is insoluble in water, on which it floats. It is a good solvent for many substances, amongst which may be especially mentioned sulphur, phosphorous, caoutchouc, and the various resins; and is largely used in many departments of the arts, forming a large proportion of all oil paints. Great quantities are imported into Britain from the United States, where it is mostly yielded by the Swamp-pine.

Turpentine is an energetic producer of Ozone (q. v.); and on keeping it for a long time in a stoppered flask, which should be occasionally shaken, the odor of ozone is very distinct on opening the vessel. Oil of turpentine forms three hydrates, of which two are solid. Commercial oil of turpentine often consists of a mixture of several isomeric hydro-carbons which act oppositely on polarized light (like the several varieties of sugar). Deville and Berthelot have ascertained that there are various modifications of which this oil is susceptible without its undergoing any change in its chemical composition. Of these, *isoterebenthene* and *metaterebenthene* differ *inter alia* in their boiling-points, and may thus be separated; *terebene* (which has an odor resembling that of oil of cloves) and *colophene* are obtained by acting on the oil with sulphuric acid; and *camphilene* and *terebilene* by decomposing artificial camphor (which is a combination of the oil with hydrochloric acid) by means of quicklime.

Under the influence of nitric, hydrochloric, and sulphuric acids, chlorine, &c., oil of turpentine yields many products of interest to the chemist, but as yet of little practical value.

Oil of turpentine is used to a considerable extent in medicine, although, from its disagreeable taste, and from certain bad effects which occasionally follow its use (as strangury, bloody urine, vertigo, a species of intoxication, and an eruption on the skin), it is often supplanted by less certain remedies. It is probably the most effective remedy for the expulsion of tapeworm, is nearly equally efficacious over the lumbrici or round-worms, and in the form of an injection is serviceable in the case of ascarides or thread-worms. For an adult, in a case of tapeworm or round-worm, the dose should be one ounce, combined with an equal quantity of castor-oil, or made into an emulsion with yolk of egg or mucilage. In the case of children and delicate women, it is better to try a milder vermicide (see VERMIFUGES). In doses of from two drachms to two ounces, and in similar combination with castor-oil, it may be given as a cathartic in cases of obstinate constipation, especially when dependent on affections of the brain; in hysteria, epilepsy, tympanitis, passive hæmorrhage, and in purpura hæmorrhagica, in which last-named disease Dr. Neligan highly recommends it. In small doses (as from 10 to 20 minims), oil of turpentine is regarded as a diuretic; but it must be given with caution, in consequence of its stimulating properties. It is of more service in chronic mucous discharges of the genito-urinary organs, as gleet, leucorrhœa, &c., than in dropsy. In small doses it is often useful in chronic rheumatism and in sciatica.

In the Dublin school, it is much employed in small and repeated doses as a general stimulant in the low stages of continued fever. *Turpentine Punch* has long been a favorite remedy in the Meath Hospital (where Graves and Stokes made their reputation) in these cases. It is composed of an ounce of oil of turpentine, two ounces of brandy, eight ounces of boiling water, and a sufficient quantity of sugar. A third of this should be taken for a dose, and should be repeated if necessary every third hour. When applied externally, oil of turpentine is a speedy and powerful rubefacient and counter-irritant, and is beneficially used in this capacity in inflammatory attacks of the throat, chest, and abdomen. The best method to pursue is to rub the oil by means of a bit of flannel over the part to be acted on; over this to lay three or four folds of flannel, wrung out of hot water, and over the flannel to place a dry towel; two or three such applications produce a sufficient result. There is a *Liniment of Turpentine* which is powerfully stimulating, and is applied as a dressing for extensive burns; and is likewise used, with friction, in rheumatic and neuralgic cases. There is also the *Liniment of Turpentine and Acetic Acid*, which is the officinal representative of the well-known *St. John Long's* liniment, and is an excellent counter-irritant (applied with a sponge) in pulmonary consumption and other chronic pulmonary affections. Lastly, *Ointment of Turpentine*, a warm stimulating application, requires mention.

It was mentioned at the beginning of this article that on distilling turpentine with water, the oil comes over. The residue left in the retort constitutes common *resin* (or *rosin*), known also as *colophony.* See RESINS.

TURPENTINE TREE. See PISTACIA.

TURPIN, Archbishop of Rheims, friend and companion of Charlemagne, and eye-witness of the exploits he relates—such are the names and qualifications assumed by the author of a chronicle in Latin prose narrating the expedition of the Frankish emperor against the Saracens of Spain, and particularly the events that preceded and followed the battle of Roncesvalles (q. v.). That a Bishop Turpin existed about this period, is admitted, but the very documents in which he is mentioned, state that he was slain at Roncesvalles. There was also an Archbishop Turpin of Rheims (753—800 A.D.), but he has no claim to the description given above; and, in fact, all internal evidence leads to the conclusion that it is a work of the 11th century. It seems to have sprung out of the epic ballads and traditions of the Carlovingian heroes, while these were still in a comparatively pure condition; but through the legendary manner in which they are told, there is visible a monkish aim—viz., to encourage the foundation of churches and monasteries, the undertaking of religious wars against the Saracens, and above all, the pilgrimage to San Jago de Compostella. Now, as in the year 1190, a brother of the Archbishop of Vienne (subsequently Pope Calixtus II.) obtained by marriage the countship of Galicia; as it was from Vienne that the pseudo-Turpin's chronicle was recommended to the rest of Christendom; as the same archbishop was detected on several other occasions fabricating false documents; as subsequently, in his quality of pope, he himself pronounced the chronicle authentic in a bull of 1122 (the authenticity of which has, however, been questioned); as he pursued the same family policy in his acts as pope, and in his sermons in honor of San Jago; finally, as the chronicle of the pseudo-Turpin is very often followed in the MSS. by a dissertation of Calixtus upon the miracles of San Jago, it has seemed to critics highly probable either that Pope Calixtus wrote the work himself, while yet Archbishop of Rheims (*circa* 1090), or, at least, that he took an important part in its composition. The book soon acquired a great popularity, was translated into French after 1206, and was made use of by divers chroniclers, as the author or authors of the *Chroniques de Saint-Denis*, Vincentius Bellovacensis, &c.

The chronicle is of great historic value, in spite of all the embellishments it has from time to time received; for, as one of the most ancient traditions of the time of Charlemagne, it has preserved numerous traits and details with more purity and fidelity than the poems of the Carlovingian cycle, which are generally of later date. The chronicle has been printed in Reuberus's edition of the *Scriptores* (Hanau, 1619; Frank. 1726), but see Ciampi's *De Vita Caroli Magni et Rolandi Historia Turpino vulgo tributa* (1822), and G. Paris's *De Pseudo-Turpino* (Par. 1865).

TU'RPIS CAU'SA, a phrase in the Law of Scotland, borrowed from the Roman law, to express an immoral consideration on which some contract or obligation is founded. The rule is, that when an immoral contract is broken, no court of law will assist either party to enforce it. Thus, if a man were to let lodgings to a prostitute, with the knowledge that the lodgings were to be used for carrying on her vocation, he would have no right to bring an action to recover rent.—The same is the rule in English law.

TURQUOI'SE, a mineral hitherto found only in the province of Khorassan, in Persia, and much prized as an ornamental stone. It is essentially a phosphate of alumina, containing also a little oxide of iron and oxide of copper. It is harder than felspar, but softer than quartz, and has a greenish-blue color. It is opaque, or sometimes translucent at the edges. It is sometimes called Oriental T.; whilst the name Occidental T. is given to a substance of similar color, found near Simon, in Languedoc, which is said to be merely bone colored with phosphate of iron.

TURRET-SHIP, a recent invention in naval warfare, consists of an iron-plated vessel rising but slightly above the water. In the middle of the deck are one or more turrets encased in the most massive plates, and holding each one or two guns of heavy calibre. The turret, in American vessels, is pivoted on the keel or other firm base; in English specimens it revolves on rollers under the periphery. By means of simple mechanism, it can be made, either by a steam-engine or by hand, to revolve with considerable speed, thus giving the gun a range in every direction. Turret-

ships were first proposed in America, by Mr. Theodore R. Timby, of New York, and were patented in this country by Captain Cowper Phipps Coles of the royal navy, who, after much discussion with the Admiralty, was allowed to adapt the *Royal Sovereign*, a wooden vessel which had been built for a three-decker, to his designs. The plan was tried under disadvantages, as the ship had not originally been destined for such heavy work. Notwithstanding, the *Royal Sovereign*, as a turret-ship, was declared

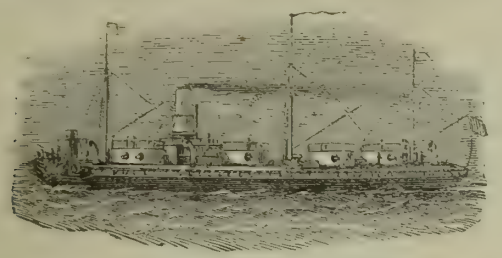


Fig. 1.—Turret-ship, *Royal Sovereign*.

by competent officers to be at that time the most powerful vessel in the British navy. Almost simultaneously in the United States, similar vessels, called 'Monitors,' sprang into existence, the principal point of difference between them and the British build being that their hulls are almost entirely submerged, the turrets being wholly above the upper deck; while, in the latter, the hulls rise higher from the water, and the turrets are sunk below the deck, except in so far as is absolutely necessary for discharging the ordnance.

The British model gives the advantage of higher free-board, and consequent greater safety in heavy seas. Captain Coles lost his

Fig. 2.—American Turret-ship, *Miantonomah*

life in the greatest naval catastrophe of modern times, the capsizing of his great turret-ship, the *Captain*, with about 600 souls on board, in the Bay of Biscay, in September 1870. This vessel was built after his complete design; but naval architects attribute her loss to a low free-board, coupled with heavy masting. It has for several years been in dispute whether to trust to turret-vessels or to ships with their battery in broadside. Under the administrations of Lords Palmerston and Russell, the Admiralty built broad-side vessels. Lord Derby's government signalized their accession to power in 1866 by immediately ordering four iron turret-ships of immense power and 4000 tons each.

Among the advantages claimed for turret-ships are—that much heavier ordnance can be carried centrically than at broadside, with equal dislocating pressure on the keel; that in a sea the platform

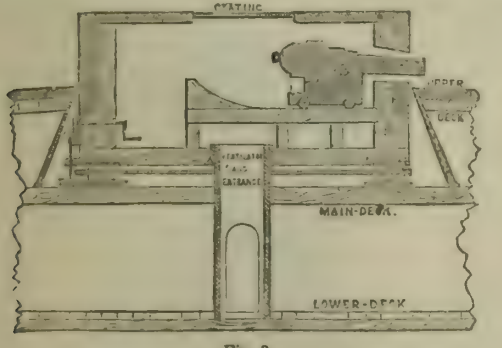


Fig. 3.

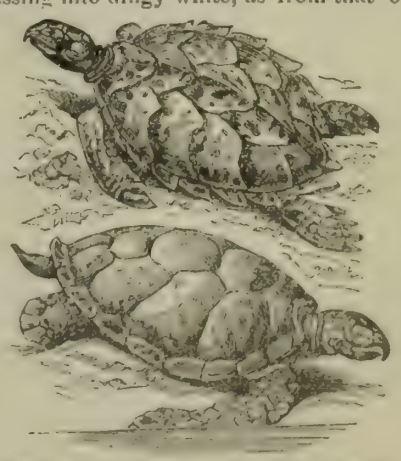
from which aim is to be taken is steadier at the center; that the mark offered to the enemy is smaller; and that the gunners are safer, as the turret can be turned with its port-hole away from the enemy during loading. The *Devastation*, with her 35-ton guns, has been exceeded in power by the *Inflexible*, whose armor-plating, amidships, is two feet thick, and which is furnished with two turrets, each containing two 81-ton guns. Mr. Rendel, upon whose principle the guns are mounted, uses hydraulic power, which enables the loading and firing to be conducted by two men only.

TURRITE'LLIDÆ, a family of gasteropodous molluscs, having a much elongated spiral shell, the lower spires remarkably separated. The name Turret-shell is often given to them.

TURTLE, the popular name of those Chelonian reptiles, the family *Cheloniadæ* of some, which have a rather flat carapace, and fin-like paddles instead of legs, suited for swimming, and not for walking. The fore-limbs are much longer than the hind-limbs. The toes are not all furnished with nails; in some species, there is only one on each foot, in others there are two. Turtles are all marine, and although they lay their eggs on the beach, seldom visit the shore for any other purpose. They deposit their eggs in holes, which they scoop in the sand with their hind-feet. The eggs are numerous, one hundred and fifty or two hundred being often deposited at a time, and the T. lays several times a year. The young, soon after being hatched, make their way through the sand which covers them, and immediately betake themselves to the water. The eggs are hatched by the heat of the sand alone, and the young receive no attention from their parents. Turtles crawl slowly and awkwardly on the shore; but their movements in water are comparatively quick, and even graceful. Some of the species feed entirely on grass-wrack and seaweeds, which their powerful, hard, and sharp-edged jaws cut with great ease: others prey on crustaceans, molluscs, and fishes. Their jaws are powerful enough to crush very large shells, and the carnivorous turtles are in general more rapid in their movements than the others. The flesh of those which subsist on animal food is musky and unpleasant; but that of the species whose food is vegetable is much esteemed.

In many tropical countries, turtles, after being captured, are kept in enclosures to which the tide has access to be killed when they are wanted. They are capable of subsisting long without food, and are imported alive from the West Indies into Britain, to supply the tables of the wealthy. In tropical countries, turtles are often very cheap. Their eggs are a much-esteemed article of food in the countries where they are found, and are sought for by probing the sand with a light stiff cane in the places known to be frequented by turtles. Turtles are easily taken when they come ashore for the purpose of laying their eggs, and one after another may be turned on its back—in which position it is helpless, and cannot make its escape—till a sufficient number is secured. They are also, however, taken in the sea, being cautiously approached by boats when resting, or apparently sleeping, at the surface, or by divers when descried at the bottom in their feeding-grounds. A small harpoon is used, or a rope is thrown over the head of the turtle. Turtles are sometimes pursued by boats in shallow parts of the sea until they are exhausted, the clearness of the water permitting them to be seen even when they dive; and when the boat gets near enough, a man leaps overboard, and seizes the T., clinging with both hands to the shell. It is said that at Mozambique a species of sucking-fish (*Echineis*) is used for catching turtles, a cord being attached to the fish, which is allowed to swim away in the sea, and is sure to fasten itself firmly to the first T. it meets.

The most esteemed T. of the West Indies is the GREEN T. (*Chelonia mydas*), which is the only kind imported into Britain for aldermanic and other feasts. The Green T. attains a large size, being sometimes six or seven feet in length, and weighing 700 or 800 lbs. The plates of its carapace do not overlap one another; the central ones are almost regular hexagons. The popular name is derived not so much from the external color, which is mostly a dark olive, passing into dingy white, as from that of the fat, so



1, Hawkbill Turtle (*Caretta imbricata*); 2, Green Turtle (*Chelonia mydas*).

much prized by epicures.—Another excellent species of T. is the EDIBLE T. (*Chelonia virgata*) of the East Indies, which is fre-

quently four or five feet long.—The HAWKBILL T. (*Caretta imbricata*), found in the warmer parts of the Atlantic Ocean, in the Indian Ocean, and in the Red Sea, is particularly valuable, as yielding the best Tortoise-shell (q. v). It is one of those turtles which have the plates of the carapace imbricated, or overlapping one another like tiles. Its flesh, although not so much esteemed as that of the Green T., is a good article of food; its eggs are also very good.—There are other turtles, having the head of a larger size, and the jaws curved towards one another at the extremity, of which one is the LOGGERHEAD T. (*Caouana olivacea*), a native of the warmer parts of the Atlantic, and a very rare visitant of the British seas. Others, again, have the carapace and plastron not hard, but leathery, and sometimes soft enough to yield to the pressure of the finger. One of these is the CORIACEOUS T. (*Sphargis coriacea*) of the Mediterranean and Atlantic, occasionally, but rarely, found even on the British shores. It attains a very large size, even greater than any of the species already described, but its flesh is course and unpleasant.

The French, encouraged by their success in pisciculture, have attempted to introduce the Green T. on the southern coasts of France. There has not yet been time to prove the success of the experiment.

TURTLE-DOVE, or TURTLE (*Turtur*), a genus of *Columbidæ*, having the bill more slender than pigeons, the tip of the upper mandible slightly bent down. They are also more slender and

Turtle-dove (*Turtur communis*).

elegant in form than pigeons, and generally smaller; the wings are longer and more pointed; and the tail is longer, rounded, or slightly graduated. There are numerous species, natives of warm climates. Their soft and gentle, yet loud *cooing* has attracted attention even more than their beauty, and made them a favorite subject of allusion in poetry. *T. risorius*, the most common species in Palestine, and probably the one intended in the Song of Solomon, is about ten inches in entire length, with a short tail; the general color gray tinged with red; the upper parts greenish brown, with a black collar on the back of the neck. It is often kept in confinement, and becomes very tame.—Very similar to this in size and form is the COMMON TURTLE-DOVE (*T. communis*), a native of almost all the warmer parts of the Old World, a summer visitant of the south of Europe and of England, where it is chiefly found in the south-eastern counties. In Kent, flocks of twenty or more are often to be seen, particularly in the pea-fields. The tail is long and much rounded; the plumage soft, and without gloss, exhibiting finely-mingled tints of gray and brown; the crown of the head bluish; all the tail-feathers tipped with white; a black patch on each side of the neck. Other species of turtle dove, from different parts of the world, as well as these, are not unfrequently kept in confinement, and are very gentle, if not very intelligent pets. Their cooing resounds through a whole house.

TU'SCAN ORDER OF ARCHITECTURE, one of the five Classic Orders (q. v.), being a Roman modification of the Doric style with unfluted columns, and without triglyphs. It is the simplest of the orders.

TU'SCANY, formerly a sovereign grand duchy in the west of Italy, lying for the most part, but not wholly, south and west of the Apennines, in lat. 42° 20′—44° 10′ N., and long. 10° 15′—12° 20′ E. Area, 8440 sq. m.; pop. in 1860, at the date of its annexation to Sardinia, 1,800,000; (1881) 2,208.516. The north and north-east of the country is filled with mountains, whence numerous rivers and streams flow down to the sea, the most important of which are the Arno (q. v.), the Serchio, and the Ombrone. This district is also the source of the Tiber (q. v.). The rest of T. is an undulating region of hills and dales, except the coasts, which are flat and marshy. Of these marsh-lands, the largest is (or was) the *Maremma* (q. v.). The principal crops are maize, wheat, rye, and barley. Wine and oil are also abundantly produced. Mules, cattle, and sheep are reared in great numbers; there are flourishing manufactures of silks, woollens, and straw (for hats); and a very considerable trade is carried on in articles in marble, alabaster, porcelain, coral, wax, &c. T., as a *compartimento* of the kingdom of Italy, comprises the administrative provinces of Arezzo, Firenze, Grosseto, Livorno, Lucca, Massa e Carrara, Pisa, and Siena.—The ancient history of T. is described at length in the article ETRURIA, and its medieval history in the article FLORENCE. It is only necessary to add that modern T. was first constituted in its present dimensions in 1569, when Cosmo de Medici became Grand Duke of Tuscany. On August 16, 1860, the national assembly of T. pronounced the deposition of the reigning dynasty; and four days later, declared for annexation to Sardinia.

TUSCARO'RAS, a tribe of North American Indians, who, at the settlement of North Carolina, had 15 towns on the Tar and Neuse rivers, and 1200 warriors. In 1711, they began a war with the settlers, and after a series of savage encounters, were defeated, and joined the Iroquois in New York, where they became allies of the English, and where about 50 familes still reside on an Indian Reservation in the western part of the state.

TU'SCULUM, anciently a city of Latium, about 15 miles south of Rome, was situated on a ridge of hills known as the *Colles Tusculani*, and forming part of the Alban range. We ought not to infer from its name (as Festus does, *s. v. Tuscos*) that it had any connection with the Etruscans. Mythically, it derived its origin from Telegonus and Circe; but we catch the first certain glimpse of its historical existence towards the close of the regal period at Rome. Then, however, it appears in the enjoyment of a high degree of prosperity and power, and therefore its beginnings are in all probability remote. Octavius Mamilius, ruler of T., and the foremost prince in Latium, married a daughter of Tarquin the Proud (see TARQUINIUS), and played a conspicuous part in the last of the great struggles made by the banished tyrant to regain his kingdom. On that occasion, the Latins were so thoroughly beaten (see REGILLUS LAKE) that they were fain to enter into an alliance with the victor, and ever after—except in the single instance of the Great Latin War 340—338 B.C.)—remained steady in their attachment and fidelity to Rome. As early as 378 B.C., the inhabitants of T. received the Roman franchise, and among its many distinguished *gentes* may be specially mentioned the Porcian, which produced two famous men of a thoroughly 'Roman' stamp, Cato *Major* and Cato *Minor*. Towards the close of the Republic, T. became a favorite country residence of the wealthy Romans. Lucullus had a villa here (with parks and gardens extending northwards for miles); so had Cato, Brutus, Hortensius, Crassus, Cæsar, and Cicero. The villa (*Tusculanum*, Tusculum House) of the great orator is peculiarly memorable as the place where he composed many of his philosophical works, and particularly those charming dialogues (*Tusculanæ Disputationes*) which derive their name from it. Long after the Western Empire had fallen, T. continued to flourish. As late as the 12th c., the ancient city continued entire; but in 1191 it was stormed by the Romans (between whom and the Tusculans there had long been a deadly feud), and razed to the ground. It never recovered from this blow; but lower down there arose from its ruins, if we may so speak, the town of Frascati (q. v.). Many fine remains of ancient T. have been dug up in recent times, the most remarkable, perhaps, being the amphitheater, theater, and city walls.

TU'SSAC GRASS (*Dactyliscæspitosa*), a large grass of the same

Tussac Grass (*Dactylis cæspitosa*).

genus with the Cock's-foot Grass of Britain, a native of the Falk-

land Islands, remarkable for forming great tufts, sometimes five or six feet in height, the long tapering leaves hanging over in graceful curves, from five to eight feet long, and an inch broad at the base. It is, however, sufficiently delicate to be very good food for horses and cattle; and the attention of British farmers having been very strongly called to it, it has been tried with success in the Hebrides, Orkney Islands, and other localities in which there is a peaty soil exposed to winds loaded with sea-spray, to which it promises to be a very valuable acquisition. The inner part of the stem, a little above the root, is soft, crisp, flavored like a hazel-nut, and often eaten by the inhabitants of the Falkland Islands. The young shoots are boiled and eaten as asparagus.

TUSSILA'GO, a genus of plants of the natural order *Compositæ*, sub-order *Corymbiferæ*, having bracteæ with a membranous edge, a naked receptacle, a hairy pappus; the florets of the ray pistilliferous, in many rows, tongue-shaped; those of the disc perfect, few. *T. Farfara*, sometimes called COLT'S-FOOT, is the only British species. It has single-flowered scaly scapes, appearing before the leaves in early spring, the flowers yellow, both disc and ray; the leaves heart-shaped, angular, downy beneath. The leaves have a somewhat glutinous and subacrid taste, and are

Colt's-Foot (*Tussilago Farfara*).

used either by smoking, or in the form of a decoction, for relief of asthmas and troublesome coughs. They have been used with advantage in scrofula.—Nearly allied to this genus is *Petasites*, of which one species, the BUTTER BUR (*P. vulgaris*, formerly *Tussilago Petasites*), is a native of Britain. The leaves resemble those of *Tussilago Farfara*, but are much larger; the flowers also appear before the leaves, but in a dense thyrsus, and are of a pale flesh-color. The flowers of both are much sought after by bees, as are those of *Petasites* (formerly *Tussilago*) *alba*, and *P.* (formerly *T.*) *fragrans*, natives of the south of Europe, not uncommon in our flower-gardens.

TU'SSOCK MOTH (*Laria pudibunda*), a grayish-white moth, about an inch long, the upper wings freckled, with four irregular

Tussock Moth and Caterpillar.

darkish lines, the under wings nearly white. The caterpillar does great mischief in hop plantations, and is known by the name of *Hop-dog*.

TUTOR, in the Law of Scotland, means a guardian of the person as well as of the estate of a boy under 14, or a girl under 12; that is, while they are in a state under that of puberity. At common law, a father is both tutor and curator of his children. Tutors are divided into three kinds: tutors nominate, tutors at law, and tutors dative. A tutor nominate is he whom the father, who has the sole power of naming a tutor, has appointed by will or deed. Sometimes several are appointed to act jointly. In general, no security is required from a tutor nominate, because the father's choice implies that the tutor is a trustworthy person. Yet, if he is *vergens ad inopiam*, or of doubtful character, security will be required. Tutors at law are those whom the law will appoint in a certain order of relationship, if there is no tutor nominate. No cognate, i. e., no relation by the mother's side, will be appointed; but the nearest agnate, i. e., a person related through the father, will be appointed, if a male, and of the age of 25, and able to give security. The tutor, however, has only the custody of the pupil's estate, while the custody of the pupil's person is given to the mother or nearest cognate. A tutor dative is named by the crown when there is no tutor nominate or tutor at law. Tutors other than tutors at law have the custody of both the person and estate of the pupil, and act alone for the pupil, suing for and discharging all debts due, and managing the property. The tutor's office is gratuitous, and he is not allowed to derive any profit from it, or to do acts inconsistent with his duty. For some purposes, however, such as selling the pupil's land, he must have the sanction of the Court of Session. He is bound, on entering office, to make up an inventory, and must keep proper accounts.

TU'TTLINGEN, a town of Würtemberg, on the right bank of the Danube, 20 miles west-south-west of Sigmaringen. It has manufactures of knives, needles, cloth, cotton, hosiery, linen, and silk, and carries on besides some trade in corn. Pop. (1880) 8022. T. is historically notable as the scene of a battle in 1643, during the Thirty Years' War, in which an Austro-Bavarian force, under Hatzfeld and Mercy, defeated the French.

TUTTY-POWDER, an impure oxide of zinc, which is found in the chimneys of the furnaces in which the ores of that metal are roasted. It has some value in medicine.

TUTUI'LA, an island in the Pacific, belonging to the group of the Navigators' or Samoan Islands (q. v.), is about 17 miles long and 5 miles broad, and is said to contain nearly 5000 inhabitants. The coast is bold, and the island is traversed by sharp-peaked mountains, highly picturesque in outline, and rising to from 2500 to 3500 feet. The harbor of Pago Pago, an ancient crater, is very deep, and completely landlocked by lofty mountains. The mountains are clothed with dense green forests, comprising the bamboo, banana, cocoa-nut tree and other palms. Between the months of November and May, fearful hurricanes break over the island, and so powerful is their effect, that they are said by the natives to *skin the land.—Cruise of H.M.S. Fawn*, by T. Hood (Edmonston and Douglas, Edin. 1863).

TU'YERE, the nozzle or small pipe through which the air is forced into a blast-furnace.

TVER, a government of Great Russia, bounded on the N.W. by the government of Novgorod, and on the S.E. by those of Moscow and Smolensk. Area, 25,080 sq. m.; pop. (1880) 1,638,196, mostly Russians. In configuration, the government is an elevated tableland, forming part of the Valdaï plateau, which throws off rivers that run north-west into the Baltic, and south-east into the Caspian Sea respectively. The chief rivers are the Volga, with its affluents, the Tvertza and the Mologa; the Western Dwina, the Msta, and the Tsna. Most of these rivers rise in the north-west of the government, where there are numerous lakes. The climate is somewhat severe; the soil is not fertile, the most of the government being in marshes, and in woods and tracts of turf, the working of which, however, is as yet insignificant. Rye and oats are the only cereals produced with success. The employments of the inhabitants are principally agricultural; but other modes of industry are gradually developing themselves, especially along the great commercial highways of the government; 50,000 men are employed in the lake-fisheries, which are important, and in the conveyance of goods.

TVER, a city of Great Russia, capital of the government of the same name, stands at the confluence of the Volga with the Tvertza, 348 miles south-east of St. Petersburg, by the St. Petersburg and Moscow Railway. The Volga, which is here wider than the Thames at London Bridge, becomes first navigable for steamers at this town, although there is much difficulty in accomplishing the voyage hence to Nijni-Novgorod, when the water is low. Among the important buildings of T. are 2 monasteries, 23 churches, and 47 factories of different kinds, of which the chief is the cotton-mill of Kaoulin and Zologin, in which 1500 people find employment. Nail-making is an important branch of industry. The situation of T. is very convenient as a landing-place, in consequence of the St. Petersburg and Moscow Railway here meeting the Volga, the principal artery of the commerce of the interior of Russia. The commercial prosperity of the town is continually increasing. Cereals and iron brought from Siberia are the chief articles of commerce, and besides the articles already mentioned, linen, leather, and paper are largely manufactured. Pop. (1880) 38,246.

TWEED, the most famous of Scottish rivers, rises in the extreme south of Peeblesshire, at an elevation of 1500 feet above sea-

level. It flows north-east to near Peebles, thence east by south to its junction with Ettrick Water, and thence in an easterly and finally north-easterly direction to its embouchure in the North Sea at Berwick-on-Tweed. The river drains great part of Peeblesshire, traverses the northern districts of Selkirk and Roxburgh shires; and in its lower course it forms the boundary between Berwickshire on the north-west and the English border-land on the south-east. It receives the Ettrick, the Teviot, and the Till from the south; and the Gala, Leader, and Adder from the north. The T. passes Peebles, Innerleithen, Melrose, Dryburgh Abbey, Kelso, Coldstream, and Berwick, where it falls into the sea after a course of 96 miles, and having drained an area estimated at 1870 sq. m.—greater than that of any other Scottish river, except the Tay. The highest regions through which the river flows are for the most part of the nature of moors; the middle course of the river is through narrow valleys, flanked by hills, clothed with woods or in pasture; and its lower course, through widespread valleys, picturesque and beautiful, and through the rich plain of the Merse (see BERWICKSHIRE), has many attractions. The tide is felt at Norham Castle, ten miles from the mouth of the river; but there is little or no navigation above Berwick. Possibly the T. owes its fame more to the associations which connect themselves with it, than to the charms of the scenery through which it flows. Traversing the heart of the 'Borders,' it has been witness to many a foray between the warrior-farmers north and south of its banks, as well as many a deadly struggle between the rival Houses of the south of Scotland; and its name is frequent in ballad and story. The T. is famous as a salmon and trout stream.

TWEE'DMOUTH. See BERWICK-ON-TWEED.

TWEEDS, a name originally given to a certain kind of woollen cloth largely made at Galashiels, Hawick, Selkirk, and other places in the south of Scotland. This kind of cloth was at first known as *tweels* (twills), so called from being woven diagonally; but owing to an accidental misreading of an invoice, *tweels* was superseded by the popular and appropriate name of *tweeds*. This cloth is of an open, soft, flexible nature; differing from English superfine cloth in not being so finely spun or closely woven, and most of all in not being so thoroughly felted. The fabric of broadcloth is not intended to show any appearance of weaving; whereas in tweeds, the whole art of weaving is capable of being developed in novel and fanciful designs, admitting of great variety of texture. Tweeds manufactured in Scotland are further characterized by their purity of color and genuineness of make—shoddy, mungo, and cotton-warp not being yet used in the production of even the cheaper kinds; though such has been the success of the article, that it is now largely imitated in the English manufacturing districts in all qualities of material. The processes of spinning and weaving are similar to those adopted for English broad-cloth, the machinery being, in the main, alike. As a manufacture, it is of comparatively recent date. At the beginning of the present century, the weavers of Galashiels, then a mere village, manufactured, as they had done for more than 200 years, a kind of coarse woollen cloth known as 'Galashiels grays,' made from wool grown on the surrounding hills. Between 1820–30, the first real break from 'Galashiels grays' occurred, when a beginning was made in the manufacture of woollen cloth in the 'shepherd's check' pattern. This fabric, partly by the patronage of Sir Walter Scott and many of his prominent contemporaries, at once, under its new name of tweeds, became popular. The warmth, comfort, and durability of tweeds, as well as their suitability for all seasons, gradually led to their being preferred to the hard tartans, Manchester linens, and Nankeens of former days; and eventually, even to English doeskins. The demand for them rapidly increased.

Galashiels, from a place of 600 inhabitants in 1778, had risen in 1881 to a place of over 15,000 inhabitants. The neighboring towns of Hawick and Selkirk have equally shared in this prosperity. Nor has the manufacture confined itself to Tweedside, but has spread northwards to Aberdeen, Elgin, and Inverness; southwards to Dumfries, and into Cumberland; and westwards to Stirlingshire and Ayrshire, and even to the Hebrides. About 1858, a great impetus was given to the manufacture, by the introduction of improved wool-washing and drying machinery, and especially the successful employment of self-acting mules for the drawing and spinning of the yarns direct from carding-engine, condenser, and rovings. Subsequently, in order to a division of labor and capital, factories were erected for spinning only, and others for weaving and finishing. The wools used in the South of Scotland for the production of tweeds are chiefly those imported from Australia and the Cape of Good Hope; though in some other districts of Scotland Cheviot, Danish, and other wools are also used. This manufacture is now one of the chief staples of Scotland, and its success has been greatly due to the sound quality of the raw material made use of in the Scotch trade, as well as to the good taste and practical knowledge displayed by the makers. The Jury Report on the woollen goods exhibited in the International Exhibition of 1862 says: 'To the Scotch manufacturers belongs the credit of having found out what the public like, and of having led for a considerable period the public taste.' In the last-named year, the total annual value of the tweeds made in Scotland was estimated at £1,600,000; but so great has been the development of the trade, and the increase of the productive power, since then, that the manufactories, when fully employed, were estimated in 1881 to be capable of turning out tweeds to the annual value of £4,500.000. About half this sum would represent the value of the wool used.

TWELFTH-DAY. See BEAN-KING'S FESTIVAL and EPIPHANY.

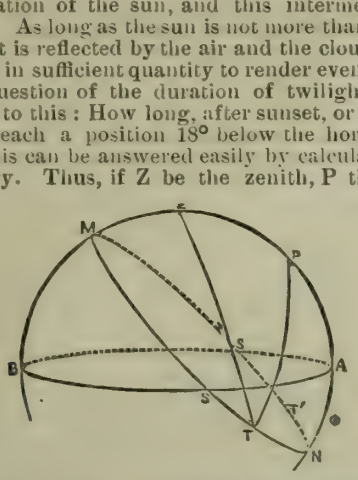
TWELVE TABLES (Lat. *Lex* or *Leges Duodecim Tabularum*), the name given to the earliest code of Roman law. According to the ancient account, the code originated in this wise: In the year 462 B.C., a tribune, C. Terentilius Arsa, brought forward a proposal to appoint five men to draw up a set of laws, with the view of limiting the *imperium* of the consuls. The aristocracy, always furious, selfish, and unwise in their struggles with the commons of Rome, violently resisted this reform, and for eight years a fierce parliamentary warfare—if we may so call it—was carried on between the two orders, which ended in a sort of partial victory for the plebeians; that is to say, in 454 B.C., the senate assented to a *Plebiscitum* (see PLEBISCITE), in virtue of which three commissioners were despatched to Greece to report on the laws in force among the different states there. After a lapse of two years, they returned; and it was then agreed that ten men (*decemviri*) should be selected to draw up a code (*legibus scribundis*); but the patrician or aristocratic party took care that these decemvirs should all be chosen from their body. The story of the political fortunes of the Decemviri (q. v.), and of the fate of the leading decemvir, Appius Claudius (q. v.), are well known, though we believe that it has not come down to us in a very historical dress; indeed, it is politically quite unintelligible in the main. But what concerns us here is not the political career of these men, but the character of the legislation ascribed to them. We say ascribed to them, for the whole story of the foreign travels of the commissioners, and of their eclectic procedure in the matter of the Solonian and other laws, is so completely at variance with the simple, narrow, *home-centered* feelings of the Roman people at that early time, and with the thoroughly *Italian* stamp of the legislation embodied in the 'Twelve Tables,' that it has very reasonably been doubted whether such a commission ever existed, or, if it did, whether it did not acquire its information from the Hellenic cities of Lower Italy. Niebuhr, however, thinks the embassy to Greece just possible, though he is obviously reluctant to go further, and affirm that it really did occur (*Lect. Rom. Hist.*, vol. i. p. 296), and points out very clearly the difference between the Roman and Greek laws. 'All,' says he, 'that is distinctive in the Roman law, is not to be found in the Athenian; and distinctive it is with regard to the rights of persons and things.

'Never had the Greeks the right of paternal authority, like the Romans; never the law, that the wife, by her marriage, entered into the relation of a daughter and co-heiress; never the *jus mancipii*, the formality in the purchase. The difference between property by formal purchase and simple property, between property and hereditary possession, does not exist in the Attic law; the Roman law of inheritance, the Roman law of debt, the Roman system in contracts of borrowing and lending, are quite foreign to the Athenians' (*Lect. Rom. Hist.*, vol. i. pp. 295, 296). These differences, and the number could easily be enlarged, have induced modern historians to adopt the theory—if, indeed, that should be called a 'theory' which, in the eyes of all sound investigators, is a demonstrated fact—viz., that the Twelve Tables, instead of being an eclectic assortment of foreign laws, hitherto unknown to the people of Rome, and imposed on them for the first time, really expressed the first effort towards the codification of the consuetudinary law of the Latin race.

According to Livy (iii. 57) and Diodorus (xii. 56), the laws of the Twelve Tables were cut on bronze tablets (whence their name), and put up in a public place. Whether these tablets were destroyed by the Gauls when they sacked and burned Rome (390 B.C.), is uncertain. At all events, the later Romans entertained no doubt that the collection which existed in their time was genuine. The only portions extant are those which have been quoted by jurists and others. The Twelve Tables is described by Livy (iii. 34) as the *fons publici privatique juris*—the fountain of public and private law. Cicero (*de Or.* i. 43, 44) speaks of them with high praise. In the course of years, the *Jus Publicum*, as could not fail to be the case, was greatly changed, but the *Jus Privatum* of the Twelve Tables continued the fundamental law of the Roman state. See George Long's article 'Lex,' in Smith's *Dic. of Gr. and Rom. Ant.*; Niebuhr's *Lect. Rom. Hist.* (English translation, vol. i. pp. 295—319), Mommsen's *Hist. of Rome* (English translation, vol. i. book i. chap. 11, and book ii. chap. 2.) The most complete essay on the history of the extant fragments of the Twelve Tables is to be found in Dirksen's *Uebersicht der bisherigen*

Versuche zur Kritik, und Herstellung des Textes der Zwölf-Tafel-Fragmente (Leip. 1824).

TWI'LIGHT. If the earth had no atmosphere, we should be involved in total darkness from the instant of sunset till the instant of sunrise. The transition from day to night, and from night to day, occupies an interval which varies with the latitude and the declination of the sun, and this intermediate stage is called twilight. As long as the sun is not more than 18° below the horizon, its light is reflected by the air and the clouds and vapors suspended in it, in sufficient quantity to render even distant objects visible. The question of the duration of twilight is, therefore, simply reduced to this: How long, after sunset, or before sunrise, does the sun reach a position 18° below the horizon of a given place? And this can be answered easily by calculation in spherical trigonometry. Thus, if Z be the zenith, P the pole of the



heavens, ASB the horizon, and MSTN the (small) circle which the sun describes about the pole; there is twilight while the sun moves from T to S. ZT being an arc of 108°. In the spherical triangle ZPT, we know the three sides, for ZP is the colatitude of the place, PT the sun's polar distance, and ZT is 108°. Hence we can calculate the angle ZPT, which is the sun's *hour-angle;* and from this we find at once how long before or after noon the sun passes the point T. If ZT' be also 108°, we see that it is night while the sun moves from T' to T, day while it moves from S (through M, its meridian position) to S', morning twilight from T to S, and evening twilight from S' to T'. Make ZC = 108°, then, if PN be less than PC, but greater than PA, there will be no point of the sun's path (MS'NS) so far as 108° from Z; and therefore the points T and T' will not exist. In this case the sun will set and rise, but there will be *no night*, or, rather, twilight will occupy the whole interval from sunset to sunrise. This cannot occur in low latitudes, but does occur during certain periods of the year in northern and southern countries. For

PN is 90° — sun's declination,
PC is latitude + 18°,

and our condition is, therefore, that 90° — sun's declination, while greater than the latitude, does not exceed it by more than 18°. Or, in a simpler form, the latitude, together with the sun's declination, must lie between 90° and 72°.

Now, the sun's greatest declination is about 23° 30', and therefore, in lat. 48° 30' (72°—23° 30'), there will be one night in the year (at the summer solstice) consisting wholly of twilight; for higher latitudes, more; and for lower, none. Some curious problems on this subject, such as the finding the time of year at which the twilight is longest in a given latitude, were among the early triumphs of the differential calculus. A curious phenomenon, known as the *afterglow*, or second twilight, often seen in the Nubian desert, is referred by Sir John Herschel to a *second* reflection of solar light in the atmosphere. Lambert and others had previously speculated on the possibility of second and even third twilights, but in their time there was no recorded observation of such appearances.

Attempts have been made to deduce from the duration of twilight the height of the earth's atmosphere; and from various measurements which have given results agreeing fairly with each other, 50 miles has been assigned as a probable value. But, till we know more of the law of temperature in the atmosphere, we have no very direct means of testing the correctness of such results. In all probability, they are too small, as, indeed, we might expect, if we suppose the higher regions of the atmosphere to be much attenuated, and, therefore, reflecting little light. Besides, the ignition of meteorites is believed to have taken place at altitudes of more than 50 miles; and auroral arches have been observed at least 60 miles high.

TWILL, a woven fabric, in which the warp is raised one thread, and depressed two or more threads for the passage of the weft: this gives the structure a curious appearance of diagonal lines.

TYBEE', an island and sound at the mouth of the Savannah River, Georgia, U.S. The sound is a bay of the Atlantic, extending from Tybee Island on the south to Hilton Head on the north, opening to Point Royal entrance by Cooper's River, Wall's Cut, Lazaretto Creek and other channels. The island is six miles long by three wide; and was occupied in 1861 by General Sherman, who erected batteries for the reduction of Fort Pulaski, which capitulated April 11, 1862.

TY'BURN, previously to 1783, the chief place of execution in London, was situated near the northeastern corner of Hyde Park, at the western extremity of Oxford Street, and at the point where the Edgeware and Uxbridge Roads unite. It took its name from a small stream which ran from Hampstead to the Thames through St. James's Park, but which has long since disappeared. The gallows seems to have been a permanent erection, resting on three posts, whence the phrase 'Tyburn's triple tree.' Wooden galleries were erected near it for the accommodation of spectators. Hogarth's Idle Apprentice was executed at Tyburn; and the print which represents the scene, gives a good idea of an execution there. The criminal was conveyed all the way from Newgate to Tyburn, a distance of about two miles, by Holborn and the Tyburn Road, now Oxford Street, but in the 17th c. a 'sloughy country road.' As Oxford Street and London generally spread westward, the long procession became inconvenient, and the place of execution was, on 9th December 1783, removed to the Old Bailey, or Newgate, where it has since remained.

In early times, the frequency of executions rendered the office of hangman more important than it has since become. Throughout the reign of Henry VIII. (38 years), the average number of persons executed in England was 2000 annually. In our own time, the corresponding number has sunk to twelve. Formerly, the hangman must have had almost daily work. This fact, taken in connection with the increase of population, and the employment of the Tyburn hangman in state executions, explains the important place he occupied in popular imagination, and the frequent mention of him in contemporary literature. The first on record was 'one Bull,' who flourished in 1593. He was succeeded by Derrick, referred to in the *Fortunes of Nigel*, and mentioned in a political broadside as living in 1647. In the ballad of *The Penitent Tailor*, published in the same year, reference is made to his successor, Gregory Brandon—

> 'I had been better to have lived in beggary,
> Than to have fallen into the hands of Gregory.'

In Gregory's time, it became the custom to prefix 'squire' to the names of the Tyburn hangmen. This is said to have originated in a practical joke played upon the Garter King-of-arms. He was induced to certify the authenticity of a coat-of-arms of a gentleman named Gregory Brandon, who was supposed to reside in Spain, but who turned out to be the hangman. The Garter King was committed to prison for his negligence, and hence the popular error, that 'an executioner who has beheaded a state prisoner becomes an esquire.' Gregory was succeeded by his son Richard. 'Squire Dun' followed; and after him came Jack Ketch, or Squire Ketch, first mentioned in 1678. He was the executioner who beheaded Lord Russell and the Duke of Monmouth. Lord Macaulay, in speaking of the execution of the latter, says: 'He then accosted Jack Ketch, the executioner, a wretch whose name has, during a century and a half, been vulgarly given to all who have succeeded him in his odious office. "Here," said the duke, "are six guineas for you. Do not hack me, as you did my Lord Russell. I have heard that you struck him three or four times. My servant will give you some gold, if you do the work well." '—See *History of England*, vol. ii. p. 205. What followed, it is needless to repeat. After this time, the 'kings of Tyburn' all received the name of Ketch, and their patronymics seem to have been less noted. Jack Ketch's immediate successor was 'one Rose, a butcher;' and the last of the Tyburn hangmen was Edward Dennis, condemned for taking part in the No-Popery Riots, but respited, it is believed, on the ground that his services could be ill dispensed with.

Among the most memorable executions at Tyburn were those of Elizabeth Barton, the Holy Maid of Kent, and her confederates (1534); John Felton, the murderer of the Duke of Buckingham (1628); Jack Sheppard, the highwayman (1724); Jonathan Wild, the thief-catcher (1725); Mrs. Brownrigg, the murderer of an apprentice (1766); Dr. Dodd (q.v.), found guilty of forging a bond for £4200 (1777); and the Rev. Henry Hackman, murderer of Miss Reay (1779). The associations connected with Tyburn have naturally led to the suppression of the name in the street nomenclature of London; but it survives in that given to the quarter of the metropolis described by Mr. Thackeray as 'the elegant, the prosperous, the polite Tyburnia, the most respectable district in the habitable globe.'—See Chambers's *Book of Days*, vol. ii., and *Notes and Queries*, 2d series, vol. ii.

Under a statute of William III. (10 and 11 c. 23, s. 2), prosecutors who secured a capital conviction against a criminal were exempted from all manner of parish and ward 'offices within the parish in which the felony had been committed.' Such persons obtained what was called a 'Tyburn ticket,' which was enrolled with the Clerk of the Peace, and sold like any other property.

The privilege the tickets conferred must have been highly valued, as they sold at a high price. 'Last week,' says the *Stamford Mercury* of 27th March 1818, 'a Tyburn ticket sold in Manchester for £280.' The act under which they were granted was, however, repealed a few months later, by 58 Geo. III. c. 70, passed 3d June 1818; and since then they have ceased to be recognized.—See *Notes and Queries*, 2d series, vol. xi.

TYE, CHRISTOPHER, an English musician of note of the 16th century. He was born at Westminster in 1500, educated in the King's Chapel, and held the office of musical instructor to Edward VI. when Prince of Wales. He received the degree of Musical Doctor from the university of Cambridge in 1545, and from Oxford in 1548. Under Elizabeth, he was organist to the Chapel Royal, and produced various services and anthems, some of which are yet in repute among musicians. Dr. T.'s general scholarship was considerable.

TY'LDESLEY, a well-built and increasing town of Lancashire. Pop. with Shackerley, (1881) 9953.

TYLER INSURRECTION. A poll-tax of three groats, imposed in 1381, during Richard II.'s minority, to defray the expenses of the war with France, roused the spirit of resistance among the common people. An insult offered by one of the tax-gatherers to a blacksmith's daughter in Essex, led to the first open outbreak. The populace rose everywhere, and under the conduct of two peasants, named Wat Tyler and Jack Straw, they mustered in great force at Blackheath, committing violence on all who came into their hands. They had an interview with the king, who, finding resistance vain, promised aquiescence with their demands, which included a general pardon, freedom of commerce, and the abolition of villeinage. Meantime, a party of insurgents had broken into the Tower, and murdered the Primate and Chancellor, and the Treasurer. The king, encountering Tyler at the head of the rioters in Smithfield, invited him to a conference, when he conducted himself with an insolence that led Walworth, the mayor, to despatch him with a dagger. The king immediately, with great presence of mind, offered himself to head the populace, and leading them to the fields of Islington, where a body of troops had been collected for his Majesty's protection, ordered the rioters to disperse. The revolt, however, was not extinguished without considerable bloodshed.

TYLER, JOHN, tenth President of the United States, born in Charles City county, Virginia, March 29, 1790. His father was an officer of the army in the Revolution, and a judge of the Federal Court of Admiralty. John entered William and Mary College at 12, and graduated at 17, was admitted to the bar at 19, and almost immediately entered upon a large practice. At 21, he was elected to the state legislature, supporting the policy of Jefferson, Madison, and the Democratic party. He was almost unanimously elected five times; and in 1816, entered Congress. During his long congressional career, he sustained all the measures of the State Rights party. In 1825, he was elected governor of Virginia; and in 1827, senator in Congress. He supported General Jackson and the Democratic policy; but sided with Mr. Calhoun on the question of nullification. At a later period, however, 1833—1834, he supported Mr. Clay's resolutions of censure on General Jackson for removing the government deposits from the United States bank. From this period, he became an active partisan of Henry Clay, the candidate of the Whig or Republican party; and in 1840, was elected Vice-president of the United States, with General Harrison as President. President Harrison died April 4, 1841, a month after his inauguration, by which event Mr. T. became President. He began his administration by removing Democrats from office, and appointing Whigs, and pronouncing in favor of Whig measures, but soon after vetoed a bill for a United States bank, passed by Congress; several members of the cabinet resigned; and after some changes, John C. Calhoun, the great Southern Democratic statesman, became Secretary of State. The most important act of his administration was the annexation of Texas, March 1, 1845. At the close of his term of office, he retired to private life until 1861, when he was President of a Peace Convention at Washington. Failing in his efforts at a compromise, he gave his adhesion to the Confederate cause, and was a member of the Confederate Congress until his death, at Richmond, Jan. 1862.

TYLO'PHORA, a genus of plants of the natural order *Asclepiadaceæ*, natives of the East Indies, New Holland, &c., with a wheel-shaped corolla, and a 5-leaved fleshy coronet. *T. asthmatica*, a native of the coast of Coromandel, has a high reputation as a medicinal plant. Its root possesses properties similar to those of ipecacuanha, and has been found of great use in dysentery.

TY'MPANUM (Lat. a drum), in Anatomy, the middle ear (see EAR). In Architecture, the flat space left within the sloping and horizontal cornices of the pediment of Classical Architecture, usually filled with sculpture (see GRECIAN ARCHITECTURE, fig. 2); also, the space between the arch and lintel of doorways in Gothic Architecture, which is frequently enriched with sculpture.

TYNDALE, or TINDALE, WILLIAM, an eminent English reformer and martyr, well known as a translator of the Bible, was born about 1484. He was educated first at Oxford, and afterwards at Cambridge, and was, from his youth, as Foxe says, 'singularly addicted to the study of the Scriptures.' After leaving Cambridge, he became tutor and chaplain in the house of Sir John Walsh, a knight of Gloucestershire, where he frequently engaged in religious disputes with the clerical dignitaries of the neighborhood, and soon incurred their wrath by what they deemed the heresy of his opinions. He went to London about the middle of 1523, bent upon the fulfilment of his long-cherished desire of translating the New Testament into English. Failing, however, to obtain the patronage he expected in carrying out this intention, he retired to Germany in 1524. Here his translation of the New Testament was published in 1525 or 1526, and conveyed into England. This work, although denounced by government, was yet so eagerly received by the English, that several reprints of it were produced by the Dutch printers within the next few years. T. continued on the continent, writing tracts in advocacy of the reformed doctrines; in 1530 he published a translation of the Pentateuch, and in 1531, one of the prophet Jonah. In 1533 he took up his abode in Antwerp, where, in 1534 and 1535, he published two revised editions of his New Testament. In 1535 he was treacherously arrested, and, after a confinement of 16 months, was publicly strangled and burned as a heretic at Antwerp in 1536.

T. was a man of great learning as well as talent, and his own writings, in addition to his translations, show how well adapted he was for the great work of his life, so fearlessly carried out. Our modern version of the New Testament is substantially T.'s translation with modernized spelling. See *William Tyndale*, by Rev. R. Demaus, M.A. (1871).

TYNDALL, JOHN, physicist, was born 21st Aug. 1820, at Leighlin Bridge, County Carlow. He had few educational advantages. On returning from the continent, where he received part of his education, he found employment in one of the subordinate grades of the Ordnance Survey. He was afterwards appointed Teacher of Natural Philosophy at Queenwood College, Stockbridge, and there commenced those original investigations which have distinguished him among the explorers of science.

In January 1853, T. communicated his first paper to the Royal Society, *On Molecular Influences—Transmission of Heat through Organic Structures*. It exhibits much of that skill in experimenting and fertility of resource which characterize his subsequent researches, and illustrates certain important questions in natural philosophy.

Year by year from the date above mentioned, T. has extended our knowledge of science. His field of research is wide and varied, as exemplified by the subjects of his papers published in the *Philosophical Transactions—On the Vibrations and Tones produced by the Contact of Bodies having Different Temperatures* (1854); *On the Physical Phenomena of Glaciers* (1857); *On Some Physical Properties of Ice* (1858—1859); *On Transmission of Heat through Gaseous Bodies* (1859); a series on *Radiation*, six papers (1861—1865); *On Calorescence* (1865); *On the Invisible Radiation of the Electric Light* (1865). During the year 1867, he lectured on *Sounding and Sensitive Flames*.

In 1855, and again in 1861, T. was appointed to deliver the Bakerian Lecture to the Royal Society: the subjects were: *On the Nature of the Force by which Bodies are repelled from the Poles of a Magnet;* and *On the Absorption and Radiation of Heat by Gases and Vapors, and on the Physical Connection of Radiation, Absorption and Conduction*, the latter being one of the series on *Radiation* above mentioned. The publication of this series of papers marks a period in the history of scientific research, for the facts therein set forth, and the conclusions drawn from them, demonstrate the relation of aqueous vapor to radiant heat, and elucidate certain meteorological phenomena which connect themselves with some of the profoundest and most interesting questions of cosmical science.

In 1864, the Council of the Royal Society awarded to T. their Rumford medal, in recognition of his scientific researches, particularly as bearing on Light and Heat. As a lecturer on scientific subjects, T. enjoys a high reputation. His lectures at the Royal Institution and the School of Mines have been marked by fullness of knowledge and clearness of illustration. T. has experimented and written on the subject of germs, and on the acoustic transparency or cloudiness of the atmosphere.

In 1852, T. was elected a Fellow of the Royal Society. In 1853, he was appointed Professor of Natural Philosophy in the Royal Institution, where, as successor to Davy and Faraday, he sustains the reputation of the place for original scientific research. His lectures at the School of Mines have been attended by crowds of workingmen. He is LL.D. of Cambridge, and is a member of a number of the scientific societies of the continent. He was chosen

President of the British Association in 1874. Besides his papers for the Royal Society, T. has written articles in the *Philosophical Magazine* and *The Fortnightly Review*. His separate works comprise *The Glaciers of the Alps; being a Narrative of Excursions and Events* (1860); *Mountaineering in* 1861 (1862); *Heat considered as a Mode of Motion* (2d ed., 1865); *Radiation*, being the Rede Lecture, delivered at Cambridge in 1865; *Lectures on Sound* (1867); a memoir of Professor Farraday (1868); *Fragments of Science*, and *Hours of Exercise in the Alps* (1871); *Six Lectures on Light* (1873); *Address delivered before the British Association in* 1874, *with additions* (1874); *Essays on the Floating Matter of the Air* (1881).

TYNE, a river in the north of England, important from the enormously valuable mineral district through which it flows, and for the flourishing towns that line its banks, is formed by the confluence of two head-waters—the North Tyne and the South Tyne. The North Tyne rises on the Scottish border, 11 miles south-east of Hawick. It flows south across Keelder Moor, and south-east to Hexham, after traversing a district abounding in picturesque villages and gentlemen's seats. Its chief affluent is the Reed, which rises on Carter Fell, and flows south-east past Otterburn to Bellingham, where it joins the larger stream. Near Hexham, the North Tyne is joined by the South Tyne, which rises on the slopes of Cross Fell, 11 miles north of Appleby, in Westmoreland, flows north to Haltwhistle, and thence east to Hexham, through a district crowded with old castles and peel-houses. From the junction of the two head-waters, the T. flows east through the south of Northumberland, which presents charming scenery, and is studded with castles and country seats. At Blaydon—about 8 miles above Newcastle—the navigation begins, and from this point, passing Newcastle (q. v.), Gateshead (q. v.), North Shields (q.v.), and South Shields (q. v.), its banks are lined with foundries, furnaces, docks, wharfs, and quays. Total length 80 miles.—See Guthrie's *River Tyne; its History and Resources*, 1880.

TY'NEMOUTH, a small village and parish of Northumberland, takes its name from the river Tyne, on the north bank of which, and near its mouth, it stands. It is 8 miles east of Newcastle by railway, and its light-house is in lat. 55° 1′ N., long. 1° 25′ W. Though itself only a village, it gives name to a township containing above 21,000 inhabitants. Much of this township, however, is comprised in the town of North Shields (see SHIELDS, NORTH), and counts in the population of that town. It also gives name to a parliamentary and municipal borough, containing (1881) 43,863; but including besides the village of T., the large town of North Shields, and the three villages of Chirton, Preston, and Cullercoats. The village of T. is much frequented as a watering-place by the inhabitants of Newcastle. Its sands, about a mile in length, form an excellent bathing-ground. There are many attractive buildings and institutions, as the castle and fortifications, the fine ruins of a priory and Lady chapel, the Master Mariners' Asylum, &c. The borough of T. sends one member to the House of Commons.

TYPE (Gr. *typos*, an impression or stamp), the name given to the stamps or dies which impress the letters on the paper in Printing (q. v.). Printers, in early times, made the letters which they used, but in process of time the necessity for a division of labor created the distinct business of *type-founding*. There is evidence that, at the beginning of the 16th c., the apparatus for type-founding was much the same as up till near the middle of this century. The first step in the process is the cutting of a punch or die resembling the required letter. The punch is of hardened steel, with the figure of the letter cut, the reverse way, upon its point. On this die being finished, it is struck into a piece of copper about an inch and a quarter long, one-eighth of an inch deep, and of a width proportionate to the size of the type to be cast. This copper being so impressed with the representation of the letter, requires to be adjusted to the mould, so that the 'face' or impression of the punch (in the copper) may be brought into such relation with the metal which forms the 'body' or stalk of the type, that when the types are 'set up' they may stand at the proper distance from each other, and be in 'line' or range, and also square to the page; this work is termed 'justifying,' and the copper is now a 'matrix.' The matrix is now fixed into a small instrument or frame, called the mould, which is composed of two parts. The external surface is of wood, the internal of steel. At the top is a shelving orifice, into which the metal is poured. The space within is of the size of the required body of the letter, and is made exceedingly true. The melted metal, being poured into this space, sinks down to the bottom into the matrix, and instantly cooling, the mould is opened, and the type is cast out by the workman. This process of casting types is executed with great celerity. Of course, every separate letter in the alphabet, every figure, point, or mark, must have its own punch and matrix. In casting types, the founder stands at a table, and has beside him a small furnace and pot with heated metal, which he lifts with a small ladle. *Type-metal* was a compound of lead and regulus of antimony, with a small proportion of tin; but in 1856, a new compound was formed by adding a *large* proportion of tin to the lead and antimony, which considerably increased the cost of the metal, but it doubled its durability. The antimony gives hardness and sharpness of edge to the composition, while the tin gives toughness and tenacity, and removes the brittleness which antimony causes when used largely without tin.

Various attempts were made during the early part of this century to cast type by machinery; but the first successful apparatus for this purpose was the invention of Elihu White of New York, which was modified and repeatedly improved upon by David Bruce, a Scotsman resident in America. The type-casting machine was introduced into Great Britain, and patented by Miller and Richard, of Edinburgh, in 1848. This machine, which requires a man to drive it, produces more than double the quantity that the hand-mould did, while the finish and regularity of the type so cast are much more perfect. Another machine was constructed and patented some years after by the same firm, with the view to apply steam for driving, which was successfully completed in 1860, and is now the most advanced and approved system of casting.

The type-casting machine consists, first, of a small melting-pot, which contains the molten metal, and is placed over a small furnace having an outer case of cast-iron. In the interior of

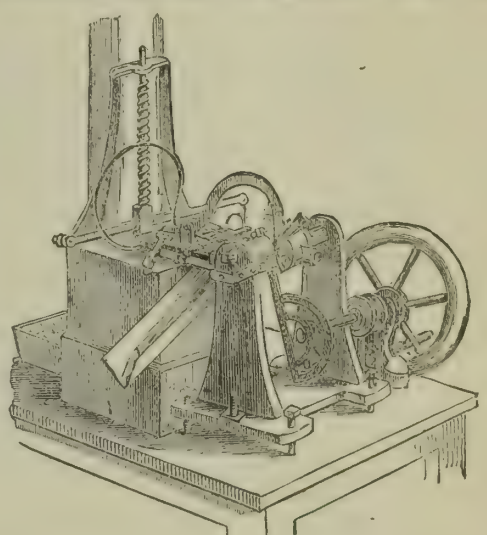


Fig 1.—Type-casting Machine.

the pot is arranged a forcing-pump and valve for admitting the metal under the piston, and also for preventing the return of the metal into the mass in the pot when the piston is depressed, and thus securing the full force exerted upon the piston being transmitted by the piston to the molten metal under it, and forcing it through a narrow channel leading from the bottom of the chamber in which the piston works to the outside of the pot, where a nipple is inserted, with a small hole through it, communicating with this narrow channel. Against this nipple, the mould in which the type is formed is pressed at the moment at which the piston descends, and so receives the molten metal that forms the type.

The second part of the machine is that which carries the mould, and to which the mould is firmly bolted. The mould is similar to the old hand-mould, but modified to suit the machine; it is much stronger; the 'jets' are shorter, and the orifice by which the metal enters is smaller, so that it may be brought exactly coincident with the small hole in the nipple in front of the pot. The mould —as the old hand-mould—is made in halves; the one half being firmly bolted to an arm which, by cams and levers, is made to oscillate, and carry the mould to and from the nipple in front of, and above the pot; the other half of the mould is bolted to another arm, which, by a peculiarly formed hinge, is attached to the first arm, so that the two halves of the mould may be made to open and shut upon each other, like the lid of a snuff-box; and so both sides of the mould oscillate together to and from the nipple in the pot from which they receive the molten metal. The furnace, with the pot and machine carrying the mould, are raised upon cast-iron framing to a height convenient for a man standing to watch the working of the machine. The operation of the machine is as follows: The piston being raised in the chamber of the pump, and the chamber being supplied with metal through the valve, the mould is brought against the nipple; the valve closes, to prevent the metal being forced back into the pot; the piston descends, and forces the metal through the narrow channel into the mould; the mould then recedes from the nipple, and in receding, the two halves separate from each other, and eject the type; the mould

again approaches the nipple, and in approaching, the two halves close together, and are ready for another operation.

A blast of cold air is directed upon each mould, to keep it cool. When the type is cast from the mould, it is in a rough state; and as soon as a heap has accumulated on the caster's table, they are removed by a boy, who breaks off a superfluous tag of metal, or 'jet,' hanging at the end of each type. From the breaking-off boy the types are removed to another place, where a boy rubs or smooths their sides upon a stone. Being now well smoothed, they are next removed to a table, and set up in long lines upon a 'stick;' they are then dressed or finished, and after being examined by a magnifying-glass are ready for use. Whatever be the size of the types, they are all made of a uniform height, and must be perfectly true in their angles, otherwise it would be quite impossible to lock them together. A single irregular type would derange a whole page. The height of type made in this country is $\frac{92}{100}$ds of an inch; those made in France, Spain, and Germany are higher. All the types of one class of any founder are always uniform in size and height; and to preserve their individuality, all the letters, points, &c. belonging to one class are distinguished by one or more notches or nicks on the body of the type, which range evenly when the types are set. These nicks, as we shall immediately see, are also exceedingly useful in guiding the hand of the compositor. Types are likewise all equally grooved in the bottom, to make them stand steadily.

The earliest types used were in the style known as Gothic or Black-letter; which was afterwards superseded, except in Germany, by the Roman letter. See BLACK-LETTER. The varieties of size of types in the present day amount to forty or fifty, enlarging, by a progressive scale, from the minutest used in printing pocket-Bibles, to the largest which is seen in posting-bills on the streets. Printers have a distinct name for each size of letter, and use about sixteen sizes in different descriptions of book-work; the smallest is called *Brilliant*, the next *Diamond*, and then follow in gradation upwards, *Pearl*, *Ruby*, *Nonpareil*, *Emerald*, *Minion*, *Brevier* (the type with which this sheet is printed), *Bourgeois*, *Long Primer*, *Small Pica*, *Pica*, *English*, *Great Primer*, *and Double Pica*. The larger sizes generally take their names thus—*Two-line Pica*, *Two-line English*, *Four*, *Six*, *Eight*, or *Ten line Pica*, &c. Other nations designate many of these sizes by different names. Some of these names were given from the first maker; others from the books first printed with the particular letter. Thus, *Cicero* is the name of a type in France and Germany, with which Cicero's letters were first printed (Rome, 1467); *Pica* is from the service of the mass, termed *Pica* or *Pic; Primer*, from *Primarius*, the Book of Prayers to the Virgin; *Brevier*, from *Breviary; Canon* from the *canons* of the Church, &c.

All kinds of types are sold by weight by the founders, the price varying in amount according to the size of the letter. The smallest size, *Brilliant*, costs about 10*s*. per pound; *Diamond*, about 6*s*. per pound; *Brevier*, about 1*s*. 6*d*.; *English*, 1*s*.; and so on in proportion for all intermediate sizes. Expensive as types thus are, their prices will not appear too high, considering the immense outlay in cutting the punches and the general manufacture. In the *Diamond* size, 2800 go to a single pound-weight of the letter *i*, and of the thinnest *space* about 5000.

A complete assortment of types is called a *Fount*, which may be regulated to any extent. Every type-founder has a scale showing the proportional quantity of each letter required for a fount; and a peculiar scale is required for every language. For the English language, the following is a typefounder's scale for the small letters of a fount of types of a particular size and weight:

a	8500	h	6400	o	8000	v	1200
b	1600	i	8000	p	1700	w	2000
c	3000	j	400	q	500	x	400
d	4400	k	800	r	6200	y	2000
e	12.000	l	4000	s	8000	z	200
f	2500	m	3000	t	9000		
g	1700	n	8000	u	3400		

It will be seen from this scale that the letter *e* is used much more frequently than any other character.

Type-founding originated in Germany along with printing; as early as 1452, P. Schöffer (see GUTENBERG) had substituted types of cast-metal for the original wooden types. The earliest and best punch-cutters were in Nürnberg, which continued for a considerable time to supply the type-founders throughout Germany with punches. Bodoni (b. 1740, d. 1813) in Italy, the Didots (q. v.) in France, and Breitkopf (b. 1719, d. 1794) in Leipzig, are the most distinguished names in the subsequent history of type-making on the continent. The art made little progress in Great Britain from the time of Caxton, and the types used were mostly imported from Holland until about the year 1720, when William Caslon, originally an engraver of ornamental devices, turned his attention to letter-cutting, and soon established such a reputation as not only put a stop to the importation of foreign types, but caused his own to be frequently sent to continental countries.

The foundry established by Caslon in London is still in existence. Baskerville (q. v.) is the next greatest name in the history of the art in England. The types produced by Alexander Wilson of Glasgow became the foundation of the fame of the Foulis (q. v.) as printers. The type-foundry of Miller and Richard in Edinburgh has enjoyed a well-merited reputation for half a century and more.

The large letters used in posting and hand-bills were formerly manufactured chiefly in London and Sheffield, but are made now also in Edinburgh. In this kind of types, very great improvements have also been made in recent times; and the varieties are becoming yearly more numerous and ornamental in character. The letter used in printing in North America is made principally at New York; and the style of both typography and press-work in that country is rapidly improving.

Type-setting, or 'Composing.'—All the types used in printing-offices are sorted in cases, or shallow boxes, with divisions. There are two kinds of cases—the *upper* and *lower case;* the latter lying

Fig. 2.

nearest the compositor upon the frame for their support. The annexed illustration exhibits the arrangement of the cases and position of the compositor—the lower case being immediately under his hand, the upper case directly above in a slanting position, and the under part of the frame stocked with cases of different founts. In the upper case are placed all the capitals, small capitals, accented letters, a few of the points, and characters used as references to notes. In the lower case lie all the small letters, figures, the remainder of the points, and spaces to place betwixt the words. In the lower, no alphabetical arrangement is preserved; each letter has a larger or smaller box allotted to it, according as it is more or less frequently required; and all those letters most in request are placed at the nearest convenient distance to the compositor. By this ingenious and irregular division of the lower case, much time is saved to the compositor, who requires no label to direct him to the spot where lies the particular letter he wants. To a stranger, nothing appears so remarkable as the rapidity with which a compositor does his work; but habit very soon leads the hand rapidly and mechanically to the letter required. When *italic* letters have to be introduced, they are taken from a separate pair of cases of the same fount.

The process of composing and forming types into pages may now be adverted to. Placing the copy or manuscript before him on the upper case, and standing in front of the lower case, the compositor holds in his left hand what is termed a composing-stick. Sometimes this instrument is of wood, with a certain space cut in it of a particular width; but more commonly it is made of iron or brass, with a movable slide, which, by means of a screw, may be regulated to any width of line. In either case, the composing-stick is made perfectly true and square. One by one the compositor lifts and puts the letters of each word and sentence, and the appropriate points, into his stick, securing each with the thumb of his left hand, and placing them side by side from left to right along the line. When he places a letter in the stick, he does not require to look whether he is placing it with the face in its proper position; his object is accomplished by looking at what is called the *nick*, which must be placed outward in his composing-stick. (See adjoining representation of a type.) This is one of those beautiful, and at the same time simple, contrivances for saving labor which experience has introduced into every art, and which are as valuable for diminishing the cost of production as the more elaborate inventions of machinery. When he arrives at the end of his line, the compositor has a task to perform in which the carefulness of the workman is greatly exhibited. The first letter and the last must be at the extremities of the line: there must be no large spaces left in some

Fig. 3.

instances, and crowding in others, as we see in the best manuscript. Each metal type is of a constant thickness, as far as regards that particular size of letter; though all the letters are not of the same thickness. The adjustments, therefore, to complete the line with a word, or at any rate with a syllable, must be made by varying the thickness of the spaces between the words. A good compositor's work is distinguished by uniformity of spacing; he will not allow the words to be very close together in some instances, and with a large gap between them in others, as is evident, for instance, in this sentence.

In composing poetry, or similar matter, where there is always a blank space at one of the ends of the line, spacing is very easily accomplished by filling up the blank with larger spaces, or *quadrats*. But whether prose or poetry, the matter of each line must be equally adjusted and *justified*, so as to correspond in point of compactness with the previously set lines. The process of composing is greatly facilitated by the compositor using a thin slip of brass called a *setting-rule*, which he places in the composing-stick when he begins, and which, on a line being completed, he pulls out, and places upon the front of the line so completed, in order that the types he sets may not come in contact with the types behind them, but glide smoothly into their places to the bottom of the composing-stick.

When the workman has set up as many lines as his composing-stick will conveniently hold, he lifts them out by grasping them with the fingers of each hand, and thus taking them up as if they were a solid piece of metal. He then places the mass in an elongated board, termed a *galley*, which has a ledge on one or perhaps both sides. The facility with which some compositors can lift what is called a *handful* of movable type without deranging a single letter, is very remarkable. This sort of skill can only be attained by practice; and one of the severest mortifications which the printer's apprentice has to endure, is to toil for an hour in picking up about a thousand letters, and then see the fabric destroyed by his own unskilfulness, leaving him to mourn over his heap of broken type, technically denominated *pie*.

Letter by letter, and word by word, is the composing-stick filled; and by the same progression the galley is filled by the contents of successive sticks. When the compositor has set up as many lines as fill a page, he binds them tightly round with cord, and removes them from the galley.

Sometimes, as in the case of newspaper and similar work, the *handfuls* of type are accumulated till they fill the galley, and in that form are prepared for press. After the matter is thus far prepared, it is the duty of the pressman to take an impression or *first proof* from the types, in order that the first-proof *reader* may compare with 'copy,' or MS.; after which it is handed to the compositor, so that he may correct the errors which are sure to have been made. Proofs are usually taken by a press kept for the purpose. After the galley matter is corrected and re-corrected by the compositor, it is divided into pages of the size wanted; and head-lines or figures indicating the number of the page, being added, the pages are arranged upon a large firm table, and there securely fixed up in an iron frame or *chase*, by means of slips of wood and wedges, or *quoins*. The annexed cut is a representation of a small *form*, consisting of four pages of type.

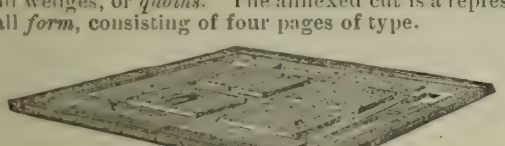


Fig. 4.

This process, which is called *imposing*, being completed, and the face of the types being leveled by a *planer* and mallet, the *form*, as it is called, is proved, and prepared for press. Proof-sheets being taken, they are subjected to the scrutiny of a *reader* employed in this peculiar function in the office, the author himself having previously given effect to his corrections or emendations. When the *reader* has pointed out words and letters to be altered or corrected, the compositor once more goes over the form, correcting the errors by lifting out the letters with a bodkin, and, when revised, the sheet is pronounced ready for printing. The imposing-table at which all these corrections are made is usually composed of smooth stone, or marble, or cast-iron on the top, and requires to be a substantial fabric. See TYPE-SETTING MACHINES.

TYPE-SETTING MACHINES. The first type-composing machine on the records of the English Patent Office appears to be that of Mr. W. Church, and the specification of his patent is dated March 1822. This, after a lapse of twenty years, was followed by a number of others, scarcely a year passing without one or more being made the subject of a patent. Moreover, some of them, among others those of Young and Delcambre, were for a long time before the public For at least half a century, therefore, the construction of a useful type-setting machine has been a problem which a number of ingenious men have tried to solve, but it is only within the last year or two that there has been anything more than the mere appearance of success. If the reader will look carefully at a page of printed matter, he will notice that the spaces between the words are not equal, and he will easily understand that to reduce this inequality to a minimum, requires skill and experience if the work is to go on swiftly. It is in the doing of this, which is called 'justifying,' where a machine fails, because another operator must afterward space the machine-setting into lines of equal length. It is comparatively easy to construct a machine which will, by some mechanical arrangement, drop any required letter from a series of files or reservoirs of types, through a channel which conveys it to a composing-stick—that is, which will set up type, in any required order, but with *exactly equal spaces* between the words; but the difficulty of justifying has not yet been got over. Still, as that operation can be performed by girls at comparatively little cost, there is a decided advantage in favor of the machine.

In the early composing-machine by Church, 'the types are arranged in files in a case at the top, each file being directly over a slit in a horizontal frame. One of a number of jacks protrudes through each of these slits, each jack being connected with a key in a manner somewhat similar to the jacks and keys of a harpsichord.' On the depressing of any particular key, the undermost type of the file is pushed into a race, from which it passes to a composing-stick. It is suprising how closely this description conveys to us the leading idea in most of the type-composing machines invented since 1822. Hattersley's machine, for example, which was patented in 1857, has somewhat analogous movements, but the keys are arranged more like those of a *concertina*, and the details are different. This machine, which occupies a space of about 2 feet by 3, has a horizontal top stage on which is placed a partitioned tray, containing the rows of types running from back to front, each row being of course all the same letter. Descending vertically along the front of this tray is a series of as many wires with pistons as there are rows of types, and these pistons are depressed by the keys acting by bell-cranks, and then return to their first position by means of india-rubber bands or springs. A propeller kept in a state of tension by an india-rubber string is placed in the rear of each row of types, and draws them forward to the piston. When the girl working the machine presses down, say an *e* key, it depresses the *e* piston, which pulls down with it an *e* type, and drops it into a tube or channel which conveys it to what represents the composing-stick, and so on with every other letter, figure, comma, or 'space.' The series of channels converge to a focus or common outlet, through which every type in succession passes to its proper place. Machines on Hattersley's principle, with the details much improved by Mr. Fraser of Edinburgh, are at present in use by a large printing firm there.

With one of these machines a girl can compose from 'copy' at the rate of from 10,000 to 12,000 types per hour, but this rate can hardly be maintained continuously, the strain of such rapid setting being too great for the operator. The types are set in long lines, and require afterwards to be 'justified.' This is done by another girl, who, with the aid of a slip of brass of the desired length of line, forms the matter into pages, spacing out each line as she proceeds.

The want of an efficient distributing machine has hitherto been the great drawback to the adoption of composers, but Mr. Fraser has met this difficulty by constructing a distributer which bids fair to supply the want. It separates the different letters by a series of switches acted upon by keys similar to those of the composing-machine. On the depression of a key, the corresponding switch is opened, and the type guided to its proper compartment in the composing-machine reservoir. Type setting and distributing machines like the above in their plan of working, have been in operation for several years in the *Times* office, one of which was exhibited at South Kensington in 1872. Another composing-machine, by Mr. Mackie of Warrington, deserves notice for the ingenuity shown in its construction. It is much more elaborate than any of those above referred to. The first operation is to perforate slips of stiff paper, which is done by a separate machine. These slips, when perforated, represent the words to be composed, and are then passed to the composing-machine proper. In it the types are placed by hand in a series of boxes above the circumference of a large wheel, which is made to revolve, and at each revolution a certain part, acting in concert with the previously perforated paper, comes in contact with mechanism which releases the desired types at the proper time, and carries them forward to a point, where they are pushed off into lines in the composing-stick.

TYPE, in Theology, an image or representation of some object which is called the antitype. In theological use, it is applied chiefly, although not exclusively, to those prophetic prefigurings of the persons and things of the New Dispensation which are

found in the ritual, and even in the history, of the Old Testament. Under the heads HERMENEUTICS. EXEGESIS, have been explained the different senses of which the literal text of Scripture is considered susceptible. Of one of these, the 'mystical,' the 'typical' sense forms a further subdivision. The word 'type' itself is used as well by the writers of the New Testament (Acts, vii. 43; Romans, v. 14; Philippians, iii. 17) as by the Jewish historians, for instance, Philo, *Opp.* t. i. p. 108; and while St. Paul and other sacred writers speak of the ancient types of things to come, St. Peter completes the parallelism by describing baptism as the antitype of the ark of Noah, 1 Peter, iii. 21. Of the types of the Old Testament, many are directly pointed out as such in their very institution; many also are distinctly applied in the New Testament. There is a large class, however, which more properly fall under the mystical sense of Scripture, and which are called indirect, that is to say, 'adaptive' or 'applied' types. In the application and interpretation of these, many of the Fathers, and especially Augustine and Gregory the Great, are most elaborate and ingenious.

TYPES, CHEMICAL. The idea of referring organic bodies to some simple type or representative, has attracted the attention of many chemists, amongst whom Dumas, Sterry Hunt, Laurent, and Gerhardt, especially deserve notice. As our limited space prevents us from attempting to trace out the history of the theory, we shall confine ourselves to a statement of the outline of the doctrine as laid down by Gerhardt, and now adopted in most recent books on organic chemistry. The four principal types, to which most of the chemical compounds are referred, are the following: (1) The hydrogen or metallic type, $\left.\begin{matrix}H\\H\end{matrix}\right\}$; (2) The hydrochloric acid or chloride type, $\left.\begin{matrix}H\\Cl\end{matrix}\right\}$; (3) The water or oxide type, $\left.\begin{matrix}H\\H\end{matrix}\right\}O_2$; and (4) The ammonia or nitric type $\left.\begin{matrix}H\\H\\H\end{matrix}\right\}N$.

The reason why the equivalents of the hydrogen in the hydrogen type, and of the water in the water type, are doubled, is as follows: an accurate study of the volumetric relations of nearly all organic compounds, shows that their molecules furnish equal volumes of vapor, and that the gaseous volume occupied by each molecule will occupy 4 volumes, if oxygen represent the unit of volume. Taking the volume of oxygen, O, as 1, those of hydrogen, H, and of water, HO, are, as is well known, 2. Hence, to fix the standard of comparison at 4 volumes of oxygen, we must write H_2 or $\left.\begin{matrix}H\\H\end{matrix}\right\}$, or H_2O_2, or $\left.\begin{matrix}H\\H\end{matrix}\right\}O_2$, instead of the apparently simpler forms, H and HO. In the other cases, this modification is unnecessary, as the gaseous volumes of hydrochloric acid (HCl) and ammonia (NH_3) are in accordance with the general laws, and are equal to four standard volumes.

1. The *hydrogen type*, $\left.\begin{matrix}H\\H\end{matrix}\right\}$, includes, according to Gerhardt, the radicals of the alcohols, marsh gas, and the hydrocarbons homologous with it, the aldehyds, &c. Thus, marsh gas (or hydride of methyl), C_4H_4, is written $\left.\begin{matrix}C_4H_3\\H\end{matrix}\right\}$, according to the type-theory, and aldehyd (hydride of acetyl), $C_4H_4O_2$, is written $\left.\begin{matrix}C_4H_3O_2\\H\end{matrix}\right\}$; or both the upper and lower equivalent of hydrogen in the typical formula may be repeated. Thus, acetone or methylide of acetyl, $C_6H_6O_2 = \left.\begin{matrix}C_4H_3O_2\\C_2H_3\end{matrix}\right\}$. Amongst the compounds of inorganic chemistry belonging to this type, Gerhardt places the hydrides, arsenides, and antemonides of the metals.

2. The *hydrochloric acid type*, $\left.\begin{matrix}H\\Cl\end{matrix}\right\}$, is removed by many chemists from the primary or principal types, and is regarded as a derived type from the preceding one, one equivalent of H being here replaced by one of chlorine. It includes the chlorides, fluorides, iodides, bromines, cyanides, the ethers of the hydracids, &c. As examples, we may take chloride of benzoyl, $C_{14}H_5O_2Cl = \left.\begin{matrix}C_{14}H_5O_2\\Cl\end{matrix}\right\}$, hydrochloric ether, $C_4H_5Cl = \left.\begin{matrix}C_4H_5\\Cl\end{matrix}\right\}$, and iodide of ethyl, $C_4H_5I = \left.\begin{matrix}C_4H_5\\I\end{matrix}\right\}$.

3. The *water type*, $\left.\begin{matrix}H\\H\end{matrix}\right\}O_2$, includes the oxides (in which term are embraced acids, bases, and salts), the sulphides, the alcohols, the simple and compound ethers, the monobasic organic acids, &c. The following are a few examples: methyl alcohol or wood-spirit, $C_2H_4O_2 = \left.\begin{matrix}C_2H_3\\H\end{matrix}\right\}O_2$; common alcohol, $C_4H_6O_2 = \left.\begin{matrix}C_4H_5\\H\end{matrix}\right\}O_2$; acetic acid, $C_4H_4O_4 = \left.\begin{matrix}C_4H_3O_2\\H\end{matrix}\right\}O_2$; acetate of potash, $KO,C_4H_3O_3 = \left.\begin{matrix}C_4H_3O_2\\K\end{matrix}\right\}O_2$; acetic ether, $C_4H_8O,C_4H_3O_3 = \left.\begin{matrix}C_4H_3O_2\\C_4H_5\end{matrix}\right\}O_2$; common ether $(C_4H_5O)_2 = \left.\begin{matrix}C_4H_5\\C_4H_5\end{matrix}\right\}O_2$, &c.

4. The *ammonia type*, $\left.\begin{matrix}H\\H\\H\end{matrix}\right\}N$, includes the nitrides and phosphides, the compound ammonias, and the amides; as, for example, ethylamine or ethylia, $C_4H_7N = \left.\begin{matrix}C_4H_5\\H\\H\end{matrix}\right\}N$; trimethylamine or trimethylia, $C_6H_9N = \left.\begin{matrix}C_2H_3\\C_2H_3\\C_2H_3\end{matrix}\right\}N$; benzamide, $C_{14}H_7NO_2 = \left.\begin{matrix}C_{14}H_5O_2\\H\\H\end{matrix}\right\}N$, &c.

Besides these three or four principal types, there are *derived types*, *multiple types*, and *mixed types;* and under one or other of these types, primary and derived, multiple and mixed, all organic compounds can be arranged; and the theory of types leads to the general conclusion, that all organic compounds, or, more strictly speaking, their molecules, may be regarded as molecules of hydrogen, water, ammonia, hydrosulphuric acid, &c., in which the hydrogen is entirely, or in part, replaced by organic radicals.—For further information on this subject, the reader is referred to Odling's *Lectures on Animal Chemistry;* to the second volume of Gorup Besanez, *Lehrbuch der Chemie* (of which the chapter 'On Types' was reprinted separately); and to the other more recent treatises on chemistry, English and foreign.

TY'PHA, a genus of plants, belonging to the natural order *Typhaceæ* of some botanists, which, according to others, is a suborder of *Araceæ*. The *Typhaceæ* all inhabit marshes or ditches. They have nodeless stems, unisexual flowers arranged on a spadix without a spathe, the spadix of the male flowers being situated at the summit of the stem, above that of the female flowers, the perianth consisting of scales or lax hairs, the anthers on long filaments, the fruit dry, consisting of the seed with adherent pericarp. They are found in very different climates, and scattered over the world. Two species of T. are found in Britain, *T. latifolia* and *T. angustifolia*, and are popularly known as CAT'S-TAIL or REEDMACE. *T. latifolia* is the most common. It is sometimes called Bulrush. It grows to the height of five or six feet. The root-stocks are astringent and diuretic, and abound in starch. The young shoots both of this and *T. angustifolia*, a smaller plant, are much eaten by the Cossacks of the Don; and are sometimes used in England under the name of *Cossack Asparagus*. The pollen of T. is inflammable, like that of *Lycopodium*, and is used as a substitute for it. *T. angustifolia* and *T. elephantina* are employed in India for making mats and baskets.

TYPH-FEVER is a term which has sometimes been used to designate continued low fever. The best-marked varieties of this affection are known as typhus and typhoid fevers, which in typical cases are easily distinguished from one another, but not unfrequently so merge into one another that it is difficult to decide whether the disease should be classed as typhus or typhoid fever; and hence the general term typh-fever is a very convenient one in doubtful cases. All the typh-fevers belong nosologically to the miasmatous order of zymotic diseases.

TY'PHON, in Egyptian Mythology, was the Greek name of a son of Seb (Kronos) and Nut (Rhea). The latter gave birth to five children on the last five days of the year; first, Osiris, and Haroeris, then T., and lastly Isis and Nephthys. The Egyptian name of T. was Set, also Suti, and Sutech, and in the earliest times he was a highly venerated god. He often appears on the monuments in the form of a beast, the cunning crocodile, the dreaded hippopotamus, or the obstinate ass, and with yellow hair and long blunted ears. From him the kings of the 19th dynasty, Seti (Sethos, Sethosis, changed by Herodotus, into Sesostris), derive their names. The city of Ombos was a special seat of his worship. In later times, however, either about the close of the 21st dynasty or afterwards, his worship was abandoned, and his figure and name were obliterated from many of the monuments. The cause of this curious religious revolution is unknown, but at any rate, T. came to be regarded as a god hostile to the Egyptians, and was gradually developed into a personification of the principle of Evil—in short, the Egyptian Devil, the opponent of holy doctrine, and adversary of Osiris—the god of the waste howling wilderness, of the salt lakes, of drought and of scorching heat.

The connection between the Egyptian *Set* and the Greek T. is not very easy to trace, but it undoubtedly existed. According to Homer, T. (called also Typhāon) was a huge giant, chained under the earth in the country of the Arimoi, and lashed by the lightnings of Zeus. Hesiod makes him a son of Typhōeus and a hur-

ricane, and, by the snake-goddess, Echidna, the father of the Chimæra, the many-headed dog Orthus, the hundred-headed dragon that guarded the apples of the Hesperides, the Colchian Dragon, the Sphinx, Cerberus, Scylla, Gorgon, the Lernæan Hydra, the Eagle that consumed the liver of Prometheus, and the Nemean Lion. Typhōeus, again, was the youngest son of Tartarus (Hell) and Gæa (Earth), or, as others say, of Hera (Juno) alone. At a later period, the father and son coalesced into one person.

Pindar describes T. as a monster with a hundred dragon-heads, fiery eyes, a black tongue, and a terrible voice. He sought to wrest the sovereignty of the world from Zeus, but after a fearful struggle, he was subdued by a thunderbolt from Olympus, and hurled into Tartarus, or buried under Ætna. The later poets modify the older myth with fabulous additions of their own. They connect T. with Egypt—a proof, perhaps, that he had come to be identified with the Egyptian *Set*. According to Ovid and others, all the gods fled before him into Egypt, and through fear, changed themselves into animals, excepting Zeus and Athene. After an appalling struggle, in the course of which Zeus was once hamstrung, and carried off by the daring monster, T. was vanquished, but not before he had hurled all Mount Hæmus against his adversary, in a paroxysm of supernatural rage. It is very possible that the fierce *physical* opposition of T. (especially when the monster came to be identified with *Set*, the Egyptian Devil) may have had (along with other causes) a material influence in determining that popular conception of 'Satan' which reigned both in patristic and medieval times, and of which Milton has so largely availed himself in his *Paradise Lost*.

TYPHOO'NS (Chinese *Tei-fun*, i. e., 'hot wind;' the word, it need scarcely be said, has no connection with the Typhon of mythology) are violent storms which blow on the coast of Tonquin and China as far north as Ningpo and the south-east coasts of Japan. Varenius, in his *Geographia Naturalis*, describes them as 'storms which rage with such intensity and fury that those who have never seen them can form no conception of them; you would say that heaven and earth wished to return to their original chaos.' They occur from May to November; but it is during the months of July, August, and September that they are most frequent. They resemble the storms of Western Europe (see STORMS) in their general characteristics, with this difference, that the main features are more strongly marked. There is a depression of the barometer, over a space more or less circular in form, accompanying the typhoon, but it is generally more contracted in area, and deeper and more abrupt than in European storms. It is not uncommon for the barometer, at the center of the depression, to read 28·3 inches, and on rare occasions to fall even as low as 27 inches; and the changes of pressure are very rapid, frequently ·2 or ·3 inch in an hour.

It is this enormous difference of atmospheric pressure between neighboring places, and the consequent rapidity of the fluctuation, which give to these storms their terribly destructive energy—the law regulating the strength of the wind being, that it is proportioned to the difference of pressure between the place from which it comes and the place toward which it blows. The low pressure in the center is confined to a very limited space, and since all round this space the pressure is greater, it follows that the level of the sea there will be higher. Hence, a high wave is frequently found to accompany these storms, advancing inland, carrying with it ruin and dismay, and not unfrequently bearing ships far over the level fields, where they are left stranded a considerable distance from the sea.

Typhoons have their origin in the ocean to the east of China, especially about Formosa, Luzon, and the islands immediately to the south. They thence proceed, in four cases out of five, from east-north-east toward west-south-west, more rarely from east-south-east to west-north-west, and scarcely ever from north to south, or from south to north; in other words, their course is generally along the coast of China. The body of the storm advances at the rate of 12 miles an hour and upwards, within which the winds blow often from 80 to 100 miles an hour, whirling round the center of atmospheric depression in a direction contrary to the motion of the hands of a watch, as all storms in the northern hemisphere do. They thus rotate in the direction south, east, north, west; and travel along the coast, so that the coast feels the northern side of the storm, while at a distance from the coast the southern side is alone experienced. The south-west Monsoons (q. v.) prevail in summer over Southern Asia, to the eastward of which are the north-east trade-winds. See WINDS Here, then, are two great aerial currents flowing contiguously, *but in opposite directions*, each highly charged with moisture, especially the south-west current, which they have taken up from the oceans they have traversed. It is highly probable that the typhoons take their origin from these opposing currents, as whirlpools do at the meeting of two sea-currents; and their intensity is aggravated by the large quantity of heat disengaged in the condensation of the vapor of the atmosphere into the deluges of rain which fall during the storm—10 and 12 inches of rain frequently falling in one day.

Much yet remains to be done towards the examination and explanation of this remarkable class of storms, the first and essential step being the establishing of meteorological stations on the Chinese coast, in Japan, in Formosa, and in Luzon.

TY'PHUS AND TY'PHOID FEVERS have so much in common, that, to avoid repetition, we shall discuss them in one article. Until comparatively few years ago, it was generally believed that no definite distinctions could be drawn between the various forms of continued low fever met with in this country. In 1840, Dr. A. P. Stewart, lately one of the physicians to the Middlesex Hospital, pointed out the differences which are now almost universally recognized between typhus and typhoid fevers; but his views received little attention till 1848—1850, when Dr. Jenner,* Physician to her Majesty, published two papers on *The Identity or Non-Identity of Typhus and Typhoid Fevers*, and on *Diseases commonly confounded under the term Continued Fevers*. In these memoirs, Dr. Jenner shows, by evidence which must be satisfactory to every unbiased mind, that typhus and typhoid fevers differ, as Dr. Watson observes, 'notably and constantly in their symptoms and course, in their duration, in their comparative fatality, in the superficial markings which respectively belong to them, and which warrant our classing them amongst the exanthemata, in the internal organic changes with which they are severally attended, and (what is the most important and the most conclusive) in their exciting causes.'—*Lectures on the Principles and Practice of Medicine*, 4th ed., 1857, vol. ii. p. 795. In addition to typhus and typhoid, there is a third well-marked variety of continued fever, known as *Relapsing Fever*, which has been considered in a special article.

Typhus Fever sometimes commences to show itself by certain premonitory symptoms, due to the depressing action of the poison—which, as will presently be seen, is the cause of the disease—upon the nervous system before it begins to affect the circulation. The patient, in these cases, is listless, unwilling to make any bodily or mental exertion, loses appetite, feels wandering pains over the body, is drowsy during the day, and restless at night. More commonly, however, the disease begins suddenly, a shivering fit being the first symptom. Severe headache, especially across the forehead, is another common early symptom. The muscular power rapidly becomes enfeebled, and the patient very soon feels compelled to take to his bed. As in typical cases of the disease, there are three sets of symptoms, each of which occupies about a week, it is convenient to divide the description of continued fever into that of three weekly stages. In the first week, in addition to the symptoms already noticed, the heat of the skin becomes increased, and the pulse, which at first is hard, becomes soft and weak, and more frequent than in health, often now rising to 120, and in severe cases reaching 130 or 140 beats in a minute. According to Dr. Jenner, the pulse in uncomplicated *typhus* gradually rises to maximum, preserves that rate for a variable time, and then slowly falls; while in *typhoid* it rises and falls irregularly. There is considerable thirst; the tongue becomes clammy and dry, and its center is covered with a white fur, which is often mesially divided by a straight brown streak, which is the first step to the blackness of that organ which afterwards ensues. The intelligence is blunted; but on being sharply spoken to, the patient still gives rational answers. As the week advances, the strength is so reduced, that he lies on his back, and is unable to turn about in bed without assistance. In the second week, the pulse becomes more frequent, weaker, and more compressible, and the tongue grows drier and browner. The teeth and lips are invested with dark sordes, consisting of morbid epithelium that had been shed; and the weakness is now so extreme, that the patient sinks down in his bed. His voice becomes very feeble, and in bad cases he cannot swallow, nor can he put out his tongue.

The two most remarkable symptoms of the second week are the delirium which seems to replace the headache, and about the ninth day ensues, and the appearance of the charcteristic eruption. The delirium usually appears on the patient's awakening from sleep. He is inattentive to all that goes on around him, and usually lies still, muttering disjointed sentences, like a man talking in his dreams. Sometimes, however, he is more actively delirious, talking loudly, and trying to leave his bed. He may sometimes be roused by a strange voice, but soon relapses into his previous state. The senses are in a disturbed condition, the patient being commonly deaf, and, in advanced cases, often suffering from *Muscæ Volitantes* (q. v.), which gives rise to attempts to grasp these visionary objects, or to pick them from the bedclothes. This symptom, which is known in medical language under the name of *Floccitatio*, is almost certainly indicative of a fatal result. The characteristic eruption which Dr. Jenner calls the *mulberry rash*, may show itself as early as the fifth day, but most commonly appears at the beginning of the second week, and sometimes a lit-

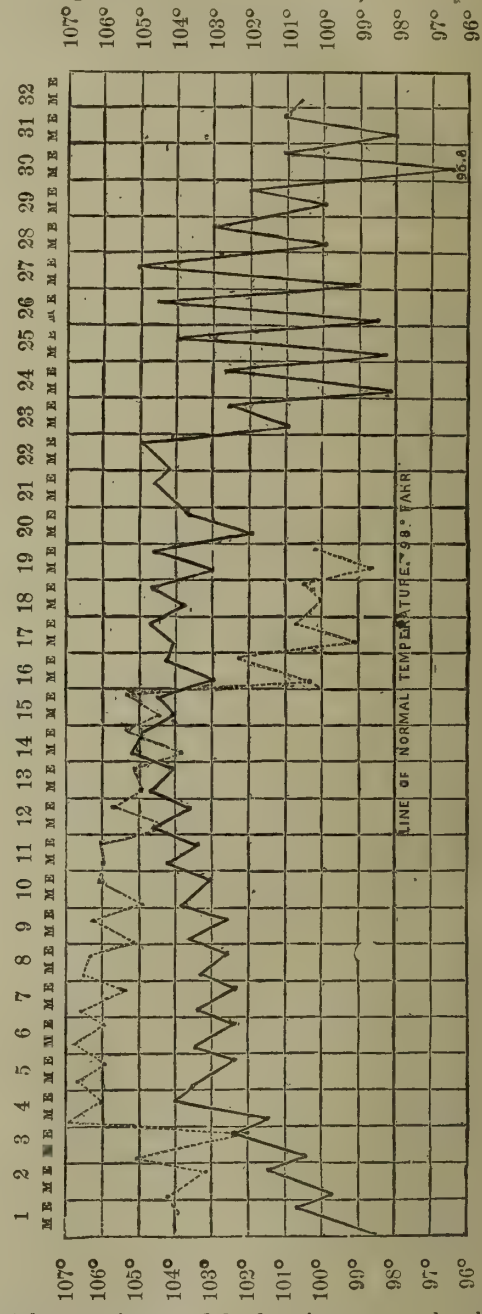
* Now Sir W Jenner, Bart.

tle later. The characters of the rash vary with its age. It consists of very slightly elevated spots of a dusky-pink color. Each spot is flattened on its surface, irregular in outline, with no well-defined margin, but fades insensibly into the hue of the surrounding skin, disappears completely on pressure, and varies in size from a point to three or four lines in diameter. In two or three days, these spots undergo a marked change. They no longer remain elevated above the surrounding cuticle; their hue becomes darker and more dingy than at first, and they now only fade on pressure, instead of completely disappearing. From this state they commonly grow paler, pass into faintly marked reddish-brown stains, and finally disappear. The spots composing this mulberry rash are generally very numerous, close together, and occasionally almost covering the skin. Sometimes, however, they are very few in number, situated at some distance from one another, and not to be distinguished at first from the *rose-spots* which, as will be presently seen, occur in typhoid fever. The mulberry rash is usually situated on the trunk and extremities, but is occasionally limited to the trunk, and in rare cases is seen on the face.

No fresh spots appear after the third day of the eruption, and the rash subsides between the fourteenth and twenty-first days. The mulberry rash, though characteristic of typhus when it occurs, is not an essential symptom of the disease. Dr. Jenner states, that in patients less than 15 years old, in whom the mortality is not more than 2 or 3 per cent., it is mostly either absent, or pale in hue and scanty in quantity; while in persons upwards of 50 years of age, in whom the mortality is about 56 per cent., the rash is always present, and usually dark and abundant. Hence, as in the case of small-pox, the degrees of development of the eruption may be taken as a direct measure of the intensity of the disease. It is in the course of this second week that death is most apt to occur. Amongst 25 fatal cases noted by Jennar, nine deaths only occurred after the 15th day, and not one after the 20th. If the case is going to terminate fatally, symptoms commonly and expressively termed *putrid*, set in; a peculiar fœtor is exhaled from the breath and the surface of the body; the tongue is dry, black, and fissured; the teeth are covered with dark sordes, and sloughing bed-sores occur. The prostration increases to the last degree, and *subsultus tendinum*, or involuntary twitchings of the muscles of the face and arms, make their appearance. In some cases, the ordinary stupor is replaced a day or two before death by the condition known as *coma vigil*. In this condition the patient never sleeps, but lies on his back, with the eyelids widely separated, the eyes staring and fixed in vacuity, the mouth partially open, and the face pale and devoid of expression. He is totally incapable of being roused to give a sign of consciousness, the pulse and breathing are hardly perceptible, and the skin is cool. The occurrence of death is only marked by the eye losing its slight lustre, and the chest ceasing its slow and feeble movements. During the third week, the symptoms gradually abate in those cases which are going to end in recovery. The patient often falls into a profound, quiet, and prolonged sleep between the 14th and 17th day, from which he awakes with a decided general improvement. The complexion is clearer, the delirium has disappeared, the pulse has fallen, and the tongue begins to show signs of moisture at the edges. In a few days, the tongue gradually becomes clean, the appetite becomes ravenous, and from that time the patient rapidly gains strength. In many cases, the amendment is so gradual, that it is impossible to say when it begins; and occasionally the favorable crisis is preceded by a temporary aggravation of the symptoms. A profuse sweat sometimes accompanies the favorable change. In the cases that terminate fatally, there is no rallying from the symptoms described as occurring in the second week.

The fact that the difference between typhus and typhoid fevers was first recognized only a few years ago, affords sufficient evidence that the symptoms of these diseases must be very similar. In describing *Typhoid Fever* it will consequently be sufficient if we indicate the leading points in which it differs from typhus. Amongst the earlier symptoms (although they are sometimes postponed to the end of the first week), the most characteristic are abdominal pains and diarrhœa. These are due to an ulcerated condition of the intestines, which will be presently noticed. The diarrhœa is either spontaneous, or continues after the operation of a purgative. The stools are loose and frequent; and either of a dark color and fœtid, or of a yellow pea-soup-like appearance. The abdomen is found on examination to be unnaturally hard and resisting, tympanitic, and sometimes much distended; its shape, as Dr. Jenner was the first to remark, 'is invariably the same, and somewhat peculiar. Its convexity is from side to side, and not from above downwards. The patient is never pot-bellied, but tub-shaped; the cause probably being that the flatus occupies the colon, ascending, descending, and transverse.' Pressure over the region of the cæcum frequently excites uneasiness, and usually gives rise to a peculiar gurgling movement, which is both audible and palpable, and doubtless arises from the intermixture of liquid and gaseous matters in the bowels. This gurgling is a still more common symptom at a more advanced stage of the disease, and is of the greater importance since it is rarely met with in typhus or any other disorder. An eruption usually appears at from the 8th to the 12th day of the disease. This typhoid rash is very different from that occurring in typhus; it consists of slightly elevated papulæ or pimples, with their heads rounded, and their bases gradually passing into the level of the surrounding cuticle. These papulæ are circular, and of a bright rose color, which fades insensibly into the hue of the surrounding skin. Throughout their whole course, they disappear completely on pressure, and reappear when the pressure is removed. Each papula lasts three or four days, and fresh ones make their appearance every day or two after their first eruption. The number present at a time is usually from six to twenty, but the limits may range from 1 to more than 100.

Their average size is a line in diameter, and they chiefly occur



on the abdomen, chest, and back. As a general rule, no fresh spots occur after the 30th day. The diarrhœa, to which reference has already been made, continues with the progress of the disease, the patient often having from three to six evacuations daily, and often unconsciously passing them in bed. This persistence of the diarrhœa is one of the results of ulceration of the bowels. Another result of this ulceration is the occurrence of hæmorrhage from the bowels, which is one of the most alarming of the symptoms of typhoid fever. It occurs most frequently during the third

and fourth weeks, and varies from a mere stain to a large amount. Sometimes the blood thus poured out by the ulceration of the mesenteric veins is retained in the bowel, and is only discovered after death; the clots being unable to pass through the valve of the cæcum. This hæmorrhage is always an extremely bad symptom, and may either cause immediate death by fainting, or may so weaken the patient as to cause him to succumb to the disease.

The ranges of temperature in typhoid and typhus fever differ very considerably, and although the range in a mild case of either of these diseases differs considerably from the range in severe cases, the foregoing diagram, copied by Dr. Aitken from Wunderlich and Traubeo, shows the typical ranges of temperature in these diseases contrasted throughout their course, from the beginning to the end of the disease. The records indicate morning (M) and evening (E) observations. The *dotted lines* indicate the *Typhus* range, and the *continuous dark lines* indicate the range in *Typhoid*. This diagram is so plain as to require no explanatory details. It is worth while, however, to direct the reader's attention to the rapid changes which in typhoid occur on and after the 22d day, and in typhus about the 15th day. With regard to the duration of the two diseases, Dr. Jenner found that the average duration of *fatal* cases of typhoid was 22 days, and of typhus 14 days; the former disease may terminate *favorably* during the fourth week, and the latter from the 13th to the 17th day.

In cases of recovery from typhoid, a remarkable fatuity remains for a considerable time; a childishness of mind often remaining for more than a month after apparent restoration to health. 'The patient,' says Dr. Aitken, 'generally wakes up, as it were, from the fever, a complete imbecile. The whole man is changed. He seems to have renewed his youth. Childhood and infancy return, and the greatest care is necessary to prevent untoward events. *No man can be considered as fit for work or for general military service for three or four months after an attack of severe typhoid fever.*' —*The Science and Practice of Medicine*, 3d ed., vol. i. p. 382.

Typhoid fever is essentially a disease of childhood and adolescence, the average age at which it occurs being 21¼ years, and it being very rarely that a person aged more than 50 is attacked; while typhus attacks persons of all ages, from early infancy to extreme old age.

The appearances presented on the examination of the body after death are very different in these diseases. While in *typhus* the most common morbid appearances are a fluid condition of the blood; hyperæmia of the cerebral membranes, and increase of inter-cranial fluid; bronchial catarrh and pulmonary congestion, especially at the posterior part of the lungs, which are more or less collapsed; softening of the heart, liver, and spleen, and enlargement of the kidneys: in *typhoid*, there is one constant and characteristic lesion, viz., a morbid condition of the agminated glands (or glands of Peyer) and solitary glands of the small intestine, and especially of the former. These morbid changes may be briefly summed up as follows: thickening, redness, tumefaction, and finally ulceration or sloughing of the glands, the ulceration always occurring in the lower third of the small intestine. On the assumption that the natural office of Peyer's glands is, as Dr. Carpenter suggests, to separate noxious matters from the blood, and to discharge them into the intestinal canal, Dr. C. J. B. Williams suggests that the ulceration so constantly met with in typhoid fever may result from the continued operation of the poison of that disease, thus escaping. When these changes proceed as far as ulceration, the case is one of extreme danger, although death does not necessarily ensue, because the scars left by healed ulcers are often seen when patients, who have had typhoid fever, have subsequently died from some other disease. The existence of these ulcers is, however, likely to prolong the illness after the fever itself has ended; to protract convalescence, and to hinder recovery; and to endanger life, even in cases of apparent convalescence, by causing hæmorrhage or perforation of the bowel. This perforation, which gives rise to intense peritonitis, occurs in about one in five fatal cases, and generally takes place through the ileum near the valve.

We now proceed to notice the origin and mode of propagation of these two diseases, beginning with *typhus*. There is undoubted evidence that all the forms of continued fever are contagious, and it may now be regarded as an established fact, from the investigations of Dr. Jenner, that one species of fever cannot generate another, but that each is produced solely by its like; that typhus, for example, always propagates typhus, and never any other form of fever, as typhoid or relapsing fever. Some persons may, by some peculiarity of constitution, be able to resist the action of the poison, while others are peculiarly susceptible to it. An attack of fever generally exerts a certain amount of protective power against another attack of the same kind of fever; and *habit* has a good deal of power in fortifying the system against contagion, just as confirmed drunkards or opium-eaters can with impunity swallow doses of their respective poisons which would prove highly dangerous to a novice. 'Upon this principle,' says Dr. Watson, 'has been explained the comparative immunity from contagious diseases, under like circumstances of exposure, of medical practitioners and nurses; of the keepers of filthy lodging-houses, while the new-coming inmates suffer; and even of prisoners, who, without having had the disease themselves, may nevertheless carry forth and communicate the infection, as is said to have happened at the celebrated "black assizes" at Oxford, and again at the Old Bailey in the year 1750.'—*Lectures on the Principles and Practice of Physic*, 4th ed. vol. ii. p. 829. Whether typhus can be generated *de novo* by great over-crowding and vitiation of air, by the organic impurities emanating from the respiratory and other functions, is still a disputed question. The conditions essential to its propagation are (1) overcrowding, combined with deficient ventilation; (2) personal filth, and clothes saturated with cutaneous exhalations; and (3) an impaired condition of the system, such as may result from insufficient food, scurvy, and any other debilitating causes. The patient is most dangerous as a focus of infection after the end of the first week to the period of convalescence, the peculiar odor from the skin and lungs being then the strongest. If the poison be very concentrated, the disease may be caught by exposure to it for only a few minutes. The infected person may actually be conscious when the poison is taken in.

Dr. Banks of Dublin, in an excellent lecture which he delivered on 24th April, 1866, in the theater of the Richmond Hospital, 'On the Origin and Classification of Fevers,' states that this happened in his own case, while examining the chest of a person laboring under the disease. 'The patient,' he observes, 'was seized with cough, and I was so placed that I must have inhaled his breath. The odor was peculiar and intolerably offensive. I was certain that I had imbibed the poison; and after a latent period of three days, I exhibited the usual train of symptoms which usher in typhus of the severest form.' The most common latent period is nine days.

From the investigations of various physicians, amongst whom Dr. William Budd deserves especial notice, it appears that the living human body is the soil in which the specific poison of *typhoid* fever breeds and multiplies. The origin of the disease is unknown, but the poison is communicated or contained in the diarrhœal discharges which issue from the diseased intestine. These discharges, as they dry up, preserve the germs of the disease; and if, through atmospheric or other agencies, these germs enter the living body, they communicate the disease, and diarrhœa soon commences. As the evacuations contain the specific virus of typhoid fever, the disease may be propagated amongst healthy persons (1) by percolation through the soil into the wells which supply drinking-water; (2) or by issuing, through defects in the sewers, into the air which is inspired; or (3) by exhalation through the apertures of small ill-trapped water-closets or privies, which are at once the receptacles of the discharges from the sick, and the daily resort of the healthy. Atmosphere thus infected with the poison is far more dangerous than that immediately surrounding a fever-patient.

For a knowledge of the means of checking the spread of typhoid fever, society is deeply indebted to Dr. Budd's researches; and provided these means are thoroughly and efficiently carried out, it is believed by many of the most eminent physicians that the recurrence of this disease might be entirely prevented. In order to judge of the extent of the infection to be destroyed, there are two points to be considered—viz., *first*, the amount and duration of the intestinal discharge in each case, and *secondly*, the number of cases actually occurring. With regard to the first point, the diarrhœa lasts on an average fifteen days. With regard to the second point, the Reports of the Registrar-general show that at least 100,000 to 150,000 cases of typhoid fever occur annually in England alone; or, in Dr. Budd's emphatic words, 'every year in England, more than 100,000 human intestines, diseased in the way already described, continue each, for the space of a fortnight or thereabouts, to discharge upon the ground floods of liquid charged with matters on which the specific poison of a communicable disease has set its most specific mark.' He suggests the following details of procedure, which should be invariably attended to as soon as this disease appears: 1. All discharges from the fever-patient should be received, on their issue from the body, into vessels containing a concentrated solution of chloride of zinc. 2. Two ounces of a caustic solution of chloride of zinc should be put in the night stool on each occasion before it is used by the fever-patient. 3. All tainted bed or body linen should immediately on its removal be placed in water strongly impregnated with the same agent. 4. The water-closet should be flooded several times a day with a strong solution of chloride of zinc; and some chloride of lime should also be placed there, to serve as a source of chlorine in the gaseous form. 5. So long as fever lasts, the water-closet should be used exclusively as a receptacle for the discharges from the sick. For further details as to the various precautions to be taken with a view of checking the spread of this and other epidemic diseases, the reader is referred to Mr. Simon's 'General Memorandum,' published (in 1860) in his *Third Report on the Public Health in England*.

Although typhoid is contagious, Dr. Jenner holds that it is 'infinitely less so than typhus.' Hence in typhus a large room should, if possible, be selected for the patient, and the air should be kept fresh by having a window or a door, or both, open. Curtains, carpets, and all superfluous furniture should be removed, and the body of the patient should be kept as clean as possible by ablution, and his sheets and night-shirt frequently changed; the latter being at once plunged into water containing chloride of zinc. As the susceptibility to the disease diminishes with the advance of life, middle-aged attendants should be selected; and all who approach the sick-bed should avoid as far as possible inhaling the patient's breath or the emanations from his skin. Friends occasionally visiting the patient should do so after a meal and a glass of wine or ale. Formerly it was the practice to distribute cases of typhus fever in the general wards of hospitals—the rule being to distribute them scantily amongst the general patients. This practice came to be looked on as unadvisable; and now each hospital is provided with its fever-house to which cases of typhus are strictly limited.

From a most careful critical study of the history of fever generally, including chemical and microscopical examination of the excretions, Dr. Parkes arrives at the conclusion, that the *general treatment of fever*, including typhus and typhoid fevers, may be summed up 'as being a combination of measures to *reduce excessive heat, to insure proper excretion*, and *to act on the semi-paralysed nerves*.' The special indications for the treatment of *typhus* are: 1. To neutralize the poison, and to correct the morbid state of the blood. Hydrochloric acid is strongly recommended for this purpose; it may be given to the extent of a fluid ounce of the dilute acid daily, mixed with a quart of barley-water sweetened with syrup of ginger, and flavored with lemon peel. 2. To eliminate the poison and the products of the destructive metamorphosis of tissue. For this purpose, alkaline salts may be prescribed to act on the kidneys and skin, and purgatives are often useful. 3. To reduce the temperature.

4. To sustain the vital powers, and to obviate the tendency to death: nourishment in the form of milk and water, coffee, broth, beef-tea, &c., must be administered at least once in every three or four hours, after the fourth day of fever, and alcoholic stimulants are usually serviceable about the seventh or eighth day. Great discrimination is required in prescribing them, and we are mainly indebted to the Dublin school—to Graves and Stokes—for pointing out the importance of the cardiac and radial pulses as guides for the use of alcohol in fevers. When the cardiac impulse becomes weak, and when the first sound of the heart is impaired or absent, stimulants should be freely given; and an irregular, intermitting, abnormally slow, or imperceptible pulse affords a similar indication. 5. To relieve the distressing symptoms, such as the headache, sleeplessness, and delirium; and 6. To avert and subdue local complications.

In *typhoid fever*, the chief indications of treatment are (1) to reduce the temperature, and subdue any vascular excitement that is present in excess; (2) to restrain excessive diarrhœa, for which purpose milk and lime-water in equal parts may be taken as a drink. The discharge ought not to be altogether checked, and Professor Gairdiner prefers giving saline laxatives to astringents, and at the same time recommends that the lower bowels should be unloaded by warm-water injections, to which a little asafœtida or aniseed is added. In cases in which it is doubtful whether to check or encourage diarrhœa, the physician will generally be on the safer side if he discourages the action of the bowels. (3) To stimulate the nervous system by proper food, and possibly by stimulants; (4) to maintain the free action of the kidneys, which is best effected by the administration of small doses of the alkaline carbonates, or of cream of tartar; (5) to influence the elimination of morbid matter from the affected intestinal glands. For this purpose, 1 or 2 grains of calomel should be given twice a day till about the tenth day, but not later. Special symptoms, such as great inflation of the abdomen (known as meteorism), hæmorrhage from the intestines, &c., must be treated by the ordinary rules. Probably the best single remedy for this form of hæmorrhage is oil of turpentine in doses of from 5 to 20 drops every hour or two. It is best administered in the form of an emulsion with gum-arabic, white sugar, and water.

The diet is a subject of the utmost importance from the beginning of the disease till complete recovery ensues. From the various forms of farinaceous food, such as arrow-root, rice, sago, tapioca, bread, &c., from eggs beaten into custard, and milk with or without lime-water (or, preferably, effervescing Carrara water), an abundant, bland, and nourishing dietary can be selected. All animal food, excepting eggs and milk, must be rigidly prohibited. Even beef-tea and mild broths have often been found to exert a special irritant action on the over-charged glands of the ileum. During the period of convalescence, no meat should be allowed till at least a week has elapsed after all the febrile symptoms have vanished, and the only admissible means of opening the bowels are by castor oil or simple enemata.

Both typhus and typhoid fever have been described under various names. Typhus has been popularly known as the jail fever, hospital fever, putrid fever, brain fever, bilious fever, spotted fever, camp fever, &c.; while from the peculiar lesions which are associated with it, the terms enteric fever and intestinal fever have been suggested as appropriate synonyms for typhoid. Its latest name, for which Dr. Murchison is responsible, is pythogenetic fever, or fever born of putrescence. If the term *intestinal fever*, suggested by Dr. W. Budd, were adopted, much confusion would be prevented.*

Had our space permitted, we should have given a brief historical sketch of the principal epidemics of typus fever. To confine ourselves to the present century, it may be mentioned, that during its first fifteen years the ravages of typhus in the armies of Napoleon, and among the population of the countries which were the seat of war, were perfectly appalling. In May 1812, the Bavarian army serving with the French numbered 28,000 men; in February 1813, the number was reduced to 2250, the great destroyer being typhus. In Mayence alone, of 60,000 French troops composing the garrison in 1813—1814, there died of typhus alone, in six months, 25,000 men. During the spring of 1856, more than 17,000 men of the French army in the Crimea perished from this disease in less than three months. According to Parkes, typhus fever occupies the fourth place amongst the causes which have produced loss of life in the British army, the three more potent causes being (1) a defective commissariat; (2) undertaking military operations in an unhealthy site, and with an unhealthy season impending; and (3) exposure to cold, with insufficient clothing and food. The present article, comparatively long as it is, contains but a very meagre outline sketch of the history and treatment of two of the most important diseases affecting the human body.—For further details, the reader is referred to Aitken's *Science and Practice of Medicine*, 3d ed., vol. i. pp. 374—474, and to Dr. Murchison's *Treatise on the Continued Fevers of Great Britain* (1863).

TYR is the old Norse name of a god, who, however, did not belong exclusively to the northern mythology, but was common also to the German, being called in old High German *Ziu* or *Zio*, and in Ang.-Sax. *Tiv*. He was the son of Odin, and was the god of war and of fame, which idea is expressed in old Norse by the word *tyr;* and when the Romans and Greeks speak of a Mars or an Ares among the Germans, it is Tyr that is meant. According to the Edda, he was single-handed. When the Asa-gods persuaded the wolf Fenrir to allow himself to be bound with the bandage Gleipnir, Tyr put his right hand in the wolf's mouth, as a pledge that he would be loosened; and when the gods refused to release him, the wolf bit off Tyr's hand to the wrist, which was called, in consequence, *Ulflithr*, or the Wolf's Joint. In the twilight-battle of the gods, he meets his death at the same time with his enemy, the monster dog, Garmr.

The old Norse Runic character ↑ bore the name of the god. The third day of the week, too, the *Dies Martis* of the Romans, is called after him, in old Norse, *Tyrsdagr;* Ang.-Sax. *Tivesday* (from which our English *Tuesday*); old Friesic, *Tysdei;* old High German, *Ziuwestac;* in the north of Germany, *Tiestac* or *Diestac*, from which the German of the present time, *Dienstag*. Places, and in particular hills and plants, were named after him. The word Tyr appears in epithets of Odin, signifying god in a general sense; as, for example, *Sigtyr*, that is to say, the god of victory; also in epithets of Thor, as *Reidhartyr*, the god of the chariot or of thunder.

TYRANT (Gr. *tyrannos*, Doric for *koiranos*, from *kuros* or *kurios*, a lord or master), a name given in modern times to an arbitrary and oppressive ruler, but originally applied, not necessarily to one that exercised power badly, but merely to one that had obtained it illegally, and therefore equivalent to our word *usurper*. The ancient Greek 'republics,' it must be remembered, were generally aristocratic and even oligarchic in their constitution. When the 'governing families' among the Athenian or Syracusan nobles, for example, quarreled with each other, it was natural, if they could not otherwise agree, that the boldest and most reckless of the set should seek for success by allying himself with the masses of the people, should figure as their champion, promise to redress their wrongs or increase their comforts, and when a fitting occasion presented itself, should, by a clever if somewhat violent stratagem—*coup d'état*, it is now called—deliver them from the domination of his order by himself grasping possession of absolute power, and ruling without any other restraint than the necessity of retaining his popularity imposed—even this limitation being frequently absent when a body-guard of foreign mercenaries rendered it superfluous.

If the political adventurer who thus rose on the ruins of the constitution happened to be a man of sense, and wisdom, and generosity, his 'tyranny' might prove a blessing to a state torn by the animosities of selfish oligarchs, and be the theme of praise in

* Cases of continued low fever, whether typhus or typhoid, are frequently spoken of popularly and vaguely as *gastric* fevers; but the term is not recognized by the medical profession.

after-ages, as was the case with the 'tyrannies' of Peisistratos (q. v.), Gelon (q. v.), Hiero II. (q. v.), and many others; but if he was insolent, rapacious, and cruel, then he sought to reduce the citizens to a worse than Egyptian bondage, and his name became infamous to all time. Such has been the fate of most of the 'Thirty Tyrants of Athens' (q. v.), more particularly of the blood-thirsty Critias, of Alexander of Pheræ, of Dionysius the Younger, &c. It was the method of exercising authority pursued by these and similar usurpers that latterly, even in ancient times, gave the word tyrant that evil significance it has ever since uninterruptedly retained.—See Plasz, *Die Tyrannis bei den Griechen* (Bremen, 1852); Wachsmuth, *Hellen. Alt.*, vol. i. pp. 279—288; and the Histories of Thirlwall and Grote.

TYRANT SHRIKE, the popular name of a section of the Shrike family (*Laniadæ*), connecting that family with the Fly-catchers (*Muscicapidæ*), and entirely American. In the genus *Tyrannus*, the bill is straight, rather long, strong, the upper mandible rounded above, the point suddenly hooked. The birds of this genus are remarkable for their fierce and bold disposition. They are always ready for battle, and often engaged in it. In defence of their young, they rush against any aggressor. The T. S., TYRANT FLYCATCHER, or KING-BIRD (*T. intrepidus*) of North America, has no hesitation in attacking an eagle, rising above him, and pouncing down upon him. This species migrates northwards in summer as far as lat. 57°. It feeds much on the larvæ of insects, but has an unfortunate fondness for bees, and will take its post on a fence or bush near a hive, to dart upon them as they depart or return; on which account it is disliked by American farmers. The true Tyrant Shrikes (*Tyrannus*) have the plumage of white and black, variously blended; but in the genus *Tyrannula*, which approaches more to fly-catchers, the plumage is almost always olive-colored, serving for their concealment among foliage.

TYRCONNEL, RICHARD TALBOT, DUKE AND EARL OF, born early in the 17th century. In his youth, according to Lord Macaulay, he was 'one of the most noted sharpers and bullies of London.' Soon after the Restoration, he endeavored to obtain the favor of the royal family by blackening the reputation of Anne Hyde, so as to furnish the Duke of York with a pretext for breaking his promise of marriage to her. Though unsuccessful in this, he succeeded in gaining the favor of the duke, and contrived to make himself welcome at the palace both as a votary of its pleasures and as a counselor in affairs of state. Immediately on the accession of James II., he was made Earl of T., and put in command of the troops in Ireland; and in 1687, by fawning, bullying, and bribing, he got possession of the office which had long been the object of his ambition—he was appointed Lord-deputy of Ireland. His arrival in that country spread terror and dismay through the English Protestant population, who had already suffered somewhat under his military rule. Events quickly justified their terrors. Nearly every office of dignity in the country was soon transferred to the hands of the Roman Catholics. The Protestant party, so long dominant complained bitterly that they had become a laughing-stock even to their own servants, and that to appeal to law was vain; judgment in every case being given for the native against the Englishmen. But this state of matters did not last long. The revolution of 1688 had a sudden and sobering effect upon the rule of the Lord-deputy; and there can be little doubt that he would have submitted to William III.; but the Irish people threatened that if he dared to sell them for wealth or honor, they would burn the castle and him in it, and put themselves under the protection of France. On the arrival of James in Ireland in 1689, he created the earl Duke of Tyrconnel.

After the fatal battle of the Boyne, at which he held high command, he retired to France. In 1691, he returned to Ireland, with a view to furthering the efforts in favor of James, which were still being made by his adherents. Notwithstanding the defeat of Aghrim (12th July 1691), and the capitulation of Galway, he made preparations for the defence of Limerick, binding himself and his countrymen by an oath not to surrender until they received permission from James, then at Saint Germain. He at the same time despatched a letter in which he stated his conviction that all was lost. On the 11th August, before an answer could arrive, he was struck with apoplexy. He died on the 14th of the same month. He has been characterized by Macaulay as 'the fiercest and most uncompromising of all those who hated the religion and liberties of England.' He was survived until 1730 by his wife—'La belle Jennings' of the court of Charles II. This lady, so famed for her beauty and fascinating manner, entered life as maid of honor to the Duchess of York; in which position she conducted herself with a propriety which, time and place considered, may almost be pronounced unique. As wife of the Duke of T., during his rule in Dublin, her conduct seems to have been characterized both by dignity and purity. It is narrated that when James and her husband, fleeing from the defeat of the Boyne, reached her residence so bespattered with mud as to be scarcely recognizable, she dressed herself richly, and received the fugitive king and his attendants with all the splendor of court etiquette. She died in a small private nunnery in Dublin in circumstances of great poverty.—See Macaulay's *History of England*, vols. ii., iii., and iv.; Chambers's *Book of Days*, vol. i. ed. 1863, p. 310; Mrs. Jameson's *Memoirs of Beauties of the Court of Charles II.*, vol. ii., p. 223.

TYRE, (Phœn. *Sûr* or *Sôr*, rock), a city of ancient Phœnicia situated in lat. 33° 12′ N., which probably derived its name from the double rock on which it was first founded. It was a matter of doubt among the ancients themselves whether T. or Sidon was the older of the two, and the question is one not easily to be settled. So much, however, seems certain, that T. had existed already independently for a long time, when Sidon, defeated by Ascalon, transferred herself almost bodily to the former (see PHŒNICIA). There were two towns of T. closely connected together in historical times; one on the continent, the other on the island opposite, together embracing about 19 Roman miles. The more important of the two was the continental town, called Palæ Tyrus; while the island-town served more or less for the purpose of store-houses, manufactories, arsenals, and the like. The situation of the entire city was one of the most fertile, and its magnificent combination of land and sea scenery formed the theme of many an ancient poet and seer.

Nothing but myths have come down to us respecting the earlier period of its existence. History begins to dawn upon us with Abibal, the predecessor of the biblical Hiram, under whose rule (980—947 B.C.) T. attained to its full glory and renown. An alliance with Solomon was also entered into; trading expeditions were undertaken jointly by the Israelites and the Phœnicians, and Solomon is supposed even to have married Hiram's daughter. During Hiram's reign, T. was much enlarged and embellished; and its two roadsteads and harbors, the wonders of the ancient world, probably date from the same period. He was followed, according to ancient writers, by Balæastartus; after him reigned, for brief periods, his four sons, by the murder of the last of whom the throne became hereditary in the House of Ithobaal, the Ethbaal of Scripture, whose daughter was married to Ahab. T. then appears to have gained the supremacy over Sidon, and also spread her colonies far and wide.

Shortly after the death of this king, Carthage was refounded by Elissa (Dido), about 813 B.C., in consequence of a popular demonstration, which deprived her of the throne in favor of Pygmalion. This 'new city' gradually diminished the importance of the old one; at least T. seems to have been weakened to such an extent by the emigration of its best elements, that it disappears from history until the three great powers, Chaldæa, Assyria, and Egypt, by turns endeavored to make themselves masters of the Tyro-Phœnician coast, with its eastern and western trade. Shalmaneser, king of Assyria, reduced T., after a long siege; and the whole of Phœnicia, the most important places of which had already thrown off their allegiance to T., was rendered tributary to Assyria. During the Chaldæo-Egyptian struggle, T., again at the head of the country, sided with Egypt, and was conquered by the Chaldæans. Once more the Phœnicians attempted to throw off the foreign yoke, and Nebuchadnezzar marched against them at the head of his armies. Having taken Jerusalem (587 B.C.), he reduced the whole sea-coast, except T., which stood a thirteen years' siege by water and by land, ending, not in subjection, but only in a kind of apparent submission, leaving the native sovereigns on their thrones, and their wealth and power untouched. In 538 B.C., Cyrus became master of Phœnicia, which at that time again stood under Babylonian supremacy, and the hegemony was bestowed upon Sidon. For a long time, Phœnicia prospered under wise Persian rulers; but when Xerxes, in his Greek wars, had completely destroyed the Phœnician fleet, and exhausted nearly all her resources, the exasperated inhabitants rose once more, but only to be utterly crushed. Sidon, at the head of the revolution, was fired by its own inhabitants, and once more T. resumed the lead (350 B.C.). Having refused to pay allegiance to Alexander the Great (after the battle at Issus), it was besieged by him in 332 B.C., and fell after a seven months' hard resistance.

Alexander replaced the old inhabitants by new colonists, chiefly Carians, and though the city had sustained all but complete destruction, it yet rose again after a very brief period to wealth and power, and already in 315 B.C., was able to hold out for 18 months against Antigonus. Under the Romans, Cleopatra received T. as a present from Antony; but the last trace of its independent existence was taken from it by Augustus. A Christian community was founded there at an earlier period. The trade and manufacture of T., aided by her exceptionally favorable naval position, insured for it, even under Roman dominion, a high place among its sister cities; and once more, in 193 A.D., it even took an active part in the contest between Septimius Severus and Pescennius Niger, which, resulting in the success of the former, brought back to it some of its ancient distinction. In

St. Jerome's time, it was again the noblest and most beautiful city of Phœnicia, nay, one of the most prosperous and noble cities of the whole East. In the 7th c., it came under the dominion of the Saracens, and so remained until taken by the Crusaders; and in 1192 A.D., became the northern boundary of Christian territory in Palestine. It continued to flourish—still chiefly through its world-renowned purple—until 1516 A.D., when the conquest of Selim I., together with the newly discovered route to Asia by the Cape of Good Hope, put an end to its wealth and commerce, and almost to its existence. Although there has been a slight improvement in its prospects of late, the desolation and wretchedness of that once magnificent city are still most striking. From 3000 to 4000 inhabitants now dwell among the ruins of its ancient glory, finding scanty livelihood in insignificant exports of tobacco, cotton, wool, and wood. Frederick Barbarossa and Origen are both buried here.

TY'RNAU (Magyar *Nagy-Szombath*), a town of Hungary, county of Ober-Neutra, on the river Trna, about 30 miles northeast of Presburg. It has so many churches and convents that it has been nicknamed 'Little Rome.' T. carries on manufactures of cloth, linen, woad, &c., and has a tolerably lively general trade, especially in wine. From 1635 to 1774, it possessed a university, which in the latter year was transferred to Pesth. T. is likewise famous for a huge cask, which can hold twice as much as the Heidelberg one. Pop. (1880) 10,824,

TYRO'L (in German more commonly spelt *Tirol;* not spoken of as *das T.*, though usually called in England *The T.*) forms with Vorarlberg the most westerly province of the Austro-Hungarian monarchy, and borders N., W., and S. on Bavaria, Switzerland, and Italy. Area, including Vorarlberg, 11,280 square miles; pop. in 1880, 912,549.

Surface.—The T. may be regarded as an eastern continuation of Switzerland. It is traversed from east to west by the great chain of the Alps, and is encircled on all sides by lofty ranges. It consists, however, almost entirely of three great valleys—(1) one running east and west north of the Great Alps, and drained by the Ine; (2) one south of the Alps, also running east and west, and drained by upper tributaries of the Adige or Etsch; (3) one running south from the middle of the last, and drained by the main stream of the Adige. These valleys are surrounded by a circuit of mountains. The northern valley is separated from Bavaria by the Algau Alps. The southern valley is bounded on the E. by the Trent Alps; on the W. by the Ortler Alps, which, like protecting walls, run south into the plain of Lombardy. The main chain is crossed towards the center of the T. by a deep depression, in which lies the Brenner Pass (elevation, 4657 feet). It is the lowest of the great passes of the Alps, and that over which runs the great commercial route connecting Italy and Germany.

The dialect and manners of the Bavarians prevail in the northern and middle valley. The dialect and manners of Lombardy, on the other hand, have crept up the third valley to a boundary-line which rests upon the mountains which bound the middle valley on the south. Hence the most important divisions of the T. are into the German Tyrol and the Italian Tyrol. The German T. is divided into (1) the Oberinnthal, or the Upper Inn Valley; (2) the Unterinnthal, or the Lower Inn Valley; (3) the Vintschgau; (4) the Etsch district; and (5) the Pusterthal, the three last belonging to the middle valley of the Tyrol. Beyond the geographical limits of the T., the Austrian province of the T. includes (6) the Vorarlberg, a district drained by streams which fall into the Lake of Constance, and in which a dialect is spoken resembling those of German Switzerland; and (7) the Lienz district, on the Drave, in which the language of the people is Austrian. The Italian T. is divided into (1) a northern valley, or that of Trent; (2) a southern valley, or that of Roveredo; (3) the valley of the Sarca, or district of Riva, on Lake Garda.

Geology and Soils.—The rocks of the T. are chiefly crystalline Silurian and Secondary, with obtruding granites and traps. The chief mineral products are iron, rock-salt, worked near Innsbruck, and marble, quarried in the south. The Tertiary strata of the Swiss and Swabian plains are totally wanting; and it is only along the water-courses that level tracts of recent formation are found. These tracts are the only parts of the country admitting of cultivation by the plough, and they very seldom attain a width of more than half a mile. Taken altogether, they do not form more than one-tenth of the whole country.

Climate.—The loftiest mountains of the T. are in the main chain of the Alps—the Gross Glockner (12.776 feet), east of the Brenner Pass, and Mount Gebatsch (12.276 feet) west of it, and, in the Ortler chain, the Ortler Spitz (12,818 feet). These mountains are covered with vast glaciers, which descend, like those of Switzerland, far into the valleys. Between 6000 and 5000 feet, snow disappears in summer, and alpine plants and grass cover the hills, diversified here and there with stunted bushes. Into this region the herds are driven, as in Switzerland, during the summer months. Below 5000 feet, the fir-woods abound; potatoes and a few vegetables are cultivated, and houses permanently occupied make their appearance. The beech replaces the fir at 4000 feet, and agriculture begins, the chief grains being rye and barley. Wheat is not cultivated with success at a higher elevation than 2000 feet. In the lower part of the southern valley, the temperature is highest, and indeed the climate is that of Northern Italy; tobacco, the fig, the olive, and the mulberry being enumerated among the chief objects of cultivation. Out of every 100 acres of the T., 30 are inaccessible mountain-tracts, 40 forests, 20 commons and meadows, and 10 corn-fields and gardens.

Industry.—The industry of the T. is not important. There are, however, glass and paper factories near Innsbruck; and carpets, linens, gloves, and straw-hats are manufactured extensively for home consumption. Wooden ware is also largely produced. The rearing of canaries is a business which was long a monopoly of the northern Tyrolese, who supplied all Europe with these birds. The exports from the T. consist of cattle, cheese, timber, wine, tobacco, silk, iron, and salt. The imports are grain and manufactured goods. The transit-trade between Italy and Germany gives employment to a large number of the inhabitants. Thousands migrate annually into neighboring countries, to sell their wood-wares, gloves, and carpets. Railways have for a number of years connected Innsbruck with Munich, and Botzen with Verona; and in 1867 the section between Innsbruck and Botzen, over the Brenner Pass, was opened, which completed the first railway communication between Italy and Germany.

Inhabitants.—The northern or German Tyrolese bear to the southern, or Italian, the proportion of three to two; and the habits and language of the people resemble those of the adjoining parts of Italy and Germany. In the T., according to the census, the inhabitants are all Catholic, with the exception of 358 Jews, 1235 Protestants, 29 Greek Christians, and a few members of other sects. The Tyrolese have an independent national diet, meeting at Innsbruck, in which are represented all classes of the population, the clergy, the nobility, the people of the country, and those of the towns. There are, to some extent, separate administrative arrangements for the Italian districts. Education is now very generally diffused, and one of the nine Austrian universities is at Innsbruck.

History.—The history of the T. is partly German and partly Italian. In early times, the T. formed part of Rhætia, and was conquered by the Romans, 15 B.C. Subsequently it was overrun by various German tribes; still later the southern valley fell to the share of the Lombards, the two northern valleys to the Bavarians. The latter valleys were divided into *gaus*, which ultimately became petty lordships, acknowledging the supremacy of the dukes of Bavaria. These lordships, however, in the course of time, came to be represented by two families who intermarried. Then the whole German T. was governed by one family of counts, whose paternal abode was the mountain fortress of Terioli, or Tyrol, near Meran. The last count, who died in 1335, left one daughter, Margaret Maultasche. She bequeathed her rights to her cousins, the dukes of Austria, who, in consequence, acquired possession of the T. in 1363. The Italian valley formed the bishopric of Trent. During the wars of Napoleon, the German T. was ceded to Bavaria, much to the discontent of the population, who were warmly attached to the House of Austria. They made a gallant resistance to the French in 1809, under Andreas Hofer, but were defeated; and the Northern T. was not restored to Austria until the treaty of Paris in 1814. The Southern T., which had been annexed to Italy, was restored to Austria in the following year. An application was made by the inhabitants of the Italian T., a few years ago, to the Austrian government to be rendered entirely independent of the German inhabitants of the northern valleys; but it led to no important change in the administration. It showed, however, the desire of the Southern Tyrolese to be considered Italians rather than Germans, and it was believed that on the event of a successful war for the recovery of Venice, the whole of the Southern T. would be handed over to the kingdom of Italy. This expectation has not been realized. By the treaty of peace between Austria and Italy, at the conclusion of the war through which Venetia again became Italian, it is declared that the frontiers of the Venetian provinces ceded to Italy are the administrative frontiers of these provinces under the Austrian rule. Even the shores of Lake Garda remain Austrian. How long this arrangement will last, it is hard to predict.

The trade of the Southern T. is entirely with the south, its wood and cattle being exchanged for the corn of Lombardy. Of late there has repeatedly been an agitation in Italy with the view of securing the incorporation with the kingdom of what is called *Italia Irredenta* ('Unredeemed Italy'), which includes, with Trieste and part of the Dalmatian seaboard, the *Trentino* and Southern Tyrol.

TYRO'NE (*Tir-owen*, 'Owen's country'), an inland county of Ulster, Ireland, bounded N. by Londonderry, E. by Armagh and

Lough Neagh, S. by Monaghan and Fermanagh, and W. by the last-named county and Donegal. A portion of Lough Neagh is assigned by the Ordnance Survey to this county; and, including this portion, the whole area is 1260 sq. m., or 806,640 acres, of which 450,286 are arable, 311,867 uncultivated, 31,796 under water, 11,981 in plantations, and 710 in towns. Of the arable land, about 260,000 acres are usually under the various kinds of crops. The pop. in 1861 was 238,500; in 1871 it had decreased to 215,766, of whom 119,937 were Roman Catholics, 49,201 Protestants of the Anglican Church, 42,156 Presbyterians; pop. in 1881, 197,719. The surface, in general, is hilly, and often extremely picturesque, this county lying for the most part between the two great mountainous districts which traverse Ulster from east to west. With the exception of Lough Neagh, the lakes, which are numerous, are small. The principal rivers are the Blackwater, the Camowen, and the Ballinderry, of which the former two are navigable.

The county is traversed by railways, which connect it with Dublin, Belfast, and the sea-coast at Dundalk. The geological structure is very much diversified. The north-western mountains are chiefly mica-slate, with primitive limestone, and rise in Slieve Sawel to a height of 2236 feet. Those on the north-east are of greenstone, with granite and occasional red sandstone. The plain, of which Omagh is the center, is a Tertiary formation, with irregular beds of lignite, red marl, and new red sandstone; and between Dungannon and Stewartstown there is a small coal-field, the produce of which is rich, and resembles the coal of Ayrshire. The rest of the plain belongs to the general limestone district. The climate is moist, and the low lands are often flooded. The soil of the plain is a fertile loam; that of the hilly districts, sandy or gravelly. There is a large proportion of bog, the turf of which supplies the chief part of the fuel consumed by the population.

The chief towns are Omagh, Strabane, Dungannon, Cookstown, Aughnacloy, Castlederg, and Clogher, which gives its name to the episcopal see. T. returns three members to the imperial parliament, two for the county, and one for the borough of Dungannon.

T. was anciently known as the district of Hy-Briun and Hy-Fiachra; and in later Celtic times was called Kinel Eogain, or Tir-owen, whence its modern name. See ULSTER.

TYRRHE'NIAN SEA (anc. *Tyrrhenum Mare*), that part of the Mediterranean Sea (q. v.) between the islands of Corsica, Sardinia, and Sicily on the west, and the Italian peninsula on the east.

TYRTÆ'US, famed for his political elegies and marching-songs, was the son of Archembrotus, of Aphidnæ, in Attica; according to another conjecture, he was a Lacedæmonian; while the story which represents him as a lame schoolmaster, of mean family, whom the Athenians (ignorant of his lyric power, and jealous of Lacedæmonian domination in the Peloponnesus) sent to the Lacedæmonians, during the second Messenian war, as the most inefficient commander they could select, must be received as a fiction of later times. He rendered, however, to the Lacedæmonians a kind of assistance which the Athenians little foresaw; and while by his elegies he stilled their dissensions at home, by his war-lyrics, he so animated their courage in the field, that they were finally triumphant in their conflict with the Messenians, whom they reduced to the condition of Helots. This success of his poems T. lived to see, and must accordingly have flourished down to 668 B.C., the last year of the second Messenian war. The best edition of the text of T. is that of Bergk in his *Poetæ Lyrici Græci*.

TY'TLER, WILLIAM, the author of several literary works of considerable merit, the principal being an *Inquiry, Critical and Historical, into the Evidence against Mary Queen of Scots*, in which it is attempted to vindicate that unhappy princess from the charges brought against her by Robertson and Hume. T. was born at Edinburgh in 1711, educated in Edinburgh, admitted a member of the Society of Writers to the Signet in 1742, and died in 1792. He was father of Alexander Fraser Tytler, Lord Woodhouselee, and grandfather of Patrick Fraser Tytler the historian. T. was an accomplished musician, and distinguished for his general culture and taste in the fine arts.

TYTLER, ALEXANDER FRAZER, a historical writer, and a judge of the Court of Session in Scotland under the title of Lord Woodhouselee. He was the eldest son of William Tytler (q.v.), the vindicator of Queen Mary, and was born at Edinburgh in 1747, educated principally in Edinburgh, and admitted to the Scottish bar in 1770. He obtained, in 1780, the professorship of History in the university of Edinburgh; in 1790, the office of Judge-admiral of Scotland; and in 1802, was raised to the bench of the Court of Session. His acquirements were of the most varied kind, embracing most departments of literature and the fine arts. His writings include a biography of Henry Home, Lord Kames; a Dictionary of Decisions of the Court of Session; and the work by which he is best known, his *Elements of General History*, first published in 1801, which has been translated into most of the languages of Europe, and even into Hindustani. He died in 1813.

TYTLER, PATRICK FRASER, an eminent historical writer, fourth son of Alexander Frazer Tytler, Lord Woodhouselee. He was born in 1791, educated partly in Edinburgh, partly in England, and called to the Scottish bar in 1813. Of his various literary and historical works, the most valuable is his *History of Scotland*, beginning at the accession of Alexander III., and terminating at the union of the crowns, a book of more critical research than any work on the same subject that had preceded it. His writings also include a life of the Admiral Crichton, a life of Wickliffe, a memoir of Sir Thomas Craig, and a collection of original letters, illustrative of the reigns of Edward VI. and Mary. In consideration of his merits as a historian, Sir Robert Peel's government conferred on him a pension of £200 a year. He died at Malvern, 24th December 1849. His talents were such as qualified him in a remarkable degree to shine in society, and his amiable and excellent private character have been the subject of deserved eulogy.—See Burgon's *Life of Patrick Frazer Tytler* (1859).

TZETZES, JOHANNES, a Byzantine (Greek) author, flourished during the latter half of the 12th c., is known as the author of certain works in prose and verse, which, though excessively dull, and without a vestige of literary genius, are valuable as storehouses of classical information, not elsewhere to be had. The principal are—1. *Iliaca*, consisting of three distinct poems, entitled *Ante-Homerica*, *Homerica*, and *Post-Homerica;* or in Greek, *Ta pro Homerou*, *ta Homerou*, *kai ta meth' Homeron;* a complete edition of which was first published by Fr. Jacobs (Leip. 1793), but the most critical edition is that of Bekker (Berl. 1816); 2. *Biblos Istorike*, more commonly called *Chiliades*, or a collection of more than 600 stories, mythical, legendary, &c.; best edition that of Kiessling (Leip. 1826), written in that worthless sort of verse, called *political*, which had regard only to syllables, and not to quantity; besides commentaries on Homer, Hesiod, and the *Cassandra* of Lycophron. Several poems and commentaries of T. exist in MS. that have never yet been published.—T. had a brother, ISAAC, who probably had some share in the commentary on the *Cassandra*.

U.

THE twenty-first letter of the English alphabet, represents in that language three distinct sounds, as heard in *tube*, *tub*, and *full*. The last is its primitive sound, which it had in Latin, and which it has preserved in German and Italian, but which is oftener denoted in English by *oo*. In *tube*, it does not mark a pure vowel sound; it is aspirated, as if *y* were prefixed—*tyub*. The sound heard in *tub* is characteristic of English; and, owing, perhaps, to the decided emphasis given to one syllable of a word at the expense of the rest, there is a tendency to allow the other vowels, *a*, *e*, *o*, when unaccented, to degenerate into this indistinct, stifled sound: *cavalry*, *sister*, *fashion* are pronounced almost, if not altogether, as if written *cavulry*, *sistur*, *fashun*. This is especially the case with *o*; and in this vowel the degeneracy is not confined to unaccented syllables; in a whole host of words, the accented *o* is exactly equivalent to *u*—e. g., *come*, *money*, *among*.

Perhaps a similar tendency in Latin may account for the prevalence of *u* in that language as compared with Greek—e. g., Lat. *genus* = Gr. *genos*; *volumus* = *boulometha*; *spatula* = *spatale*; *scopulus* = *skopelos*. *U*, in Latin, sometimes goes into the still thinner sound of *i*; thus *maxumus*, *caputis*, degenerated into *maximus*, *capitis*. Of the labial series of vowels (see LETTERS), *u* approaches nearest to the labial consonants; so much so,

that in Latin the vowel *u* and the consonant *v* were both denoted by the same character, *v*, of which *u* is only a later modification. In the middle ages, the two characters were used indifferently whether as vowel or consonant; and it was only in the 16th c. that the Dutch scholars fixed the use of the character *u* for the vowel, as distinct from *v*.

UBE'DA, a town of Spain, Andalusia, in the modern province of Jaen, stands on an olive-clad slope in a cultivated plain, 26 miles north-east of the town of Jaen. It contains some fine specimens of architecture, of which the chief is the cathedral. It was built by the Moors, and under them it is said to have contained 70,000 inhabitants. There are now only about 18,000, who are engaged in agriculture, in the manufacture of porous vessels, made of red and white clay, and in trade in the products of the fertile vicinity.

UCAY'ALI, a great river of South America, one of the chief head-waters of the Amazon. It joins the Amazon from the south, in south latitude 4° 40′, and west longitude 73° 30′, opposite the town of Nauta in Ecuador; but the whole course of the river is in Peru. It is the largest river that joins the Amazon above the Brazilian territory, and on account of its length, has been regarded by some as the main stream of the Amazon, but at its mouth it is not above half the width of the Amazon. The Maranon and Huallaga from the south, with many smaller but still large rivers from the north, have united to form the Amazon. The sources of the U. are in the Andes, Cuzco being situated on one of its feeders, which rises considerably further south; whilst another has its rise on the western side of the Andes, to the north-west of Lima, and after flowing southward for about 150 miles, makes its way through a cross valley, and takes a northward course.

Attention has of late been very strongly directed to the U. as affording means of communication between the western parts of Peru and the Atlantic Ocean. It was partially explored by the Count de Castelnau and others in 1846, by Lieutenant Herndon and Mr. Gibbon of the United States navy in 1851, and more recently by an expedition sent out by the Peruvian government. It has been found to be navigable by steamers from its mouth to towns not far distant from Lima, 3700 miles from the mouth of the Amazon. On the branch which comes from Cuzco, there are falls and rapids, which form an impediment to navigation more than 100 miles below that city. The course of the U. is winding, but generally northward. Without regard to any but its principal windings, the length of its course is not less than 1100 miles. It receives many large branches. The name U. is not given to any of its head-waters, the chief of which is the Tambo, formed by the junction of the Mantaro, a river which has its sources to the north-west of Lima, and the Apurimac, which comes from a more southern region. The greater part of the country through which the U. flows is covered with forest; but it seems very suitable for colonization, if easy communication with the rest of the world were established, the soil being fertile, whilst the mountains abound in valuable minerals.

U'DAL RIGHT, in the Law of Scotland, means that right in land which may be completed without charter and sasine by undisturbed possession provable by witnesses before an inquest. Though dependent on the crown as superior, the vassal pays only a tribute called skat. The right is said to have been the old tenure prevalent in Britain before the feudal system was introduced, and prevails chiefly in Orkney and Shetland. The lands held on udal right are now commonly converted into feus.

UDI'NÉ, a city of N. Italy, Venetia, in the province of the same name, formerly called also the province of Friuli, situated in a fertile plain, about 75 miles north-east of Venice by railway. It is a walled town, 4 miles in circumference, with wide, handsome streets and squares. The castle, which stands on a hill in the midst of the city, was formerly the residence of the patriarchs of Aquileia and is now the seat of the tribunals. The Antonini Palace is a work of the architect Palladius. U. trades in silk, in copper utensils, and rosolio. There are leather, paper, and silk factories. Pop. (1881) 32,020. Two miles from U. stands the village of Campoformio, where, in 1797, the treaty between Bonaparte and Austria was signed, by which Venice was ceded to the latter. Pop. of prov. (1881) 501,649.

U'FA, a government of Russia, formed in 1865 out of the five north-western districts of Orenburg, and separated from the present government of Orenburg by the south-west branch of the Ural Mountains. Pop. (1880) 1,648,753. See ORENBURG.

UFA, capital of the government of the same name, on the right bank of the Biélaia, or White River. It was built in 1573, in the reign of Ivan IV. It contains 12 churches and 24 manufactories, the principal articles of trade being honey, wax, fat, furs, and skins. The Biélaia, an affluent of the Kama, and thus connected with the Volga, is here navigable for large ships. Pop. (1880) 20,917.

UGANDA, an African empire extending along the north-west shore of the Victoria Nianza; the name of its late king, Mtesa, has become well known through Stanley and other recent travelers. The people of U. proper are estimated at 500,000; with subject tribes, perhaps 2,000,000.

UGLI'TCH, a town of Great Russia, in the government of Jaroslav, on the right bank of the Volga, 488 miles south-east of St. Petersburg. In early times it was the chief town of an independent principality. In 1592, most of the inhabitants were banished, and the town, formerly prosperous, became deserted. Linen, weaving, and tanning are the principal branches of industry. Pop. (1880) 13,100.

UGOLI'NO DELLA GHERARDESCA, COUNT, an Italian nobleman of the 12th century, chiefly known for his cruel death, which Dante has immortalized in his *Inferno*. U. was for a time the head of the party of the Guelphs at Pisa, but a conspiracy, led by Archbishop Ubaldini, a Ghibeline leader, was formed against him, and with his sons and grandsons he was cast into the tower of Gualandi, and left to perish miserably by starvation.

UHLAND, JOH. LUDWIG, a celebrated German poet, was born at Tübingen, 26th April 1787, and studied at the university of his native city. He began to publish ballads and other lyrics in various periodicals, the first collection of which, under the title of *Gedichte*, appeared in 1815. To this he kept adding all the rest of his life, and it is on these *Gedichte* that his fame rests. Their popularity has been, and continues to be as great as it is merited, upwards of a dozen editions having been published. Other productions of U.'s are his admirable essays, *Ueber Walther von der Vogelweide* (Stuttg. 1822), and *Ueber den Mythus der nord. Sagenlehre vom Thor* (Stuttg. 1836), a masterly collection of old popular songs, *Alter hoch und niederdeutscher Volkslieder* (Stuttg. 1844—1845); and two dramas, *Herzog Ernst von Schwaben* (Heidelb. 1817), and *Ludwig der Baier* (Berl. 1819). He died at Tübingen, 13th November 1862. U. was a patriotic politician as well as a poet. He entered the representative assembly of Würtemberg in 1819 as deputy from Tübingen, and proved an active member of the liberal party. He was also a delegate to the Frankfürt Assembly of 1848; but though Germany has reason to be grateful for his services to the cause of constitutional liberty, it is as a poet he will be best remembered. His pieces are full of spirit, imagination, and truth, finely picturesque in their sketches of nature, and exquisite in their varied tones of feeling. Nothing, indeed, can surpass the brevity, vigor, and suggestive beauty of his ballads, in which a romantic sweetness of sentiment and a classic purity of style are happily combined. U. is the acknowledged head of the 'Suabian School' of German poets. See Pfizer's *Uhland und Rückert* (Stutt. 1837), and Mayer's *U.* (1867). Longfellow has translated some of U.'s ballads, in his *Hyperion*, into English; and translations by Platt, Skeat, and Sanders have also appeared.

U'HLANS (a Polish word signifying 'lancers'), light cavalry of Asiatic origin, were introduced into the north of Europe along with the colonies of Tartars who establishad themselves in Poland and Lithuania. They were mounted on light active Tartar horses, and armed with sabre, lance, and latterly with pistols. Their lance was from 5½ to 6½ feet in length, and like that of the modern 'lancers,' was attached to a stout leather thong or cord, which was fastened to the left shoulder, and passed round behind the back, so as to allow the lance to be couched under the right arm. Immediately below its point was attached a strip of gaudy-colored cloth, the fluttering of which was designed to frighten the enemies' horses. The early dress was similar to that of the Turks, and the regiments, or *polks*, were distinguished from each other by the red, green, yellow, or blue color of their uniforms. The Austrians and Prussians were the first to borrow this species of cavalry from the Poles. In 1734, an attempt was mode by Marshal Saxe to introduce the U. into France, and a 'polk' of 1000 men was formed; but it was disbanded at its author's death. The Prussian Uhlans won great renown in the Franco-German war of 1870—1871 by their bravery and marvelous activity. The Prussians applied the term, however, rather loosely, including all their light cavalry under the designation.

UIST, NORTH AND SOUTH, two islands of the Outer Hebrides, are situated from 15 to 18 miles west of the Isle of Skye, from which they are separated by the Little Minch. Unlike the other islands of the Hebrides, the east coasts of North and South U. are much and deeply indented, while the west coasts are, as a rule, almost unbroken.—NORTH U., between which and *South U.* the island of Benbecula intervenes, is 18 miles long from west to east, and from 10 to 3 miles in breadth. The eastern half of it is so cut up by lochs and watercourses as to have the appearance of an archipelago. This region is a brown, peaty, dreary bog, partly relieved, however, by a line of low hills running along the coast at the distance of about 2½ miles. In the west part, which, as a rule, is hilly, there is a tract of uneven, low land, exceedingly

beautiful in certain seasons, rendered fertile by the drifting of shell-sand from the coast, and producing good clover and grain crops. Pop. (1881) 3371.—SOUTH U., 20 miles long, and 7 miles broad. Its east coast is much indented by the lochs Skiport, Eynort, and Boisdale. The eastern district is upland; the western is alluvial and productive, under proper treatment. Pop. (1881) 3825, engaged, like the inhabitants of North U., in fishing and agriculture.

UJEI'N, one of the seven sacred cities of Hindustan, in Sindia's dominions, of which it was formerly capital, stands on the right bank of the Sipra, 35 miles north-north-west of Indore. It is surrounded by walls with round towers, is six miles in circumference, contains the grand palace of the head of the Sindia family, several mosques and mausoleums, an observatory, and an antique gate. The number of the inhabitants is not ascertained.

U'JHELY-SATORA'LYA, a market-town of Hungary, 105 miles N.W. of Pesth. It is noted for its wine-culture. Pop. (1880) 11,264.

UJIJI, a small country or district on the eastern shore of Lake Tanganyika. The chief town in it, Kawélé, is the terminus of the great caravan route from Zanzibar, and is an important Arab station.

UKASE, or UKAS (Russian *ukasat*, to speak), a term applied in Russia to all the orders or edicts, legislative or administrative, emanating from the government. The ukases either proceed directly from the emperor, and are then called *imenny ukas*, or are published as decisions of the directing senate. Both have the force of laws till they are annuled by subsequent decisions. Many ukases are issued in the course of one reign; and as an immense chaos of ukases had accumulated since 1649 (the date of the last codification of laws), the Czar Nicholas ordered (1827) that a collation of them should be made. The result was a collection of laws in 48 volumes, which has been supplemented year by year by volumes of new ukases, and which, after the elimination of such ukases as are unimportant or of temporary authority, constitutes the present legal code (*svod*) of the Russian Empire. The *prikases* are imperial 'orders for the day,' or military orders given during a campaign.

UKRAI'NE (Slav. a frontier country or March), the name given in Poland first to the frontiers towards the Tartars and other nomads, and then to the fertile regions lying on both sides of the middle Dnieper, without any very definite limits. The U. was long a bone of contention between Poland and Russia. About 1686 the part on the east side of the Dnieper was ceded to Russia (Russian U.); and at the second partition of Poland, the western portion (Polish U.) also fell to Russia, and is mostly comprised in the government of Kiev. The historic U. forms the greater part of what is called Little Russia (a name which first appears about 1654), which is made up of the governments of Kiev, Tchernigov, Poltava, and Kharkov.

ULCERA'TION is 'that part or effect of an inflammatory process in which the materials of inflamed tissues liquefy or degenerate, are cast off in solution or very minute particles from free surfaces, or, more rarely, are absorbed from the substance of the body.'—Paget on 'Ulcers,' in Holmes's *System of Surgery*, vol. i. p. 197. Generally speaking, however, the name of ulcer is not applied to any inflammatory result, unless the substance of a tissue deeper than the epithelial is exposed; and when the cast-off particles are only epithelial, the result is termed desquamation, abrasion, or excoriation, although the process may be essentially the same. Ulceration is closely allied to gangrene, the two processes differing in degree rather than in kind. 'When the degenerate or dead substance,' says Sir J. Paget, 'is cast off in one or more portions visible to the naked eye, the process is usually called gangrene; when the portions are not so visible, or are quite dissolved, it is called ulceration.' The degenerate tissues are always suspended or dissolved in a liquid, termed the 'discharge,' or 'ichor,' which varies in appearance and properties according to the cause and characters of the ulcerative process. 'From some ulcers, e.g., the primary syphilitic, it is contagious; from many, it appears corrosive, exciting by its acridity inflammatory changes in the tissues with which it is in contact.'

U'LCERS (derived from the Latin *ulcus*, a wound) may be arranged either according to the constitutional or specific disease from which they are derived, or according to the characters which they present. According to the first system, we speak of ulcers as healthy, inflammatory, strumous, &c.; while, according to the second, they are named irritable, chronic, sloughing, &c. In this article, we shall adopt the former of these arrangements, as being, upon the whole, the most satisfactory, although each possesses its own advantages.

A *common, simple or healthy ulcer* is such as is left after the separation of an accidental slough in a healthy person, and is merely a healthy granulating surface, tending to cicatrization. Its edges shelve gently down to the base, and are scarcely harder than the adjacent healthy skin. Their surface near the border is of a purplish blue tint where the young epidermis modifies the color of the healing granulations; and within this, the granulations have a deeper hue than those at the center, being most vascular where the cuticle is being chiefly developed. The discharge from such an ulcer is healthy or 'laudable' pus. The only treatment required is a little dry lint, if there is much discharge; or the water-dressing, if the sore is comparatively dry. When the granulations are too luxuriant, they must be touched with nitrate of silver, and dressed with dry lint. *Inflammatory ulcers* differ less than most kinds from the above described common or healthy ulcers. They commonly arise from some trifling injury, such as a blow or slight abrasion of the skin, which, to a healthy person, would have done no harm. Their most common seat is on the lower half of the leg or shin. Their surface is red, and bleeds easily; the discharge is thin and watery; the edges irregular or shreddy; and the surrounding skin shows a red tinge, and is the seat of a hot and aching sensation. This ulcer most commonly occurs in the infirm and old, the ill-fed and overworked. Hence constitutional treatment, good diet, and complete rest (with elevation of the limb) are here demanded, in addition to water-dressing or lead-lotion applied warm. *Senile ulcers* usually present very little discharge, exhibit granulations of a rusty red tint, and are surrounded by a dusky red area. Nourishing food, wine, bark, and the mineral acids are here required, and opium in small repeated doses is often serviceable. The local treatment must be of a stimulating nature; and in bad cases, Sir. J. Paget recommends strapping the leg daily with a mixture of resin ointment and Peruvian balsam spread on strips of lint. *Strumous* or *scrofulous ulcers* usually occur as the consequence of scrofulous inflammation in the subcutaneous tissue or lymphatic glands. They most commonly occur in the neck, groins, cheeks, scalp, and the neighborhood of the larger joints. The discharge is thin, and of a greenish-yellow tint. These ulcers are seldom very sensitive or painful. The general treatment must be that recommended for constitutional Scrofula (q. v.). Iodine, in some form or other, is the best local application.

A poultice of bruised and warmed sea-weed is a very popular remedy; but there is probably nothing so efficacious as tincture of iodine diluted with water till it causes only a slight discomfort, and applied three or four times a day. (About 30 drops of the tincture may be added to an ounce of water, to begin with.) Of the numerous other species distinguished by Sir J. Paget, we shall briefly notice the *Varicose*, *Indolent*, and *Sloughing Ulcer*. *Varicose Ulcers* are connected with an enlarged or varicose state of the veins of the lower extremity, which weakens the parts, and renders them especially liable to ulceration. See VARICOSE VEINS. The *chronic, indolent, or callous ulcer*, beyond all doubt, gives more trouble to the poor-law medical officer and the workhouse surgeon than any other half-dozen surgical affections. It is usually seated in the lower half of the leg, and is most commonly of an oval form, with its long axis parallel to that of the leg. 'Its base lies deep, and is flat, pale, or tawny and dusky, with very minute or no visible granulations. The margin is usually abrupt, or unequally shelving, and in its most characteristic form, strictly overlaid with opaque, white, dense epidermis.'—Paget, *op. cit.*, p. 217. Many volumes have been written on the proper means of treating this form of ulcer. The distinguished surgeon from whose Memoir we have so largely quoted, especially recommends opium, regulated pressure, and blistering. A grain of opium night and morning is usually sufficient. The pressure is applied with straps of adhesive or lead plaster on linen. The object of blistering is not only to stimulate the ulcer, but to soften its callous edges by causing absorption of part of the exudation with which they are infiltrated, and desquamation of the cuticle which covers them. The expediency of healing old ulcers of this kind has often been called in question, inasmuch as apoplexy, palsy, mania, and other serious diseases are said to have followed the healing of such ulcers. In the following cases, it may be decided that a cure should not be attempted. (1) If the ulcer be affected by the gout, having regular attacks of pain, returning at stated periods, and similar to what the patient has experienced from gout in other parts. (2) If an ulcer habitually occur whenever the constitution is disordered. (3) If the patient be very infirm and old; for under these circumstances the removal of a habitual source of irritation, or the diversion of a habitual efflux of blood, may prove fatal; and especially as very old ulcers have been known to heal spontaneously a short time before death. To these cases, specified by Sir E. Home, Dr. Druitt adds (4) that of ulcers on the legs of stout women about the critical period of life, and displaying a tendency to discharge profusely as the menstrual discharge diminishes. To counteract these dangerous tendencies, the bowels should be freely purged during, and for some time after, the cure of an old ulcer; and if there are any symptoms of congestion in the head, a seton should be inserted in the back of the neck.

For the treatment of *Sloughing Ulcers*, we must refer to the article SYPHILIS.

U'LEABORG, a seaport town of Russian Finland, capital of the government of the same name, stands on the south bank of the Ulea, on the eastern shore and near the head of the Gulf of Bothnia. It was founded in 1605, and the privileges of a port were granted to it in 1715. In 1822, it suffered severely from fire. The harbor has of late years become so shallow, that vessels are obliged to unload in the roadstead, four miles from the town. Pop. (1880) 9705, who are engaged in the dockyards, sawmills, and breweries of the town. In 1854, an English flotilla burnt the government property in the place.

ULE'MA, the collective name of a certain class of theological jurists in Turkey, who, as is the case in Mohammedan countries, derive their decisions from the Koran and its commentaries. The Ulema enjoys many privileges; he pays no taxes, cannot be condemned to death or deprived of his property by any court of law. He can only—eventually—be deposed and banished. The ulemas have to recognize, save their two immediate superiors (the *kadiasks* or *kadilesks*), only the mufti as their chief authority, whilst they are the superiors of all the Mollahs (q. v.) in the different provinces. The kadis form the lowest judicial class, and are subject to the mollahs in every respect.

U'LEX. See FURZE.

ULFILAS (*Ulphilas*, *Wulfilas* = little wolf), the celebrated translator of the Bible into Gothic, was born about 318 A.D., of Marcomannian parents, north of the Danube, among a Gothic population. Consecrated bishop in 348, he was expelled by his heathen compatriots from his native place, and sought refuge, together with a number of newly-converted Christians, in Lower Mœsia, at the foot of the Hæmus, where he remained for thirty years. In 388, he went to Constantinople (whither he had gone once before to assist at a council, in 360), and died there shortly afterwards. He was one of the chief lights of Arianism (see ARIUS), in the interest of which he exerted himself with the utmost energy. Nor was his political influence less felt among his Gothic countrymen; and the contemporaneous Greek historians, no less than those that followed within a short time after his death, are unanimous in attributing to him the largest share in the religious and social development of the Gothic population. His greatest work, however—one which will render his name famous for all ages—is his Gothic translation of the Bible, a work by which he contrived both to fix the Gothic language and to perpetuate Christianity among the Gothic people. Familiar with Latin, Greek, and Gothic, and accustomed to write in each of them, he undertook to render the whole Bible, with the exception of the two warlike books of Samuel and Kings—the influence of which he feared for his easily inflammable people—into a language which till then had, as far as we know, never been used for any literary composition of importance. Up to the 9th c., this sacred and national work accompanied the Goths in all their migrations. But from that period forth, nothing was known of it beyond what was found stated in the ancient ecclesiastical accounts. It was not till the end of the 16th c. that Arnold Mercator discovered in the Abbey of Werden the four Gospels of Ulfilas. Thence it found its way to Prague, where it remained till 1648, when the Swedes took it as a spoil to Upsal, where it still remains in the University Library, under the name of the *Codex Argenteus*. In 1818, further remnants of the work—a great portion of the Letters of St. Paul—were discovered by A. Mai and Castiglioni, on palimpsests, in a Lombardian monastery, which, added to a few minor fragments, bring the New Testament somewhat near completion. But hardly anything—save a few passages from Ezra and Nehemiah—has survived of the Old Testament. The immense importance of this sole Gothic remnant for Teutonic philology cannot well be overrated. It is principally through it that the wonderfully fine structure of Gothic—a Germanic dialect of surpassing wealth and purity—has become known.

U'LLSWATER, after Windermere, the largest of the English 'Lakes,' lies between the counties of Cumberland and Westmoreland, 10 miles east of Keswick. Length, 9 miles; breadth, 1 mile. Its scenery has none of the soft beauty of that of Windermere, but is rugged and grand. One of the chief features of the landscape is the lofty mountain Helvellyn, which rises from the southwest extremity of the lake.

ULM, the second city of Würtemberg, in 49° 54′ N. lat., and 8° 8′ E. long., was, till the war in 1866, a stronghold of the Germanic Confederation, garrisoned by troops of Würtemberg, Austria, and Bavaria. It was long one of the most important imperial free cities. U. is situated at the junction of the Blau with the Danube, which then becomes navigable, 53 miles west of Augsburg by railway. Two bridges unite the city with New Ulm, a village on the Bavarian side of the river. The streets are narrow, and the buildings old. Pop. (1871) 26,290; (1880) 32,669. The environs of U. are flat. The cathedral, which is a Protestant church, is remarkable for architectural beauty, and is, next to the cathedral of Cologne, the largest church in Germany. It is 475 feet in length, 165 in breadth, and 140 in height, the unfinished tower over the main entrance being 320 feet. The building was begun in 1377, and finished in 1494. There are good schools for the people, a gymnasium, high school, and trades' school, a public library, an agricultural society, and many charitable institutions. Leading industries are weaving linen, cotton, woollen, and mixed fabrics; bleaching; making paper, leather; beer-brewing; ship-building; book-printing, &c. U. is famed for ornamental pipe-bowls, and pastry called Ulmer bread. Around the city, gardening is extensively carried on, and asparagus especially cultivated.

The Romans had a settlement at this important point. In 1531, the city accepted the Reformation, and the majority of the people have since been Lutherans. In 1802, U. was attached to Bavaria, and became part of Würtemberg in 1810.

ULMA'CEÆ, a natural order of exogenous plants, regarded by some botanists as a sub-order of *Urticaceæ*. They are trees or shrubs, having rough alternate leaves, each leaf with a pair of deciduous stipules. The flowers are small and in loose clusters. The perianth is small, membranous, bell-shaped, irregular; the stamens equal in number to the lobes of the perianth, and inserted into their base; the ovary superior. The fruit is 1—2-celled, nutlike, or compressed and winged. There are about 60 known species, natives of temperate parts of the northern hemisphere. See ELM, NETTLE-TREE, and ZELKOUA.

U'LMIN. See HUMUS.

U'LNA. See ARM.

ULODE'NDRON, a singular genus of coal-plants, founded on stems which occur chiefly in the roof-shales. The stems are covered with small rhomboidal scars, as in Lepidodendron, formed by the bases of leaves or scales; but they differ remarkably from that genus in having a double series of large oval or circular markings, arranged linearly on the opposite sides of the trunk. These markings are variously interpreted as representing the cicatrices produced by the bases of cones, by branches, or by leaf-stalks. It is, like many of the coal fossils, an extremely enigmatical plant; and it is difficult to determine its position in the vegetable kingdom. It is probably an ally of Lepidodendron, and that is known to be a vascular cryptogam nearly related to Lycopodium. Seven species are known.

ULPIA'NUS, DOMITIUS, a celebrated Roman jurist, of Tyrian extraction, flourished in the early part of the 3d century. The exact date of his birth, however, is unknown. He appears to have held juridical offices during the reigns of Septimius Severus and Caracalla, of which he was deprived by Elagabalus; but, on the accession of Alexander Severus (222 A.D.), he became the principal adviser of that emperor, who appointed him *scriniorum magister* (keeper of the public records), a *consiliarius* (public assessor), and *præfectus annonæ* (superintendent of the corn market). He also held, during the reign of Alexander Severus, the important post of prefect of the Prætorian Guards, though it is uncertain whether that monarch first conferred it upon him. He was murdered by his own soldiery, 228 A.D. U. was both a voluminous and a valuable writer.

In the *Digest* of Justinian, there are no fewer than 2462 excerpts from him, many of which are of considerable length. Altogether, they form about a third of the whole body of the *Digest*. Unfortunately, the originals have almost entirely perished. The principal were—*Ad Edictum* (83 books), *Ad Sabinum* (51 books), *Ad Leges Juliam et Papiam* (20 books). The so-called *Fragmenta* of U. (first published at Paris by Tilius in 1549) consist of 29 titles, whence they are called in the Vatican MS. *Tituli ex Corpore Ulpiani*. The best edition is Böcking's (Bonn, 1836).

ULRIC, ST., Bishop of Augsburg, and venerated as one of the Fathers of the German Church, was born at Augsburg about the year 890. His father, Hupald, was one of those counts of Dillingen who play so important a part in medieval German history, and U. himself owed part at least of the extraordinary influence which he exercised in his time, to the distinguished rank of his family. He was educated in the celebrated Benedictine monastery of St. Gall (q. v.) in Switzerland; but his later life, and the character of his mind, as well as the tendency of his religious views, appear to have been influenced less by his monastic instructors, than by the counsels of a remarkable female recluse named Wiborada, whose cell was in the vicinity of St. Gall, and with whom he formed a close association. It was by her counsel that, instead of adopting the Benedictine habit at St. Gall, he devoted himself to the secular ministry, and returned to his native diocese of Augsburg, where he received holy orders. In accordance with the usage of his time, he made a pilgrimage to Rome, and soon after his return, was consecrated Bishop of Augsburg, on the death of Hiltine in the year 923. The details of his history as administra-

tor of this church, which had suffered serious disorganization through the Magyar invasion and other wars, would be out of place here; but they are related with much circumstantiality by his contemporary biographer; and they throw so much light as well on the externals of the religious life of the time, as on the moral and spiritual character of the people, laity as well as clergy, as to merit the most serious consideration of every student of medieval history.

Bishop U. bore an important part in the public affairs of the empire during the reign of Henry I. and his son Otho; and he was the guiding spirit of the several councils in Germany which, in the 10th c., labored at the work of reformation. He died in 973.—See the ancient *Vita S. Oudalrici Episcopi*, which is edited by Mabillon, by the Bollandists, and recently by Dr. Pertz. Some letters and sermons, still extant, have been ascribed to U., but they are regarded as spurious by Mabillon and Pertz, as well as by the Bollandists.—See Braun's *Geschichte der Bischöfe von Augsburg*.

ULRICI, HERMANN, a German philosopher, born at Pförten in Lower Lusatia, 23d March 1806, studied at Halle and Berlin, and after a brief career as a lawyer, devoted himself exclusively to literature and philosophy. In 1834 he was appointed a professor-extraordinary at Halle, where he still occupies a chair. His first work was his *Geschichte der Hellenischen Dichtkunst* (1835), which was followed by a very ingenious essay on the dramatic art of Shakspeare (*Ueber Shakspeare's dramatische Kunst*, 1839; Eng. transl., 1846). Other works of U.'s are his *Ueber Princip und Methode der Hegel'schen Philosophie* (1841); *Das Grundprincip der Philosophie* (1845–6); a *System der Logik* (1852); *Gott und die Natur* (1862; 2d ed. 1866), *Gott und der Mensch* (1866), in which U. develops a system of theistic philosophy, in opposition to materialism and anti-ethical pantheistic speculation. Further Shakspearian studies we have in *Romeo und Julia*, and a *Geschichte Shakspeare's und seiner Dichtung* (1867).

U'LSTER (Lat. *Ultonia*), a province of Ireland, the most northern of the four provinces which compose that kingdom (see IRELAND), is divided into nine counties—Antrim, Armagh, Cavan, Donegal, Down, Fermanagh, Londonderry, Monaghan, and Tyrone, each of which is described under its proper head.

The territorial distribution under which U. formed a province, or at least a distinct territory, is of very ancient origin. It formed one of the five ancient divisions of Ireland, and was the seat of the Hy-Nialls or O'Neills, as well as of the lesser septs of O'Donnell, O'Cahan, O'Doherty, Maguire, MacMahon, &c. The north-eastern portion, now the county of Down, was early overrun by John de Courcy, and subsequently by Hugh de Lacy, and was the most permanent seat of English power in the north. The Antrim coast was occupied by a Celtic colony from Scotland and the Isles; but although various efforts were made by the English to effect a permanent settlement in the north and north-west, the success was but nominal until the reigns of Elizabeth and of James I., when the Plantation of U. was effected. Of this gigantic scheme of colonization, the chief seat was the county of Londonderry (q. v.). In U., the Celtic race, owing to the frequent and large infusions of a foreign element, is found in a much smaller proportion. In 1861, the whole population was 1,910,108, the Roman Catholics numbering 963,687. These proportions, owing to emigration, were reversed in the returns of 1871—total, 1,833,228, of whom the Catholics were only 897,230. Of the total population in 1881, 1,739,542, the Protestants of all denominations made up 907,014; the Roman Catholics, only 831,784. Of the former, the greater number, viz., 466,107, were Presbyterians, 377,936 belonged to the Episcopalian Church, and the rest were Protestants of other denominations.

ULSTER BADGE. On the institution of the order of Baronets in England by James I., a sinister hand, erect, open, and couped at the wrist gules, the armorial ensign of the province of Ulster, was made their distinguishing badge, in respect of the order having been intended for the encouragement of plantations in the province of Ulster. This badge is sometimes borne in a canton, sometimes on an escutcheon, the latter placed either in the fess point or in the middle chief point, so as to interfere as little as possible with the charges of the shield.

ULSTER KING-OF-ARMS, the king-of-arms, or chief heraldic officer of Ireland. A king-of-arms called Ireland existed in the time of Richard II., but the office seems to have fallen into abeyance in the following century. Ulster was created to supply his place by letters-patent of Edward VI. in 1552. Ulster holds his appointment from the crown, and acts under the immediate direction of the Lord-lieutenant of Ireland. His office is in the Record Tower of Dublin Castle; and the professional staff under him consists of two heralds, four pursuivants, one registrar, and one clerk of records. The records of Ulster's office comprise pedigrees of the nobility and gentry of Ireland, certificates of their deaths and funerals, and grants of arms. The official arms of Ulster King-of-arms are: Argent, St. George's cross gules, on a chief of the last a lion passant gardant between a harp and a portcullis or.

ULTIMA'TUM, in Diplomacy, the final conditions or terms offered by one government for the settlement of its disputes with another: the most favorable terms which a negotiator is prepared to offer, whose rejection will generally be considered to put an end to negotiation.

U'LTIMUS HE'RES, in the Law of Scotland, means the crown, which is the last heir after all the kin have become exhausted, and succeeds to the property of those who die without leaving next of kin, or who, being bastards, have no next of kin.

ULTRAMARI'NE, a beautiful blue pigment, formerly obtained only from the very valuable mineral, lapis-lazuli; but an artificial kind is now made so cheaply, and is so good, that it is generally used instead. The true ultramarine, from its costly nature, was only used by artists; the artificial sort is, however, extensively used by house and ship painters, and is as cheap as it is beautiful. Many artists still insist upon having the former kind, which is prepared as follows: Fine lapis-lazuli is broken up into very small pieces, so as to enable the operator to see and pick out the small white portions which occur in it. Of the pieces of pure blue which remain, a pound-weight is then taken, and in a carefully covered crucible, is heated to redness, and then thrown into cold water. It is next reduced to an impalpable powder, and mixed with six ounces of finely powdered resin, as light in color as it can be obtained, and two ounces each of spirits of turpentine, bees-wax, and linseed oil, all previously melted together.

When these ingredients are thoroughly worked into a mass, portions of it are taken and kneaded in clean water; as long as any blue color is given out, this is continued, until every portion has been so treated. The blue water is then allowed to rest, and the sediment is collected and washed in water several times. The first washing removes a considerable quantity of dirt and other foreign matters, and is consequently rejected. The second, after being well agitated, is decanted; and from it is obtained the highest quality of the pigment. That which remains, usually has two other washings, each of which gives a product of a less value than the operation which preceded it. The product obtained by sediment from each of the waters used, is carefully dried, and is then employed either to make cakes for water-color painting, or a mixture for oil-painting, the value being about £1 per ounce. ARTIFICIAL ULTRAMARINE.—The French chemists Clement and Desormes, in studying the curious process of obtaining ultramarine from lapis-lazuli by mixing it with resin, &c., were led to an analysis of the coloring matter that suggested to Guimet the idea of composing it artificially. In this he succeeded, and obtained for his discovery the prize of 6000 francs offered by the *Société d'Encouragement des Arts*. Almost simultaneously, Gmelin in Tübingen gave an analysis and a synthetic process which also succeeded, and artificial ultramarine is now a regular article of manufacture. Chemical skill, however, is necessary to success, and the manufacturers' formulas are very various—differing in the quantities of the ingredients, and the order of mixing them.

The German manufacturers are very successful, and some of them have recently produced a fine green ultramarine. The following formula is one of the simplest: 100 parts of finely washed kaolin or porcelain clay (silicate of alumina), 100 of carbonate of soda, 60 of sulphur, and 12 of charcoal, are mixed and exposed in a covered crucible to a bright heat for 3½ hours, when a green, unfused residue should be left. This residue, after being well washed and dried, must be mixed with a fifth of its weight of sulphur, and exposed in a thin layer to a gentle heat, so as just to burn off the sulphur. When this is accomplished, more sulphur must be added, and the washing repeated; and so on, until the mass acquires a light blue color, which is usually the case after the third roasting. In 1872, however, Fürstenau introduced improvements into the manufacture of ultramarine, showing how the blue tint could be produced in one calcination. There is reason to believe, from the experiments of Wilkens, that ultramarine is composed of two portions—one of which is constant in its composition, and is the essential coloring matter, containing about 40 of silicic acid, 26 of alumina, 13 of sulphur, and 21 of soda, arranged as a mixture of two silicates of alumina, sulphite of soda, and sulphide of sodium—the blue coloring principle being a compound of the latter two; while the other portion differs from the former in resisting the action of hydrochloric acid, and contains a variable amount of sand, clay, oxide of iron, and sulphuric acid. Ultramarine, if heated in the air, gradually assumes a dull green tint; and it is quickly decomposed by the action of the mineral acids and chlorine.

The term *Yellow Ultramarine* is sometimes given commercially to chromate of baryta, a yellow insoluble powder used as a pigment.

ULTRAMO'NTANE (Lat. beyond the mountains—the Alps—namely, in relation to France), that party in the Church of Rome

which assigns the greatest weight to the papal prerogative. The pope, according to the U. doctrine, is superior to general councils, and independent of their decrees; he is considered to be the source of all jurisdiction in the church; and it is through him, and not directly in virtue of their episcopal office, that the bishops derive their powers of 'jurisdiction' as distinguished from those of 'order.' See ORDERS. The U. school has been the opponent of those doctrines and views which favor the right of self-government by national churches. The school opposed to the U. is called the Gallican. See GALLICAN CHURCH.

ULUGH-BEG, the grandson of Timûr (q. v.), governed Western Turkestan as regent for his father Shah Rokh, while the latter was employed in regulating the affairs of the southern half of the empire, and succeeded, in 1447, to the imperial throne on his father's death. He was a successful warrior, as was of necessity every ruler of this period; but happening, unfortunately, to conceive suspicions of the loyalty of his eldest son, suspicions founded only upon astrological indications, the offended and injured prince rebelled, defeated and captured his father, and soon after caused him to be put to death, thus fulfilling the prediction, 1449 A.D.

U. is known to posterity as the founder of the observatory at Samarkand, as the liberal patron of astronomers, and as himself a most diligent observer. The astronomical tables which bear his name, in all probability compiled by himself and his two fellow-laborers, Salah-ed-din Cadizadeh al Roumi and Gaiathed-din Mohammed Jerusheid al Coushgi, enjoy a high reputation for accuracy, considering the time when they were compiled, and the means of observation in the hands of astronomers. The astronomical works of U. were written in Arabic, afterwards translated into Persian, and thence the chronological portion of them rendered into Latin (Lond. 1650), by Greaves, who followed with a Latin version of the geographical part in 1652. An independent version of the same work in Latin and Persian was published by Dr. Thomas Hyde, at Oxford, in 1665. A new edition of U.'s catalogue of stars will be found in the *Memoirs of the Royal Astronomical Society*, vol. xiii.

ULULA'TION (Lat. howling). It sometimes happens that articulate sounds or cries resembling, perhaps imitative of those of animals, or mere shrieking and howling, form the sole or chief symptom and characteristic of a morbid mental state. The act is automatic, and may be regarded as indicative of grave changes in the physical and moral nature. In the middle ages, during great religious excitement, and those mental epidemics which involve large communities, such phenomena appear to have been of frequent occurrence. It appears that in the 18th c., a family of five sisters, in the county of Oxford, were affected with a modification of hysteria, during which they howled or barked like a dog, and that, about the same period, a large religious community of females in France, one and all, and at the same hours, shrieked or mewed like cats; and were only reduced to sobriety and to silence by the presence of military.—Laycock on *Nervous Diseases of Females*, p. 286; Calmeil, *De la Folie considérée sous le point de Vue Pathologique, Philosophique, Historique, et Judiciare*, t. ii. p. 310.

U'LVA. See LAVER.

U'LVERSTON, a small but important market-town and seaport of Lancashire, in the district of Furness, 22 miles by railway north-west of Lancaster. It stands in an extensive agricultural and mining district, and is the center of commerce for Furness, and for parts of Cumberland and Westmoreland. It contains cotton and paper mills, and carries on manufactures of linen, ropes, and woollen yarn, and has a coasting-trade in iron and copper ores, limestones, grain, and gunpowder. Pop. (1871) 7607; (1881) 10,001.

ULY'SSES, ULYXES, AND ULIXES, the Latin forms of the Greek ODYSSEUS, i. e., the 'Angry,' the name of one of the most celebrated heroes of the Trojan war. Different accounts are given of his parentage; but according to the oldest legend, the Homeric, he was the son of Laertes, Prince of Ithaca (one of the Ionian Isles), and of Anticleia, daughter of Autolycus. According to a later account, his father was the crafty Sisyphus; whence he is sometimes called, by way of reproach, Sisyphides. He married Penelope (q. v.), by whom he became the father of Telemachus. While still a youth, he had acquired a reputation for courage, eloquence, and address. When the expedition against Troy was resolved on, Agamemnon visited Ithaca, and prevailed on U., though with difficulty, to take part in it. Later traditions, or, as in this case, perhaps we ought to call them *inventions*, go on to exaggerate the reluctance of U. to leave his home, and represent him as feigning madness—an artifice which did not, however, succeed. Before hostilities broke out, U., in conjunction with Menelaus and Palamedes, was sent to Troy, with the view of persuading the Trojans to give up Helen and her treasures; but this little bit of diplomacy having failed, the Greek princes assembled their fleets in the port of Aulis, and sailed for Troy, U. bringing with him twelve ships. During the siege, U. performed important services for the Greeks. In prudence, ingenuity of resource, and *finesse*, he was the foremost of the Hellenic chiefs, while in courage he was inferior to none. After the fall of Troy, the most interesting part of U.'s career begins, and forms the subject of the Homeric poem called the *Odyssey*. Several of his adventures are manifestly of eastern origin, and closely resemble those of *Sinbad the Sailor*. Setting sail for home, his ships were driven by a storm on the coast of Thrace, where he plundered the town of Ismarus, but lost a number of his crew.

Having re-embarked, a north wind blew them across the Ægean and the Levant, to the country of the Lotophagi (the 'Lotus-eaters'), on the coasts of Libya, where the companions of U. ate of the wondrous fruit, and wished to rest for ever. (Our readers will remember Tennyson's delicious rendering of this episode.) But their leader compelled them to leave the land 'in which it alway seemeth afternoon;' and sailing north again, they touched at the 'island of goats,' where U. left all his ships but one. Thence he proceeded westward, till he reached the 'Island of the Cyclopes' (Sicily), where occurred the incident narrated under POLYPHEMUS (q. v.). The island of Æolus, and the city of the Læstrygones (a race of cannibals), whither fortune and the winds next carried the Hellenic chief, are supposed to be only names for particular parts of Sicily. Thence he sailed westward to the island of Ææa, inhabited by the sorceress Circe (q. v.). After a year's sojourn, he departed, and sailing still further west, crossed Oceanus, the 'ocean-stream,' into the country of the Cimmerians (q. v.), where darkness reigns perpetually. Here (following the advice of Circe) he descended into Hades (q. v.), and inquired at the blind seer Teiresias how he might get back to his native land. Teiresias disclosed to U. the fact of the implacable enmity of Poseidon (Neptune), on account of his having rendered Polyphemus (who was a son of Poseidon by the nymph Thoosa) blind, but encouraged him at the same time with the assurance that he would yet reach Ithaca in safety, if he would not meddle with the herds of Helios (the sun-god) in Thrinacia.

U. now retraced his course, and once more visited Circe, the kindly sorceress, who forewarned him of the dangers he would yet have to encounter, and how to act. A west wind blew them past the perilous island of the Sirens (q. v.) to the coasts of Italy. In passing between Scylla and Charybdis, the monster that inhabited the first of these rocks devoured six of U.'s companions. He next came to Thrinacia, which he would fain have passed by, but his crew insisted on landing, and in spite of their oath, killed some of the cattle of Helios while U. was asleep. The anger of Zeus was kindled. When they had sailed away, a fierce storm arose, and Zeus sent forth a flash of lightning that destroyed the ship. Every one on board was drowned except U. himself, who, after many dangers, reached the island of Ogygia, the abode of the nymph Calypso, with whom he lived for eight years. After his departure (which was commanded by Zeus, who had promised to Athene that U. should one day see Ithaca again—the poet always represents him as having a longing after his native isle), Poseidon persecuted him with a storm, and cast him on the shores of Scheria, the island of the Phæacians, in a very forlorn and indescribable condition. He was, however, very kindly received by Nausicaa, daughter of King Alcinous; and having revealed his name at a feast, the monarch provided him with a ship to carry him home. U. was asleep when the vessel approached the coast of Ithaca; and the Phæacian sailors who had accompanied him bore the unconscious hero to the shore, and left him there. When he awoke, he did not at first recognize where he was; but Athene appearing, informed him, and of all that had happened to Penelope (q. v.) in his absence. Disguised as a beggar, he repaired to his own court, where he was recognized by his nurse, and, as Homer touchingly describes, by his old dog, Argus.

Aided by Telemachus, and the swine-herd Eumæus, he took vengeance upon the insolent suitors of his wife, all of whom, without exception, he slew. Homer records nothing more of U.'s history; but he makes Teiresias prophesy, in the 11th book, that the hero would meet a painless death in a happy old age. Another tradition says that he was slain by Telegonus, his son by Circe. Later poets, e. g., Virgil and Ovid, represent U. as a much less noble and valiant character than he appears in Homer; his wisdom and subtlety are changed into cunning and deceit; and instead of heroic courage, he displays the spirit of a coward.

UM is a Kaffir or Zulu word signifying river, and is used as prefix in the names of most of the rivers on the south-east coast of Africa, from the Great Kei, where the names of Hottentot origin appear to cease, as far to the north-east nearly as the Sofala coast, where the names Imhambane, Imhampoora, have the same prefix in a corrupted shape. Amongst the principal rivers on this coast bearing this prefix may be mentioned the Umgazi, Umbashee, Umtata, Umzimvoobo, and Umzimculu, draining Independent Kaffraria; the Umcomanzi and Umtugela, in the colony of Natal;

and the Umfolusi, Umhlatoozi, and Umapoota, between Natal and Delagoa Bay. The Hottentot word Kei has the same meaning, and is still preserved in the Kei and Keiskamma rivers, the Keriega, Keisuga, and other streams on the east-coast of the Cape Colony.

UMA is, in the epic and Purânic mythology of India (see *Religion*, under INDIA), one of the principal names of the consort of the god S'iva. Other names by which she is also usually designated are *Durgâ*, *Devî*, *Kâlî*, *Pârvatî*, *Bhavânî*, while there are many more belonging to her which are of less frequent occurrence, as *Kâtyâyanî*, *Ambikâ*, *Haimavatî*, *S'ivâ*, &c. As S'iva is not yet a deity of the Vedic period of India, such of these names as are met with in Vedic writings have there a different import from that assigned to them by the later mythology. Thus *Ambikâ* is, in the Yajurveda, a sister of *Rudra* (q. v.); *Kâlî*, a word which occurs in the Mun'd'aka Upanishad (q. v.), is there the name of one of the seven flickering tongues of Agni, the god of fire; *Durgâ*, in a hymn of the Taittirîya Aran'yaka, is an epithet of the sacrificial flame; and *Umâ*, when mentioned in one recension of the same Aran'yaka (see VEDA and UPANISHAD), and in the Kena Upanishad, means the Brahma-science, or the knowledge of what is the nature of Brahman, the Supreme Soul; and in this sense she is identified in the Taittirîya Aran'yaka with Ambikâ. But since Rudra is in later mythology a name of *S'iva*, and the Vedic Rudra is a form of Agni, the fire, more especially of the fire of the sun; and since Umâ, in the Kena Upanishad probably designates the power of Sûrya, the sun, it becomes intelligible that S'iva (q. v.), who, at a later period of Hindu religion, is both the type of destruction and contemplation, had then associated with him deities which originally represented the energy of the fire and the power or wisdom of the sun, and that those deities were afterwards held to be merely different forms or names of one and the same deity, viz., his female energy (see S'AKTAS), or wife.

Though this double character of the consort of S'iva is not always discernible in the myths which are connected with special designations of hers, and though at a late period the popular creed looked upon her far more as the type of destruction than as that of divine wisdom, yet the works devoted to her praise never fail to extol her also as the personification of the highest knowledge. Thus, in the *Devîmâhâtmya*, the Rishi Mârkan'd'eya, in reply to a question of King Suratha, says: 'By Devî, this whole universe, with what is movable and immovable, has been created, and, when propitious, she who bestows blessings leads men to their eternal bliss; for she, the eternal goddess, is the highest wisdom, the cause of eternal bliss, and also the cause of bondage for this world; she, who lords over the Lord of the universe.' And in another passage of the same work, she is invoked thus: 'O Devî, thou art the seed of the universe, the highest Mâyâ (q. v.); all this world is bewildered, but, descending on earth, thou art the cause of its final liberation; all the sciences are merely different modes of thyself.' Similarly, also, in the *Mahâbhârata* (q. v.), Arjuna says to her: 'Of sciences thou art the Brahma-science,' &c.; and in the *Harivans'a*, Vishn'u addresses her as Saraswatî, the goddess of eloquence, as Smriti, tradition, and, of sciences, as the Brahma-science, &c.

The myths relating to this goddess, who is worshiped in various parts of India—particularly, however, in Bengal (see S'AKTAS)—are met with in the great epic poems and Purân'as, in poetical works, such as the *Kumârasambhava* (see KALIDASA), and in modern popular compositions; but the text-book of her worshipers is the *Devîmâhâtmya*, or 'the majesty of Devî'—a celebrated portion of the *Mârkan'd'eya Purân'a*, and considered to be of especial holiness by the worshipers of this goddess. In the *Râmâyan'a* (q. v.), she is spoken of as the daughter of Mount Himâlaya (her names *Pârvatî*, *Haimavatî*, *Adrijâ*, *Girijâ*, and similar ones, mean 'the mountainous or the mountain-born'), and of the nymph Menâ, whose elder daughter, however, was the Ganges.

According to the Vishn'u and other Purân'as, she was in a former life *Satî*, the daughter of Daksha, who abandoned her corporeal existence in consequence of having been slighted by her father when he performed a great sacrifice, and did not invite S'iva to share in it; but it was only as Umâ that she bore children to her husband, viz., *Ganes'a*, the god of wisdom, and *Kârttikeya* (q. v.), the god of war. According to the *Harivans'a*, she was, in another life, born as the daughter of Yas'odâ, and exchanged for *Vishn'u*, when in his incarnation as *Kr'ishn'a*, he was born as a son of Devakî. See VISHN'U. On that occasion she was killed by *Kansa* (q. v.); but as soon as he had dashed her to the ground, she rose to the sky, leaving behind her corporeal frame, and became a divine virgin, to whom the gods addressed their praises. Hence her names *Kanyâ*, *Kumârî*, &c., the virgin. This connection between the legendary history of Umâ and Vishn'u is also briefly referred to in the *Devîmâhâtmya*, though this work is chiefly concerned in the narrative of the martial feats of the goddess. The latter consisted in the destruction by her of two demons, *Madhu* and *Kait'abha*, who had endangered the existence of the god Brahman; and of the demon *Mahisha* or *Mahishâsura*, who, having conquered all the gods, had expelled them from heaven, and who met Devî, assisted only by her lion, with a numberless host of demons; moreover, in her defeating the army of *Chan'd'a* and *Mun'd'a*, two demon-servants of S'umbha and Nis'umbha; in her killing the demon *Raktavîja*, who had a sort of charmed life, each drop of his blood, when shed, producing hundreds of demons like himself; and ultimately, in her destroying the demons *S'umbha* and *Nis'umbha* themselves. In commemoration of her victory over Mahishâsura, a festival called the *Durgâpûjâ*, or *Durgotsava*, is annually celebrated in Bengal. 'The goddess,' the Rev. Mr. Banerjea relates in his introduction to the *Mârkan'd'eya Purân'a*, 'is there represented with ten arms, trampling upon the demon, who is also attacked by her lion, and wounded in the chest by her spear. She has also laid hold of him by the hair, and is about to chop off his head.

'The most popular commemoration of this event takes place in the autumn, about the time of the equinox; and if the practice may be supposed to be 800 or 1000 years old, it is not inconceivable that it was originally fixed at the equinox, though the precession has since made it a few days later. The calculation of the day depends, however, on a certain lunar day; but it can never be earlier than the seventh of As'win, which is about the time of our present equinox; nor can it be more than a month later than that date. The idea of the possible connection of the *Durgâpûjâ* with the equinox, is suggested by the fact, that there is a corresponding festival about the time of the vernal equinox too, in which, though it is not so popular as the autumnal *pûjâ*, the same group of figures is constructed, and the image of the goddess is in the same attitude, with the same attendance, and the same enemy.' (For a somewhat more detailed account of this festival, see Moor's *Hindu Pantheon*, p. 156.) Three weeks after the *Durgâpûjâ*, another festival in honor of this goddess, called the *Kâlîpûjâ*, takes place, to commemorate her victory over *Chan'd'a* and *Mun'd'a*. 'The sable goddess,' Mr. Banerjea says, 'is represented holding the severed head of Chan'd'a in her hand, with the heads of his soldiers formed into a garland suspended from her neck, and their hands wreathed into a covering round her loins—the only covering she has in the image constructed for the *pûjâ*. The worship

Kali (after the figure in Coleman's *Mythology of the Hindus*).

of *Kâlî* (i. e., the Black), to which the narrative (of her victory over Chan'd'a and Mun'd'a) has given rise, is considered by the Hindus themselves as embodying the principle of *tamas*, or darkness. She is represented as delighting in the slaughter of her foes, though capable of kindlier feelings to her friends. She is, however, styled the Black Goddess of Terror, frequenting cemeteries, and presiding over terrible sprites, fond of bloody sacrifices; and her worship taking place in the darkest night of the month.' (For this worship, see also the article THUG.) With S'iva, she resides on Mount *Kailâsa*, the northern peak of the Himâlaya, or in her own palace on the Vindhya mountain, where she amuses herself with hunting. Her representations are numerous and various. Sometimes she is seen riding on a bull, with a trident in her hand, a serpent as bracelet, and a half-moon on her forehead; sometimes, when in the act of fighting Mahishâsura, she rides on her lion (*Manastâla*), the latter standing between the frontal bones of her elephant. Or, as *Bhadra-Kâlî*, she is represented 'eight-handed, two of her hands being empty, pointing upward and downward, one of her right hands holding something like a caduceus, its corresponding left hand, a cup; the next right and left hands, a crooked sword, and a shield with an embossed flower or fruit; the superior right hand, an agricultural implement; and the left, the noose to strangle victims with [see THUG]. Her person is richly dressed and ornamented; between her full breasts, a five-headed serpent uprears itself; she has a necklace of human heads; her ear-drops are elephants; and a row of snake-heads peeps over her coronet. Her forehead is marked either with S'iva's third eye, or her own symbol; and her open mouth shows her teeth and tusks, giving her a fierce and threatening aspect.' See Moor's *Hindu Pantheon*, where, besides, other descriptions of images of this goddess are given.—For the myths relating to her, see John Muir's excellent work, the *Original Sanskrit Texts*, vol. iv. (Lond. 1863; the *Harivans'a*, translated by A. Langlois (Paris, 1834—1835); and the *Mârkan'd'eya Purân'a*, in the *Bibliotheca Indica*, edited, with an elaborate Preface, by the Rev. K. M. Banerjea (Calcutta, 1862).

UMA'N, a town of Russia, in the government of Kiev, 120 miles south of the town of Kiev, on the Umanka. It is enclosed by earthen ramparts. Pop. (1880) 15,393.

UMBA'LLA, or AMBA'LA, a walled town of India, in a division of the same name in the Punjab, 120 m. N.N.W. of Delhi. Under the walls of the fort are the British cantonments. Pop. (1868) of city, 24,040; of cantonments, 16,622; of division, 1,652,728.

U'MBEL. See UMBELLIFERÆ.

UMBELLI'FERÆ (*Apiaceæ* of Lindley), a large and important natural order of exogenous plants, containing more than 1000 species, abounding chiefly in the temperate regions of the northern hemisphere. A peculiar regularity distinguishes the inflorescence of most of this order; a number of stalks, radiating from a common center at the top of the stem, or of a branch, each of which bears a flower at its extremity, thus forming what is called an *umbel*. The umbel is often compound, the primary stalks dividing in a radiated manner, and forming *secondary umbels* or *umbellules*. The flowers are generally small, although the umbel which they compose is often large. They are generally white, rarely yellow, still more rarely red, though frequently tinged with pink at the edges; have a 5-toothed calyx, often obsolete, or nearly so; a corolla of five petals, inserted in the top of the calyx, and alternating with its teeth, five stamens, an inferior germen, and two styles. The fruit is very peculiar, and consists of two one-seeded, unopening carpels, rarely fleshy, touching one another on the inner side, and there attached to a little column (the *carpophore*), their common axis. Each carpel has five primary and four secondary longitudinal ridges, more or less distinct; and beneath the separating furrows there are often linear receptacles of essential oil, called *vittæ*. The U. are mostly herbaceous plants, rarely shrubby. They generally have divided or compound, rarely simple leaves. They generally abound in a resinous secretion, and a volatile oil, from which many of them derive poisonous and medicinal properties, which are more or less common to all parts of the plant, and often highly developed in the seeds.

Acridity is their general characteristic. Some are pleasantly aromatic, others have a powerful and disagreeable smell. In the roots of some, especially when enlarged by cultivation, starch and sugar are secreted, so that they become useful for food, although the peculiar flavor of the essential oil is still retained. The systematic arrangement of the U. has been found difficult by botanists. Sprengel, De Candolle, Koch, and others, have devoted much attention to this order. Of esculent-rooted U., the carrot and parsnip are the best known examples. Skirret, earth-nut, and arracacha are also of some value. The roots of *Anesorhiza Capensis* and *Fœniculum Capense* are used as esculents at the Cape of Good Hope. The roots of *Chærophyllum tuberosum*, or SHAM, are used in the Himalaya. The herbage of *Prangos pabularia* is so bland that it is much used in the temperate parts of the East Indies for feeding cattle, and made into hay for winter fodder. It is said, however, to be injurious to horses, although oxen and sheep are rapidly fattened by it. The blanched stems of celery, enlarged by cultivation, are a favorite salad, and those of Alexanders (*Smyrnium olusatrum*) were formerly used in the same way. The candied stalks of eryngo were once much esteemed, and those of angelica are still used. The leaves of parsley, chervil, fennel, &c., are used for flavoring. Lovage (*Levisticum officinale*) is sometimes cultivated as a salad plant. The seeds of anise, caraway, coriander, &c., are used as carminatives. Hemlock, water hemlock, water parsnip, fool's parsley, and many others, are narcotic poisons—asafœtida, galbanum, sagapenum, and opoponax are medicinal products of this order.

U'MBER (*Scopus umbretta*), an African bird of the family *Ardeidæ*, allied to the storks, but having a compressed bill with sharp ridge, the tip of the upper mandible hooked, and the nostrils

Umber (*Scopus umbretta*).

situated in a furrow which extends all the length of the bill. It is about the size of a crow, with umber-colored plumage, and the male has a large crest on the back of the head.

UMBER, a minerel used as a pigment, a variety of the iron ore called Hæmatite (q. v.), and consisting chiefly of oxide of iron, with some oxide of manganese, silica, alumina, and water. It is soft and earthy, of a dark brown color, and has a conchoidal fracture. It readily imbibes water, and falls to pieces, like newly-burnt lime. It is found in Cyprus in beds. When roasted, it becomes reddish brown in color, and in that state is also used as an artist's color.

UMBI'LICAL CORD, or NAVEL STRING, the bond of communication between the fœtus (which it enters at the umbilicus, or navel) and the placenta, which is attached to the inner surface of the maternal womb. It consists of the umbilical vein lying in the center, and the two umbilical arteries winding from left to right round the vein. Contrary to the usual course, the vein conveys arterial blood to the fœtus, and the arteries return venous blood to the placenta. These vessels are imbedded in a yellow gelatinous matter, known from its first describer (in 1659) as Wharton's gelatine. Nervous filaments have been traced into the cord; but the presence of lymphatics is doubtful. The whole is invested by a membrane (the amnion), and its ordinary length is about 20 inches. As soon as a child is born, and its respiration fairly established, the umbilical cord is tied, and divided near the navel, which spontaneously closes, the fragment of attached cord dying away. See the articles FŒTUS (in which there is a figure of the umbilical cord) and PLACENTA.

UMBILICAL CORD, in Botany, the connecting link between the placenta of the ovary and the ovule, through which pass the vessels which nourish the ovule till it ripens into the seed. In some plants, the ovules are so closely connected with the placenta, that no umbilical cord can be said to exist; in others, it is of considerable length.

UMBILICAL HERNIA is the term applied to the protrusion of intestine at the navel or umbilicus. It is for obvious anatomical reasons, of most frequent occurrence shortly after birth; but it is not uncommon in women who have been frequently pregnant. If the hernia is reducible, and the patient an infant, the ordinary course of treatment is, after returning the parts to their proper position, to place the convex surface of an ivory hemisphere on the navel, and to retain it there either with strips of adhesive plaster, or with a bandage. Special trusses are made for the treatment of this affection in adults. In cases of irreducible hernia, a large hollow pad should be worn. If it becomes strangulared an operation may become necessary.

UMBILI'CUS is the anatomical term for the navel.

AE
5
C443
1888
v.7

Chambers's encyclopaedia

PLEASE DO NOT REMOVE
CARDS OR SLIPS FROM THIS POCKET

UNIVERSITY OF TORONTO LIBRARY

UTL AT DOWNSVIEW
D RANGE BAY SHLF POS ITEM C
39 11 09 16 10 007 8